
UNIT 1 ISSUES IN COMMUNICATION

Structure

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1.0 INTRODUCTION

This is the first unit of the course on Communication Technology for Distance Education. The purpose of this Unit is to discuss the concept of communication as a basic human process. We shall discuss and explain the broader framework for the study of communication, which is the mainstay of distance education.

The quality of communication is becoming more and more significant in social transactions and in the educational systems in particular. In this unit we discuss two broad issues — i) the concept of communication, particularly educational communication, and ii) the process of communication. An attempt has also been made to link the concept of general communication with education in general and distance education communication in particular.

1.1 OBJECTIVES

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

- define the concept of communication,
- explain the functions and process of communication;
- describe the different kinds of communication with examples of each;
- enumerate educational communication as a system;
- describe the barriers in the way of effective communication, and
- explain the implications of communication for distance education.

1.2 COMMUNICATION: THE CONCEPT

Communication is defined in many different ways. Some explain it as an 'art' — something creative, while others say it is a science — a learned

behaviour/skill. In a broader sense, communication is much more than an art. It is partly a skill and partly a science as it involves certain learnable techniques and psychomotor skills. However, communication is better described as a science because it is based on certain principles that can be verified and used to make it effective. Our assumption here is that communication is a scientific study, which produces skilled communication practitioners. Thus, we shall study 'communication' as a science and seek a scientific explanation for the concept of communication.

It is difficult to define communication through a single definition. Different people perceive it in different ways in the different contexts, provided by the various environments or surroundings where communication takes place. Starting from the sharing of meaning to persuading others to elicit the desired/intended responses, communication has been defined to suit situational purposes. We may agree that 'the search for the single definition of communication seems to be a futile quest'. At best we can define communication according to its components. There are three main components of communication: *the source, the channel, and the receiver*. From the source's point of view, communication is essentially persuasion, i.e., to assure you as a communicator that your communication has taken place, or that the desired outcomes are achieved. From the receiver's point of view, communication is a process to elicit the desired responses. As a source you would be happy if the receiver could behave in the way you intended him/her to behave. From the channel point of view, communication is a medium, a carrier of information from the source to the receiver and/or vice-versa. In other words, we can say that communication is defined in terms of the functions to be performed or the objectives to be achieved. According to Shanon and Weaver (1949) the primary concern of communication is to reproduce as faithfully as possible a message sent from one place to another place. On the basis of different explanations, Schramm (1973) defined communication as the functions of persuading, informing, teaching and entertaining people. Therefore, communication is a process by which people create and share information with one another in order to reach a common understanding (Rogers, 1986).

1.2.1 Functions of communication

On the basis of the explanation we have given in the preceding paragraphs, we conclude that communication involves individual as well as collective activities of sharing ideas, facts and information. Thus communication performs various socio-psychological functions. MacBride (1980) has discussed some functions of communication in a social system. The main functions are as follows:

- i) Information:* Communication refers to collective storage and dissemination of information for wider utilisation by people. In this way it enables people to participate in and take intelligent decisions on, any issues of social relevance. Information has been taken as a resource for development — socio-cultural and economic.
- ii) Socialisation:* Communication helps individuals become active members of the society to which they belong. People learn social norms in

order to live cohesively. Having access to a variety of information, individuals get opportunities to understand each other and appreciate other people's feelings, emotions, ideas and expectations in a social system.

iii) Motivation: Motivation of the individual members of a society plays an important role for its development. Communication fosters the individual and community activities, and motivates the people to meet goals, which have been mutually agreed upon. Well-informed individuals take the initiative in activities of social welfare.

iv) Education: Dissemination of information enhances the individual's intellectual development and helps one acquire the skills and aptitude required to become a productive member of society. In this way, communication and education are two sides of the same coin. The quality of education depends on the quality of communication between society and its members.

v) Entertainment: Entertainment and recreation are important means of making individuals and society healthy. People find enjoyment and entertainment through various communication activities, viz. dance, drama, sports, music, etc. These means of communication provide personal and collective enjoyment.

What we have given here is a brief account of the functions of communication. You may add a few more functions of communication based on your own experience. Now let us take a look at the means of communication.

1.2.2 Means of communication

There are various tools and media which serve as means of communication among human beings. Starting from the signs — the primitive means, to super computer-based-communication, there are various techniques, technologies and materials generally used to collect, produce, carry, receive, store, retrieve and disseminate information. All human beings make use of one or the other means of communication depending upon their accessibility and effectiveness. We shall discuss some of the prominent means of communication in this sub-section. Since this is an issue that concerns everybody, we shall discuss the potential of each means of communication as well as its weaknesses.

i) Signs and sounds: Since primitive times, human beings have been using simple signs for communication. Body language and other non-verbal languages, viz., facial expression, gestures, music, songs, drawings, paintings, etc. are in use in different societies. In the tribal societies these means of communication are used for a variety of purposes, despite their obvious limitations (MacBride, 1980). These means of communication became refined and their reach was extended to still larger uses with the passage of time.

ii) Language: A number of languages and dialects are used for communication purposes all over the world. In India, there are 18 main languages listed under the Eighth Schedule of the Constitution and over

hundreds of dialects used for communication. Language plays an important role in communication in both the face-to-face situation and at a distance — at the national or the international levels. The use of language is an important factor in educational communication too. Problems arise as a large section of the people does not understand each other's language, and this hampers the effectiveness of communication among them.

iii) Postal system : The postal system is the most vital network for point-to-point delivery of information. It serves as the focal point for communication at a distance throughout the world. You may be aware of the fact that most of the communications of open-universities, including IGNOU, takes place through post only. The postal system is the most accepted means of communication in both developing and developed countries. India has one of the biggest, well-established and efficient postal services in the world, which makes it possible for us to reach each and every corner of the country.

iv) Telephone: One of the interpersonal communication networks is the telephone system. The telephone is a sophisticated extension of traditional oral communication. No other media can match the telephone for direct and spontaneous communication (MacBride, 1980). The use of the telephone in education is not yet popular in India. The limited telephone network and the high costs, besides the lack of initiative on the part of the educators in the country, are the main handicaps in using the telephone extensively in distance education. The growth of telephone communication, however, has been quite rapid in our country in recent years. It is expected that the density of the telephone in the year 2000 would be 26.44 million (2.77 telephones per 100 persons). The number of the telephones in the rural areas, however, would be very low (1.33 million) during the same year while about 80 per cent of India's population resides in the rural areas (Narain & Gupta, 1989). When we compare these figures with those of the developed countries, we find that the facility of the telephone networks is very poor in our country. In Australia, Japan, Canada and the U.S.A., one telephone connection is available to every 2, 2, 1.5 and 1.3 persons respectively (Agarwal and Agarwal, 1990).

v) Mass media: The invention of the printing press and the radio waves have revolutionised the communication system throughout the world. These means have increased the reach and effectiveness of communication. Textbooks, newspapers, radio and television broadcasts have stepped into the area of mass education. By overcoming geographic barriers, broadcasting is successfully transmitting information to an unlimited audience. It crosses the boundaries of countries. The innovations in communication technology have opened new horizons for communication.

vi) Satellites: The satellite-based communication has opened new horizons for the transmission of information over long distances. Satellites have brought the entire world together. One can transmit or receive information from any part of the world in no time at all. Many countries have their own communication satellites. India is among the few countries to have her own multi-purpose communication satellites. The satellites so far launched by India are largely used for various domestic purposes. Besides the television

and radio broadcasts, the Indian National Satellites (INSATs) are capable of providing facilities for the meteorological data, telephone networking, remote sensing, etc.

vii) Computers: The computers are the most advanced and sophisticated means of communication. They are a force in education, as they perform a number of functions with complete efficiency. They have made communication more interactive and individualised. We have a separate block on the computer and communication networks in this Course (Block 5), where we discuss computer-based communication in detail.

1.2.3 Process of communication

Having discussed the concept, functions and means of communication, let us now discuss another important theme — the process of communication. The process of communication most widely accepted is that of Shannon and Weaver (1949), which identifies five elements in the process, viz, the source, the receiver, the channel, a coding system and noise. We shall elaborate on each of these components in this sub-section along with the feedback and contextual issues in the communication process.

i) Source and receiver: These two are the most important components of any communication process. No communication takes place without the source (i.e., the sender of information) and the receiver (i.e., the consumer of information). The source and the receiver could be human beings, animals or even non-living objects. For instance, the computer (a non-living machine) can be a source of information. In the case of educational communication, the institutions are the sources and the learners are the receivers of information.

ii) Channels: The means through which communication between the source and the receiver takes place are known as the medium or channel of communication. We communicate through various channels viz., by touch, by beating drums, through spoken words, through printed words, electronic gadgets, etc. Even facial expressions can function as a verbal and non-verbal channel of communication. The tribal societies still use the traditional channels of communication such as sound signals sent over long distances. In the present century, modern societies use the radio, television, cassettes, telephone, computers, video discs, videotexts, satellite, etc., as channels for communication. We can add many more examples of the communication channels used these days.

The relationship among the source, the receiver and the channel can be shown as follows:

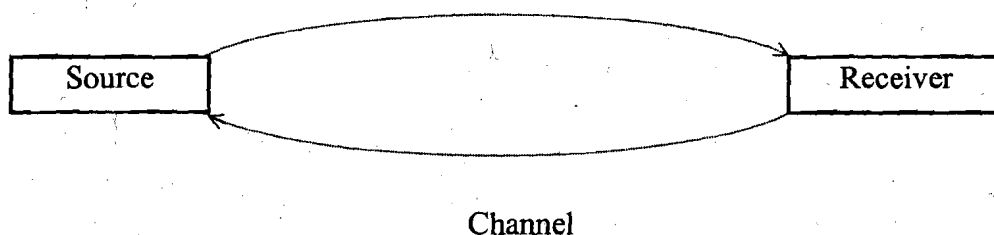


Fig. 1: Channel of Communication

The channel (the term medium is also used interchangeably) is an important component of effective communication, and we should be very careful in selecting the appropriate channel for communication. There can be two types of channels of communication — direct and indirect. In the direct channel of communication we use spoken words, facial expressions, physical postures and so on as channels for transmitting information and ideas. In the indirect channel of communication, we use various electronic and non-electronic channels of communication. In classroom teaching, for example, we usually depend on direct communication, i.e., face-to-face teaching, while in distance education, besides oral communication, we use both print and non-print media. The choice of a communication channel has important implications for the curriculum design in a given mode of education.

iii) Code: A communication code is a set of signals or symbols that creates meaning for both the source(s) and the receiver(s) (Rogers, 1984). Word of mouth, written material, visuals, etc., are codes that communicate ideas, views and feelings. There are several verbal and non-verbal codes that we use for our social communication. For successful communication the code used should be mutually accessible to the source and the receiver.

iv) Noise: There are some factors that affect the smooth flow of communication. Those factors which disturb or interfere with the passage of information between the source and the receiver are termed 'noises' or 'barriers'. Thus, noise is the term that refers to any factor which prevents the proper exchange of information, apart from those caused by the sender and the receiver. It may be anything, such as technical problems in reception, overloaded information, etc. The spatial position of noise can be illustrated as follows:



Fig. 2 Noises to Communication

There can be various types of noise causing barriers in the flow of information. We discuss here three types of noise.

- a) **Poor reception:** You might have seen that poor sound quality in audio media, distorted pictures in a video programme, poor quality of paper and printing in text materials and so on can distort the message or reduce its effectiveness. Such interruptions demotivate the users from participating in the communication process.
- b) **Overloaded/ ambiguous information:** Overloaded information can interfere with the reception of the message. For example the course unit, with too much content can distract the students and prevent them from comprehending the meaning of the message. Too much continuous information through the radio or TV broadcasts may distract the attention of the audience and make them passive users. The

bombardment of messages from the source cannot ensure that every message will go through. Similarly ambiguous information creates barriers in student's learning.

- c) *Environmental distractors*: Environmental distractors are also frequent sources of noise. You can take an example of listening or viewing of audio or video-cassettes. Distractions such as the ringing of a telephone, or the noise made by a typewriter, lessen the effectiveness of communication. Even home viewing is distracted by children playing around one, ringing of the telephone, discussion among the members of the family, etc.

To ensure effective communication, the receiving end/place should be noise-free, and the environmental distractors should be eliminated or minimised to the extent that these do not affect the attention of the consumer while receiving the message. This is true in the case of studying the instructional materials also.

Both the terms — noises and barriers — are used to express any interference in communication (whether one-way or two-way) between the source and the receiver(s). The noises or barriers are deciding factors in the effectiveness of the pedagogic interaction between the student and the teacher in both face-to-face and mediated instruction. Taking this fact into consideration, barriers to communication have been given an extended treatment in Section 1.4.

v) *Feedback*: So far we have been discussing one-way communication only, i.e. a message that flows from the source to the receiver. This type of communication is helpful for certain purposes such as giving information, making announcements, etc. The radio and the television broadcasts are good examples of one-way communication. But in day-to-day life you have seen that most communication is two-way. The source and the receiver of information get feedback from one another and this process continues to affect the behaviour of both of them. The second aspect of feedback is that the response messages are acted upon to make adjustments or improvements in the content, methodology or style of communication. Thus feedback is a communication in response to the previous message received from the source. Broadly, feedback refers to any process by which the sender obtains information as to whether and how his/her intended receiver received the information. The receiver, in turn, raises his/her queries or doubts for further clarification and tries to confirm whether or not he/she has understood the information correctly, or as it is intended by the source.

Besides informing the source as to how satisfactorily the information has been received by the receiver, feedback enables both the source and the receiver to correct omissions and errors. Feedback influences one's on going or future communication behaviour. In a face-to-face situation, feedback can be verbal as well as non-verbal. The source or the receiver can respond instantly by either accepting or rejecting the communication. A simple smile can communicate the reaction of the source or the receiver. You might have observed that simply nodding the head can make communication two-way, and the sender can get the necessary feedback about whether or not his/her

communication has got through. In some cases, for instance in distance education, feedback is received through printed communication. In non-face-to-face communication situations, feedback takes different forms. There can be two types of feedback — immediate feedback and delayed feedback. In face-to-face teaching, the student gets immediate feedback from his/her teachers. Even in computer assisted learning the student can get immediate feedback on his/her progress. But since the student prepares his/her assignment-responses and submits them to the evaluators for their comments and grading, he/she gets feedback on his/her work after a few days time. In the radio and TV broadcasts also, the teacher and the student get feedback after time gap. Whether immediate or delayed, feedback is important to make communication effective and to ensure the intended effect on the students. It also implies that we are concerned with producing the desired effect on the receivers by making feedback more frequent and systematic.

vi) Context: The context in which communication occurs also plays an important role in sharing information. The meaning of communication is affected by the social, physical or cultural context. In our daily life, we hear many persons saying, 'you have taken my words out of context'. 'You have taken me very seriously. I was just joking', and so on. The belief, values and behaviour - related factors also influence the effectiveness of communication. Similarly, the mental and physical condition (they could be suffering from anxiety and fatigue) of the participants also affect the process of communication.

To conclude, the communication process includes a sender, a channel, a receiver, a relationship between the sender, an effect, a context in which communication occurs and a range of things to which the message refers (Mcquail & Windahl, 1981). It also includes a purpose, or an objective to be aimed at and achieved. These components are used to collect, pool and disseminate information.

Check Your Progress 1

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

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

Define the following terms, in two lines each.

i) Channel ii) Code iii) Noise

- i)
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- ii)
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- iii)
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1.2.4 Types of communication

Communication can be discussed at four levels, which are :

- Interpersonal communication
- Group communication
- Organisational communication
- Mass communication

Interpersonal communication: Interpersonal communication includes conversation between two persons. This is a common type of communication, in which two persons share their feelings, emotions, thoughts, ideas, etc. Interaction between two friends, between teacher and student, between mother and child and the like are a few examples of interpersonal communication. Talking on the telephone to someone is yet another example of interpersonal communication at a distance.

Group communication: In this type of communication, the members of a group interact with each other. A group is a collectivity of people who have common interests. Discussions in a workshop, a seminar, or a family are examples of group communication. Group communication is used to take a collective decision on a problem, an issue or a matter of common concern. The participants involved in a group communication take active part in communication to achieve a set of goals, to develop social contacts or to find the solution to a problem faced by the group. Group communication is represented diagrammatically in Figure 3. The family, a section in an office, and a classroom are examples of group communication systems.

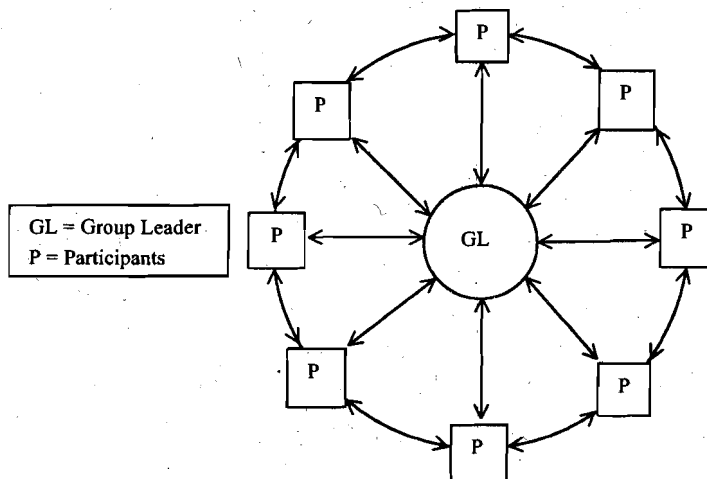


Fig. 3 : Group Communication

Organisational communication: It is that communication which revolves around one organisation. Since any organisation consists of groups of individuals, it can be said to be multiple group communication system having interaction among each other. Communication may start from any point in the organisation, but the immediate ways of the information is only within the organisation. Examples of this type of communication are schools, industries, offices, etc. Notifications are normally used as means of communication in such organisational communication system.

Mass Communication: Mass communication involves more than two persons but it is beyond group and organisational communication. As the term 'mass' indicates, this type of communication always concerns a large number of people sharing information, ideas, thoughts, etc. In this case we use the mass media to communicate with a large number of people. In mass communication we include face-to-face, as well as, print and non-print communication. For example, the radio and television programmes are broadcast to educate, inform or entertain a large number of people.

Mass communication has three characteristics. We discuss them briefly here:

- i) *The audience is large and heterogeneous.* You know that radio and television, being mass communication media, have a large audience with different backgrounds, tastes, ages, occupations, etc. Both the illiterate and the literate can make use of these media. The newspapers, another mass medium, have a comparatively smaller audience.
- ii) *The source is an institution or a group of people.* For example, the Ministry of Information and Broadcasting, Government of India, is engaged in broadcasting television and radio programmes all over the country. The Times of India group, is one of the private institutions engaged in printed mass communication in India. Similarly, IGNOU is engaged in creating and disseminating knowledge to a large number of students throughout the country, and it is an example of a mass education institution.
- iii) *Some kind of mechanism is used to reproduce information.* The mechanism could be the printing press, programme production studio, transmitters, the TV and the radio receivers, etc.

Check Your Progress 2

Notes: a) Write your answer in the space provided.

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

- i) Write two educational implications of interpersonal communication.

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- ii) Give at least one example each of different types of communication.

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1.2.5 Educational communication

The word 'communication' came from the Latin word 'communicate', meaning 'to share'. The act of teaching and learning is also an act of sharing the content, the skills and the attitudes. Distance education is an act of sharing of content, etc. with the students, at a distance. Thus, education can be seen as a communication process between society and individuals (Hills,

1986). Hills further elaborates that education should be looked at constantly in order to determine how well it is communicating the norms of society. In other words, educational communication concerns itself with the process of how the teachers and students act and interact to enhance the knowledge of the latter. In educational communication, the sources are teachers/institutions, and the messages related to the curriculum (the content, the skills and the attitudes and related activities which educate, inform, train, enlighten, inspire and entertain the students). The receivers are the students and various teaching strategies such as demonstrations, tutorials, textbooks, assignments, audio-visual components, libraries, etc. are used as media to transfer the contents. In distance education, the act of communication is performed through self-directed education by making various teaching-learning arrangements.

With the advancement in communication technologies, it is now possible to impart education throughout the world via satellites, which have the potential to communicate even live events to the students at their workplace. Thus, education has crossed many barriers of space and time. As a consequence, the methods of teaching and learning have also changed. Technologies such as computers, video-tapes, video discs, teletexts, communication satellites and teleconferencing services have stepped in to improve the nature of educational communication. These technologies have made the teaching learning process more lively and interactive. They have enhanced the pace of learning and also improved the means of retention and retrieval of information. Interestingly, Hills (1986) regards the computer as man's 'fourth brain', taking its place alongside the other three — cerebrum, optic lobes and cerebellum.

Let us take the example of the Shannon and Weaver model of communication (1949), and discuss its application to educational communication. In this model, the source of information is the teacher or the educational institution, i.e., the agency which intends to transmit knowledge, skills, values and culture to the future generations. The teachers supply and manage information in a way so as to make it understood by the students. The teachers make their ideas visible by coding them in a series of symbols in the form of spoken or written words, or visual signals.

As there are various channels of communication used in education these days, the main question in selecting the appropriate channel of communication is whether it clearly and accurately communicates with the students as desired by the source (the teacher or educational institution). The teachers have a variety of audio-visual media, viz., broadcast, audio / video cassettes, computers, teletext, teleconferencing, etc., which can be exploited to achieve the desired objectives at a faster pace and for larger student bodies.

The important point is that information should reach the students without any distortion. There are many sources of noise, which can mar the effectiveness of the teaching and learning process. The interruptions (noise) in the way of communication should be removed. The biggest potential source of noise in distance education is the reading material that constitutes the master medium. The reading materials need to be prepared with clear

objectives, to be written in simple language and to be presented in a logical sequence. The materials should be self-explanatory, self-directed, self-contained and self-evaluating.

As mentioned earlier, the students should receive the information that is intended by the teacher or distance education institution. For this, they should possess the minimum pre-requisite of knowledge skills to comprehend the message, undertake notes, answer the self-assessment questions and work on the prior knowledge possessed by the students. In other words, the course materials should be based on the background or prerequisite knowledge of the target students.

Feedback plays an important role in improving the quality of the course materials and achieving the desired objectives. The teacher should get information about how his/her materials/units, audio or video programmes are being received and assimilated by the students. Such information will make communication more effective and will eliminate errors in decoding and the problems caused by 'noise' in the entire teaching/ learning process. On the other hand, the students should also get feedback on their progress of comprehension of the content discussed. Feedback about their performance will motivate the students to draw more from the learning material.

For the purpose of clarity, the process of educational communication can be represented as follows:

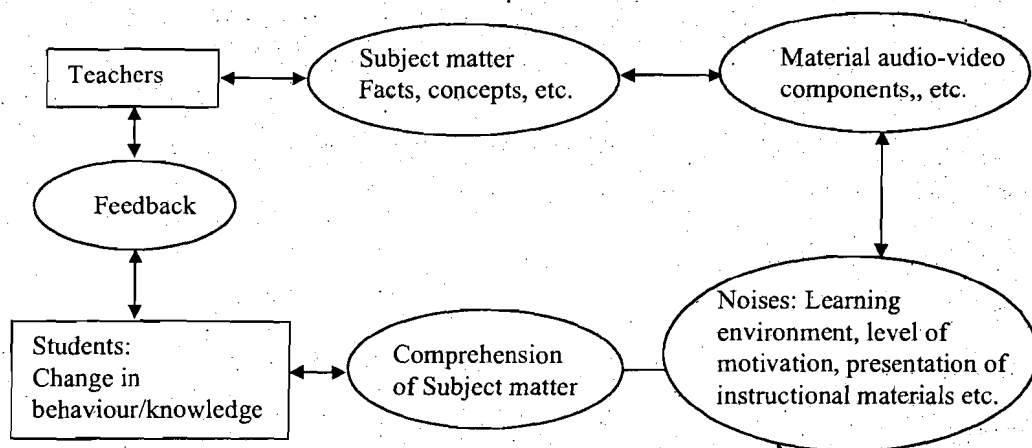


Fig. 4: Educational Communication Process

You will notice here that the students have a dual role. They function as the receivers as well as the sources in educational communication. The teacher plays the role of a 'manager', and uses various teaching arrangements to help the students achieve their course objectives. The students interact with the learning materials and get the desired meaning out of it. Therefore, in educational communication, more importance has to be given to the students, the students are not simply the passive recipients of communication, but they actively participate in the learning process. The students in distance education are independent learners who are the directors of their learning. It is all the more necessary that the medium used for them is free from noises.

Tiffin and Rajasingham (1995) discusses education as a communication system, which is purposive, receives certain inputs like students, teachers, knowledge, problem, and processes them at different communication levels so that the learners become knowledgeable to apply learned skills and knowledge to given problems. Education as a communication system also shares the characteristics of an open system, viz. negative entropy, feedback, steady state, differentiation, equifinality, teleology and hierarchy. Let us discuss these concepts in order to understand and apply them to distance education.

- i) Negative-entropy:** Open systems resist the trend towards disorder and move towards increased organisation. For this purpose, they depend on feedback system and the environmental supra system.
- ii) Feedback:** Feedback is a special input about the system and its environmental conditions; and about its functioning. This enables the system to take corrective steps to adjust its malfunctioning, if there is any.
- iii) Steady state:** It is a condition of dynamic equilibrium, in which the system maintains its structure as stable, despite fluctuations in environmental condition.
- iv) Differentiation:** Open systems not only adapt to changing environment, but also move in the direction of higher level of organisation or growth. Growth leads to differentiation of functions and to specialisation.
- v) Equifinality:** It is the ability of open systems to reach a given state or condition by several different paths. Because of their inherent resilience and capability to adjust in changing environmental open systems arrive at a given desired state through various alternative methods.
- vi) Teleology:** It is a characteristic of open system that indicates the purposefulness of the system and works according to its objectives.
- vii) Hierarchy :** Open systems are hierarchical, that is, they are both independent framework consisting of a number of integral lower level sub-systems, and each one is a dependent member of the higher level system.

All these characteristics can be easily applied to education as a communication system. Figure 5 depicts distance education as a communication system having the characters of an open system. Processing at different fractal levels in the figure indicates the communication types. Support sub-system in distance education includes, study centre, regional centre, material distribution system, etc. The control sub-system includes the Instructional Design (ID) and administrative sub-system that looks after the system in general.

Check Your Progress 3

Notes : a) Write your answers in the spaces provided.

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

i) Define 'feedback' in three lines.

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ii) Why is 'feedback' so important in educational communication?

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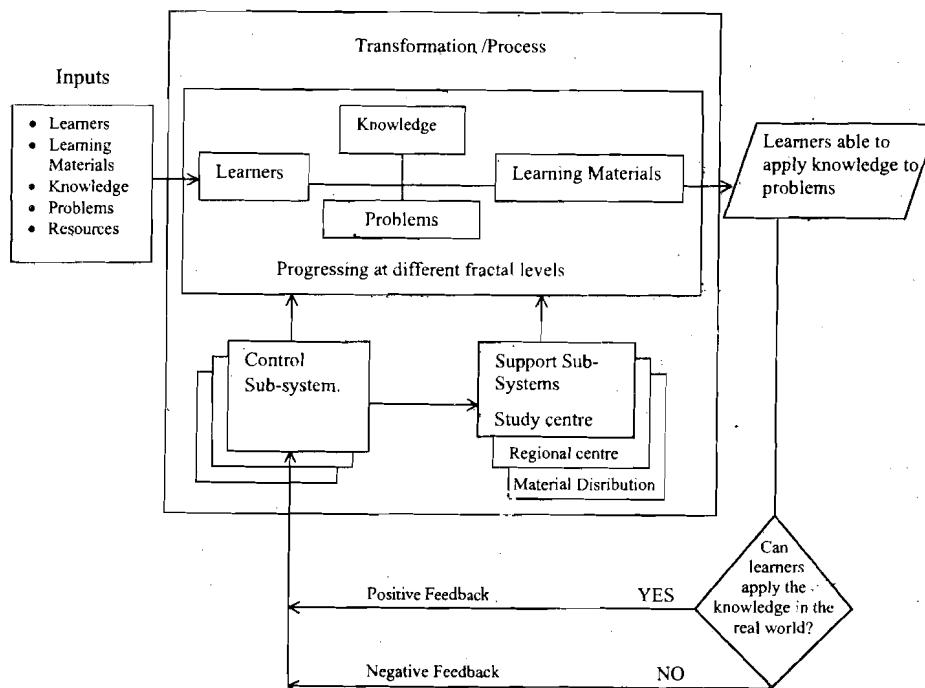


Fig. 5: Distance Education on a Communication System.

Adapted from: Tiffin and Rajasingham (1995).

1.3 ROLE OF COMMUNICATION

In the previous section, you studied the concept of communication in detail. In this section, we discuss the role of communication in society in general and education in particular. Communication is woven into our day-to-day existence, and is considered to be both individual and a collective activity embracing all transmission and sharing of ideas, facts and data in our daily life.

We all communicate with each other through discussions, writing letters, through telephone conversations, the radio and T V broadcasts. Every social

system depends on the effectiveness of communication among its members. By 'effective communication' we mean clear understanding of the message by the participants — both by the source and the receiver. Communication does not mean just giving information — it is a two-way process. Information should be understood by the receiver(s) in terms of the intentions of the sender(s).

Why do we study about communication? The answer is simple. We are all involved in one or the other type of communication in such a way that we cannot overlook the importance of communication in our life. We, therefore, require a serious study of the concept. A thorough understanding of communication as a process will help us ensure that the information gets through. If the receiver does not receive the message in its correct perspective, the communication will collapse. This is the reason why we try to clearly understand the concept of communication. Now think of the importance of educational communication, which deals with complicated information. It is a difficult task to communicate educational information in such a way that every student understands it properly. If the student succeeds in showing some change or improvement in his/her behaviour, we can claim that educational communication is successful.

To communicate with the students at a distance is more difficult than with those who study in a face-to-face situation. There are several barriers between the distance education institutions and the students learning at a distance. For example, there is no provision, in most cases, for immediate feedback from either side. Most of the students and teachers do not know each other. In such a situation where you do not know much about your students, you have to be extra careful to ensure effective communication to achieve the educational objectives or bring about the desired changes in their behaviour. So, whatever medium is used, communication should reach the receiver(s) successfully.

1.4 BARRIERS TO COMMUNICATION

There are various stages through which a message has to pass through from the source to the receiver(s) and vice-versa. These cause a number of interruptions and distortions in the way of effective communication. Sillars (1988) discusses two types of barriers that usually distort the flow of communication, and these are discussed below.

a) **Barriers caused by the senders and receivers:** The act of communication is broken down by the senders and the receivers themselves. The reasons may be a lack of understanding between each other, poorly defined objectives, failure to comprehend the language used, etc., or both the sender and the receiver may not be clear about what to communicate.

The receiver may not perceive the message as intended by the source (communicator). Similarly, defensiveness, permanency of attitude, situational misunderstanding, unfounded certainty, etc. are forces that can lessen the effectiveness of communication among the participants.

The individual's background and experience also influences the effectiveness of communication. Personality characteristics — aptitude, attitude, interest, motivation, etc. can interrupt the smooth flow of information. Similarly, hidden distractors, such as tension, frustration, anxiety, etc. among students can also lessen the effectiveness of educational communication. You, as a source, cannot force a student, as a receiver, to learn unless he or she is mentally ready to receive educational messages or has the necessary pre-requisites and study skills to grasp it.

At times, it is difficult to avoid barriers created by the source and the receiver. To overcome such barriers, we need to take special care at the stage of planning and developing the instructional materials. Use of different teaching arrangements (for instance, the print materials supported by the audio-video programme) can be used to bypass or overcome some of the distracting barriers. The use of language that is understood easily by the sender and the receiver may facilitate sharing the content.

As mentioned earlier, selection of the wrong medium may be disastrous for getting the message across. For example, if you want to discuss minor details of a system or, more specifically, if you want to discuss the flow of blood in the human body, the audio medium may not be as effective as the visual medium. So the use of appropriate medium can make communication effective and efficient. Similarly, choosing an unsuitable time for communication may have a negative impact on the outcomes. The effectiveness of communication may be enhanced if the timings of communication are appropriate.

b) Barriers caused by the external factors: There are certain external factors that can disrupt the flow of communication. Any type of 'noise', such as, physical noise caused by the plying of vehicles, the sound of a typewriter, conflicting messages, poor printing impressions, poor reception of the sender and the receiver.

One of the barriers of effective communication is indifferent behaviour and lack of sufficient motivation (of course, due to some internal or external factors) on the part of the receiver(s). The participants may not be ready to receive information and willing to actively participate in its transaction.

The domestic or social problems faced by a student may cause him/her to be less attentive than he/she might otherwise be. Similarly, lack of incentives, such as poor employment opportunities after passing a course may make communication defunct.

There are certain technical interruptions which create a lot of distortion in the communication process. Poor maintenance of equipment, substandard tools, defective receiving sets, weak transmission waves, etc. inhibit effective communication. The interference of some of the barriers can be reduced to a large extent if the sender/source understands the models or theories underlying the process of communication. We shall discuss some such measures as follows:

- i) Both the parties involved should know that communication needs to be attended to. Both should take initiative in sharing information.

- ii) Both the parties should recognise each others communication signals, i.e. they should understand each other's language. Both should work at the same wavelength.
- iii) Both the parties should be capable of thinking and feeling in somewhat similar ways. They should understand each other's message correctly, otherwise, they will not understand each other.
- iv) Both the parties should engage jointly in a purposeful communication act. Comprehension of message is not enough in itself. For communication to succeed, there must be an outcome; the participants should display the communication specific intended behaviour. Information must be successfully shared so that a tangible outcome can be displayed.

1.5 LET US SUM UP

'Communication', as a scholarly field of study, is a science that produces skilled communication practitioners. It deals with the process of informing, motivating, teaching and entertaining people. It also involves creating and disseminating information, facts, ideas and feelings to its users.

Communication has manifold functions of which the main ones include informing, persuading, sharing, socialising, motivating, educating and entertaining people. These functions are carried out by various means of communication — signs, words, written language, postal services, the telephone, the radio, the television, the computers, etc.

There are six components of communication: i) the source and receiver, ii) the channel, iii) the symbol of code, iv) the noise, v) the feedback and vi) the context in which communication takes place. The effectiveness of each component contributes to the overall effectiveness of the communication process.

Broadly, there are four types of communication, viz., interpersonal, group, organisational and mass communication. Communication between two persons is known as interpersonal communication, and communication among more than two persons beyond an organisation is called mass communication. Education is also a communication system, which can be effected at all levels. Educational communication makes people well informed and socially productive members of society. Communication plays an important role in social transformation: socio-cultural and economic development.

There are various interfering variables, which distort the effectiveness of communication. The personality factors of the source and receiver, the choice of medium, the domestic and social problems, physical and technical disturbances, etc. are some of the prominent barriers to communication. These barriers can be overcome or reduced to a large extent, provided all the components of the communication process function effectively. Mutual understanding between the source and the receiver does increase the effectiveness of communication.

1.6 CHECK YOUR PROGRESS: THE KEY

1.
 - i) Channel: The means or medium through which communication takes place between the source and the receiver is called the channel.
 - ii) Code: A Code is a set of symbols that create meaning for both the source and the receiver. For example a written or spoken word is a code.
 - iii) Noise: The factors which disturb or prevent proper exchange of information between the source and the receiver are called noise.
2.
 - i) The educational implications of interpersonal communication could be outlined as follows:
 - a) Personal contact programmes should be organised for distance learners.
 - b) Telephone and postal correspondence should be used.
 - c) Instructional materials should be directly addressed to the students.
 - d) Self-study groups should be formed.
 - e) Comments on the student assignment-responses should give the feeling that the student is, as it were, talking to the teacher and the peer group.
 - ii) Examples of different types of Communication are as follows:

Intrapersonal communication	:	Reading a book
Interpersonal communication	:	Teacher and Student
Group communication	:	Class room
Organisational communication	:	School, offices
Mass communication	:	TV, Radio broadcast.
3.
 - i) Feedback: Feedback is communication in response to a previous message. In other words, feedback refers to the process by which the sender and the receiver get information as to whether the information has been received and understood.
 - ii) Your answer may, among other things include:
 - giving information on the progress of the student,
 - suggesting modifications in the content and approaches adopted in presenting the content,
 - telling whether the objectives of the course have been achieved, and to what extent,
 - facilitating pedagogic interaction between the teacher and the student, and thus motivate the student for learning, and
 - breaking the feeling of isolation among the students.

UNIT 2 GROWTH OF COMMUNICATION TECHNOLOGY

Structure

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2.1 INTRODUCTION

In ancient times when people started writing on stone or wood, communication became portable to a limited area only. As civilization advanced, various other means of communication were also invented. The printing press, the most remarkable invention in this regard brought about a revolution in communicating to larger groups. The printed words communicated to all those who could read what had been written in the printed material — on stones, wood or paper. The technological innovations added to the efficiency of the printing technology. Today we have the most sophisticated communication technologies both print and non-print. As a result, common people have increased their ability to share experiences and feelings of others.

In this Unit, we shall review the growth of communication technologies in the world in general, and India in particular. Various problems in transferring and adopting communication technologies are also touched upon in this Unit. Towards the end of the Unit, the policy on communication in relation to education has been discussed briefly. More emphasis has been given to the practices prevailing in India. However, illustrations/examples related to other countries have been presented to give an overall idea of the communication technologies used in various countries of the world.

You may recall what you have already studied about the basic concept and the process of communication in Unit 1. You have also studied the importance, types and role of communication in detail in that unit. This unit

is an extension of Unit 1, but the emphasis is shifted from the general communication to the technologies of communication.

2.1 OBJECTIVES

The main aim of this Unit is to study the growth and adoption of communication technologies. After going through this Unit you should be able to:

- describe the growth of communication technology in the world;
- identify major developments in various media;
- identify and explain the problems of growth and adoption of the communication technologies; and
- analyse the importance of policies on communication for education and development.

2.2 DEVELOPMENT OF COMMUNICATION TECHNOLOGY: AN OVERVIEW

Communication is a fundamental human and social process. It makes the existence of societies possible, and by its nature, distinguishes between the human and other species (Schramm, 1973). The functioning of any society thus depends upon the quality of communication among its members (Melody, 1986). In other words, the prosperity of a society is judged by the extent to which its members can afford and use various modes of communication — the printed text, radio, television, video cassette recorders, video text, computers, etc. This is the reason why now-a-days more emphasis is being given to the manufacture, storage, processing, editing, interpretation and transmission of information to one and all. With the advancement in and access to a variety of communication technologies we are moving towards an information-based society.

We should know a bit about the history of the growth of communication technologies. So, we shall touch upon the historical development of communication technology in this section. You must be aware that the growth of communication techniques has a long history. For centuries, people developed their own ways to expand their ability to communicate as effectively and efficiently as possible under their respective circumstances. Use of signals, symbols, gestures, facial expressions, etc. were the primitive ways of communication prevalent in primitive societies. It took centuries for the first mass medium — print, to be developed and used for communication purposes.

In the following subsections, we shall discuss the growth of the individual media — print and non-print. Under non-print we shall take up four important media — the audio, audio-visual, telecommunications and multimedia communication — for discussion through which we shall try to throw some light on the growth of communication technologies as a whole with special references to the Indian scene.

Let us begin with the print medium.

2.2.1 Print medium

The growth of modern communication technology begins with the invention of printing technology. Gradually, it led to more specialised print materials — religious and political books which worked as instruments in the transformation of human beings.

You will appreciate that even in the age of the computers and satellite communication, the most powerful and pervasive educational technology is the printed text material (Altbach, 1987). There is little evidence so far, even in developed countries to show that the influence of printed materials as tools of education has declined. The printed text remains a basic tool for education throughout the world. The educators still depend on the printed text for teaching and learning.

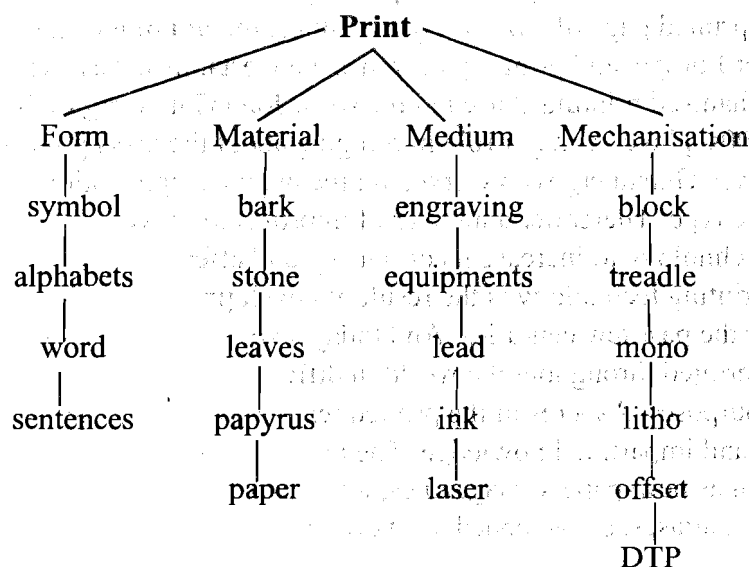
In ancient times people used papyrus, bark, leaf, etc. for writing on. The Chinese wrote on flat pieces of bamboo or on silk fabric until an emperor, around 100 AD ordered his courtiers to discover a more convenient writing medium. As a result, the Chinese developed paper technology. The use of the written words to serve educational purposes actually started in 105 AD when the Chinese made paper and ink.

In early times, the written words had to be copied by hand, which required very hard work on the part of the writers in order to get multiple copies of a written text. Because of this reason, reading materials were very expensive and were available to only a few. The need for more copies of reading materials, particularly in matters related to religion, gave birth to the reproduction of original works on a large scale. As a result the printing process started. As early as 868, the teachings of Lord Buddha were printed by movable type in China in a book form. The Chinese experimented with wood, pottery, and tin for producing printing blocks that could be assembled to form a printed page of a book. By the 1400s, the printing technology swept over Europe, and printing machines were established as a craft. Thus more mechanised printing started in the west. John Gutenberg of Germany, in mid 1400s, played a major role in bringing about the mass printing of books. It was Gutenberg who worked on the practical application of the idea of movable type. Thereafter a number of improvements were made in printing technology to increase its efficiency and effectiveness as well. Modern printing technology is the result of developments that have taken place over the past few centuries. And today, every day thousands of books are being printed throughout the world in different languages and for different purposes. As a result the printed text has become the main medium of storing and imparting knowledge. The print medium is used in various forms, such as newspapers, magazines, journals, pamphlets, handbooks, dictionaries, atlases, encyclopaedias, workbook, etc.

Technology undergoes constant change and improvement. With the passage of time, publishing a book became easier and the products came to be of high quality. During the 1980s, the computers and laser technology were added to printing and distributing print media. The computers and other

electronic devices have made it possible to store in large quantities, as the printed text materials, and use them as and when required. Manuscripts are being composed in microcomputers utilising very efficient word processing software packages. This provides the writers, the freedom of preparing a manuscript in bits and pieces that can be quickly assembled in any desired sequence. Paragraphs can be shifted from one place to another, sentences can be rephrased, spelling can be checked and corrected automatically and so on. The text thus prepared can be stored magnetically on either the hard disc or a floppy. Now-a-days, more and more writers and printers use the computers from the very initial stages of preparing learning texts through editing and printing. These new devices have improved the quality of the printed texts and, have made the entire process faster and much less cumbersome.

Having discussed the growth of print medium, let us try to encapsulate it in a conceptual framework. The emergence and growth of print medium can be tracked down through its four elements, viz. Material, Form, Medium, and Mechanisation. In the earliest times the *form* of communication was basically sign language – symbols, until the development of the alphabet, words and spoken language. Similarly, the *materials* used to communicate were barch bark, stone, leaves etc. and then use of papyrus came into and finally paper was invented. On the *medium* front, initially it was engravings on stone cages using metal equipments. Later on lead came into being and the Chinese used ink. As for the *mechanisation* of the process of communication is concerned, it is the most remarkable development that has made communication faster and cheaper. With the initial use of blocks in printing machines, it has now reached the stage of DeskTop Publishing (DTP) which makes printing so easy and time saving. A concept map of the development of print could be depicted as follows:



Having briefly touched upon the growth of the printing technology in general let us now turn to the Indian scene. You may be aware that the first printing press was brought to India almost by accident on September 6, 1556 (Moses & Maslog, 1978). Interestingly, the press was being shipped to

Ethiopia (known as Abyssinia at that time) for the Christian missionaries there. The Jesuit priest who accompanied the press died during a brief stopover in Goa (India) and the press remained in India. Thus, printing was introduced in India by chance. 'Doctrina Christiana' was the first book printed in India. The second printing press in India was set up in 1578 at Punikael, a village in Thirunelveli district of Tamil Nadu. The press was set up by the Christian missionaries and was used to print religious books. The third printing press — and the first non-missionary press — was set up in 1674 in Bombay.

More than two centuries after the arrival of the printing press, the first newspaper was printed in 1780 in India. The first newspaper, The Bengal Gazette, came out on January 29, 1780. Thereafter many presses were established and newspapers were brought out. The first non-English language publication in India was the Dig Darshan, a Bengali monthly founded in 1818, followed by other newspapers, magazines in some other Indian Languages. Printing in the Hindi language came rather late. The first paper published in Hindi was Oodunt Martand in 1826.

Now let us look at the other side of the picture. We need to understand clearly that new technologies used in printing are not a blessing for all countries. Many developing countries find electronic devices out of their reach, because of their cost, accessibility and technological complexity. As a result, many countries still depend on the traditional printing technology and skills to prepare and distribute the printed text materials.

2.2.2 Audio media

The radio is a twentieth-century phenomenon. The massive growth of the radio took place between 1920s and 1940s. From the day of the discovery of radio waves till today we have seen a continued refinement of radio technology and the rapid growth of broadcasting facilities. In the beginning, radio technology progressed rather slowly, but accelerated during the World War II, and finally had very rapid growth in the recent decades. More and more people got the opportunity to listen to the news and entertainment components through the radio. After the World Wars, election campaigns became potential inputs for sustained growth of the radio all over the world, particularly in U.S.A. As a result, politicians in power took special interest in commissioning more radio stations for political propaganda. Besides political propaganda, the potential of radio for disseminating economic news also stimulated the planners to establish more and more radio stations throughout the world. By 1922, there were 564 licensed broadcasting stations in USA alone (Thomas, 1987).

Commercial information and entertainment potential/value of the radio medium contributed to its rapid growth. Even today the radio is being used mainly for entertainment followed by information/news. Some countries such as France and Hong Kong make considerable use of the radio for entertainment (70 and 72 per cent of total broadcast hours respectively) (UNESCO: 1980).

To reach and inform more and more persons, necessary improvements in the radio technology were made. These improvements brought down the size and the cost of the radio sets. As a consequence, the radio with the help of transistor technology has now become a mass medium in almost all the countries in the world. People in low-income groups can buy radio sets these days and carry them in their pockets.

Use of the radio for educational purposes (used in a broader sense) came later. Due to easy access to a large number of persons, it was realised that the radio could be a potential medium of enhancing the knowledge of the people.

The television began to create meaningful competition for the radio. As a result, the radio started to make adjustments. A number of improvements were made to refine the radio technology, and the approach to broadcasting. Several technical developments such as multiplexing, stereophonic broadcasting, and the easy availability of transistors, boosted the growth of the radio. Currently Digital Audio Broadcasting (DAB) technology is being tested all over the world.

Apart from radio, the audio medium has grown tremendously because of the developments in technologies like gramophone records and tape recorders. Though the cassette tape technology has now almost replaced the gramophone disks, these media have made the audio medium more popular and accessible to the public in general. Mostly used for the purposes of entertainment, the audio tape has tremendous educational value, because of its portability and ease of use. In the audio medium, the current buzzword is audio CD, which because of its digital recording gives a very clear output of sound. We have a separate unit on radio and audio components in this course. You will read more about them in Unit 2 of Block 2.

2.2.3 Audio-visual media

Television came in on the heels of the radio. Discoveries pertaining to the television were made in the late nineteenth and the early twentieth centuries. After continued research, the Bell Telephone Laboratories could send an experimental television programme by wire from New York to Washington in the USA in 1926-27. By 1930, a number of developments took place in the television technology, and there were 17 experimental television stations in operation in the USA.

Audio-visual technologies are rapidly expanding all over the world, especially in advanced countries. Beginning with the broadcast television, now we have the video cassettes, cable TV, computers, videotext, video disc, and so on, at our disposal. The analog broadcast television is changing to a digital environment. The reach of TV is also increasing day by day.

More and more sophisticated technologies, such as, talk-back facility, videophone system, facsimile, etc., are being put into practice all over the world. Depending on their economic conditions and level of technological development and requirements, various countries are in the race for acquiring as many audio-visual technologies as fast as possible. We have discussed the visual media in detail in Unit 3 of Block 2 of this course.

Moreover Blocks 3 & 4 are also related to audio-visual media. In fact the use of communication technology in education is based on the basic premise of the effectiveness of the audio-visual media in learning and therefore has a special place in distance education.

2.2.4 Telecommunication

The transmission of telegraphic signals over wires was the first development in the field of telecommunications. In 1876, Alexander Graham Bell demonstrated his telephone set and the possibility of telephony — long distance voice transmission. This point-to-point telephone connection demonstrated by Bell was the beginning of the whole world of telecommunication, which has almost changed the way people communicate. Since then the telecommunication technology has also changed from marvel switching systems, having gone through various phases of development. The technology, which was started as a medium to transmit audio at a distance, now can transmit full multimedia — audio, video, picture, imager, text all combined together. It is this capability which has tremendous application in distance education.

2.2.5 Multimedia communication

As indicated in the previous section, the capability of telecommunication channels have increased, especially the speed of transmission, called bandwidth. The term 'broadband' is used to describe high-speed transmission signal channel, which is measured in megabits per seconds (Mbps). The traditional telephone services run in the speed of kilobits per seconds (kbps) and are usually referred as 'narrowband'. The development of very small Aperture Technology, Integrated Services Digital Network (ISDN) and Broadband ISDN have made multimedia communication possible. The computing technology and the growth of Internet also plays a very significant role in multimedia communication. This is because the system of the Internet is more interactive. In the multimedia communication environment, any number of services may be demanded and supplied simultaneously. Because of the possibilities of multimedia communication at a very high speed all the media discussed above are leading towards convergence.

Convergence of communication technology

The World Communication Report (1997) presents a very clear picture of convergence of communication technology, which we have reproduced in Fig. 1. The trend is towards interactive services and the technology is moving towards that. Computing power, telecommunication technology and media expertise are all converging into interactive services through a wide variety of media — be it mass media, interactive media or self media.

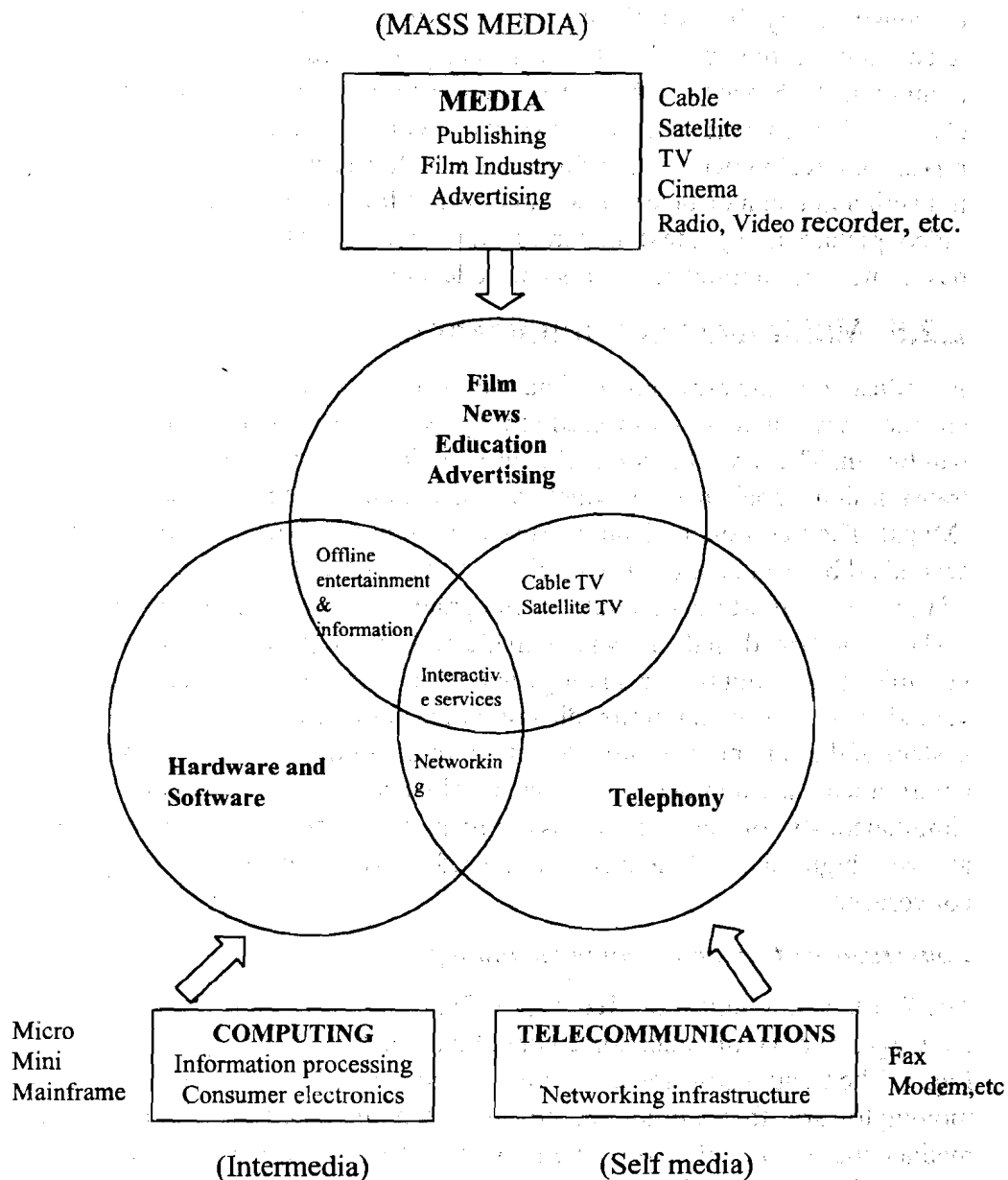
Check Your Progress 1

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

ii) Compare your answer with those given at the end of the unit.

Identify and write the current trends in each of the following media

- a) Print d) TV broadcast.....
 b) Audio e) Telecommunication
 c) Radio broadcast f) Multimedia communication.....



Source: World Communication Report (1997)

The convergence of various communication technologies has become possible due to the developments in microcomputer technology. Because of

the developments, now you can receive educational programmes at your home through the Internet. The Internet is an example of the convergent technology that can handle, text graphics, audio, video, animation, etc. altogether. It can also facilitate synchronous interaction. Because of the convergence, the computer has become a gadget that can provide, education, information and entertainment at your doorstep on demand.

2.3 GROWTH OF COMMUNICATION TECHNOLOGY: PROBLEMS

The growth, transfer and adoption of technology is not as simple as it may appear, on account of the fact that we are equipped with sophisticated technologies. There are various underlying conditions that influence the way a particular kind of technology is adopted to solve educational problems. Both the developed and the developing countries have almost similar conditions to fulfil for the development of technologies. For instance, the economic strength and enthusiasm of society, the attitude of policy makers, etc. influence the adoption of new technology in both situations the same way (Thomas, 1987). We shall discuss the more significant of these factors in the following sub-section. They are:

- political,
- economic,
- cultural,
- technological, and
- educational.

2.3.1 Political factors

Communication in the developing countries is not only a socio-economic need but a political necessity too. A political system, i.e., a group of people that holds power can effect the adoption and growth of a particular communication technology in a country. In other words, the introduction of new technology in the service of social change and education depends on the underlying motivation or the will of the political system of the country concerned. You may recall that the rapid growth of computer technology in India, both through import and indigenous industrialisation was the result of the interest of the late Prime Minister of India, Rajiv Gandhi. It is an example of the force of political decisions behind the adoption of technology in India, consequent upon which the computer industry flourished in the country manifold. Today, India is one of the major exporters of software in the world.

It is true that technology influences society, but it is also true that society influences the adoption and growth of technology. We, therefore, need to ensure that, rather than getting carried away by the fashion of the day, the communication needs should be identified and evaluated from the country's point of view and then the communication policy for education and development should be formulated/framed accordingly.

Some societies may adopt technology more easily than others because their cultural and linguistic structures may be more adaptable to information processing. You might be aware that Japan took to technology more easily than other countries in Asia. Within a country, the upper classes and capitalists adopt technology more easily and faster than the middle and lower classes; the urbanites go for technology more quickly than the ruralites. There is also social bias that influences adoption of the technology at an individual's level. For example, the young take to technology faster than the old do. The males take to it more easily than the females (Hawkrige, 1983). Resek (1981) reported that the secondary school girls do not use microcomputers to the extent the boys do in schools, and avoid joining the 'computer club' because it is male dominated. Though there is no systematic evidence for the causes of this bias, some educators blame the long standing prejudice against mathematics among the girls and mathematics is associated closely with computers. These observations are based on experiences in the developed countries. We do not know much about the gender or age-based preferences of the Indian society in this case. We should take up systematic research in the use of and the preference for technologies by various sections of our society.

2.3.2 Economic factors

Cost is an important factor that influences the adoption and growth of communication technologies in a country. And this is absolutely true in the case of the developing countries which import technology from the developed countries. They lack sufficient budgetary provision to run or afford technology-based projects. Some countries have made heavy investments in acquiring various technologies without building the necessary infrastructure to make those technologies productive. As a result these countries are under heavy debts. The point we want to highlight is that investment on new technologies should be seen in terms of the economic growth of the country. We should assess the rupee value of communication technology benefits like the benefits of spending the same amount of money on other measures/areas of social development.

In this subsection, we draw heavily on the discussion presented by Thomas (1987) who focussed his attention on four major economic considerations that affect the use of communication technology in a country. These considerations are as follows:

- financial strength of the society
- attitude of the policy makers
- budget allocation for technology
- cost efficiency of technology.

Let us elaborate on each issue, in the given order.

There are countries which are economically better off with higher per capita income. The per capita income of the developed countries is much higher than that of the developing countries. Since technologies cost huge amounts, it is quite obvious that the country with the higher per capita income is in a better position to afford more communication technologies, and most

developing countries lack adequate technologies for communication. They still depend on their traditional methods of communicating. By saying this, we do not mean to suggest that the traditional methods are irrelevant. We, however, believe that those methods have certain limitations, particularly in terms of their reach and efficiency. And if societies want to work on modern social agenda, they must also modernise their communication and technologies.

The adoption and growth of new technology in a country also depends on the attitude of the policy makers towards it. If they perceive communication technology being adopted as a helping hand in the development of the country, they would see that the required technology is adopted and implemented in various areas including the educational systems. The policy makers decide the amount to be allotted or the priority to be given to developing or importing a particular technology for specific purposes. In our country, the policy makers have a favourable attitude towards the utilisation of communication technologies, and are quite liberal in recommending and implementing them. At times, they become over-enthusiastic in adopting a technology at various levels of education, even without creating the adequate infrastructure in the form of required resources, including skilled manpower, maintenance mechanisms, etc.

Then we come to the cost of technology and budgetary provisions to buy or manufacture the tools for technology. Lack of foreign exchange, lack of capital, and the unavoidable difficulties in relation to balance of payments are recognised as principal economic hurdles faced by the developing countries (Jonscher, 1985). The total budget allocated for the education sector is the basis for deciding the amount to be earmarked for the adoption of communication technology. The initial expense to be made on installation of a technology is, as you know, very high. But once a country acquires a communication technology, she can reach and teach an unlimited number of students without involving high budgetary allocation. However, the skilled personnel and receiver equipment require recurring expenses.

The last point to touch upon here is the cost-efficiency of a chosen technology. We have to assess whether by implementing the technology the desired goals have been achieved optimally in terms of money, time and energy spent on it (Thomas, 1987). So the educational planners have to judge the efficiency of the technology being recommended for different target groups. They have to provide convincing answers to several questions, such as, is face-to-face instruction more effective than that done through the radio? Is the television more effective than the radio or vice versa? Such questions are to be resolved before investing in specific communication technologies. The educationists have to ensure that the investment in technology yields greater benefits to a larger number of the students, otherwise it is no good to bring in a technology for use on a large scale.

2.3.3 Cultural factors

The communication technology plays an important role in disseminating knowledge about cultural heritage and stimulating cultural activities.

Culture is a complex whole which includes knowledge, beliefs, art, morals, laws, customs, and any capabilities and habits acquired by a human being as a member of the society (Contractor, Fulk, Monge & Singhal, 1986). There are differences in these cultural factors of various societies all over the world. One society differs from another because of these variations. It is, therefore, assumed that the variations in cultural systems do function as determinants in implementing technologies, their manufacture and utilisation. In other words, these variables/variations influence individual as well as group attitude towards various communication technologies.

Thomas (1987) elaborates that the cultural element of language is one of the most important factors in the transfer of the educational software from one country to another. The radio and television programmes, computer software and even printed text are produced in different languages in different countries with different cultural backgrounds. Similarly, philosophical traditions also influence technological exchanges. The adoption of the technologies thus depends on the attitudes, values, beliefs and lifestyles the people in a country have. For example, a confrontation between modernisation and traditionalism recently started in India with the infiltration/encroachment of various technologies from the developed societies. As a result, a section of the people has become pro-innovation and pro-implementation, while others have stuck to the traditional practices. There was a hue and cry even in the mid-eighties when the computers were introduced in the banking institutions of India. The bank employees went on strike against automation in the banks. One of their apprehensions was that computers would replace them but it really did not happen. There was another apprehension that the computer would add to the already long queues of unemployed youth in the country. On the other hand the use of computers have opened up more jobs. Again, when for the first time computers were introduced for the management of a large examination system in the Central Board of Secondary Education, there were apprehensions expressed by some higher level officers, financial advisers and people in general about the need and desirability of such a step. The actual use of the computers, however, removed their apprehensions. Similarly, an important cultural factor in the formal education system is the teachers' resistance and an approach of non-cooperation to any innovation or change in their existing teaching-learning practices. They seem to be quite satisfied with their present methods of teaching and, therefore, see no reason to adopt a new technology and invite unnecessary hardships in terms of money, time and energy. This is an important reason why the modern mass media are not used adequately in spite of their availability in some countries.

Our contention here is not that we should adopt technology without considering the socio-cultural factors. We need to evolve an indigenous model of communication, which has direct relevance to our conditions. The technologies should support our culture and values under the changed conditions. Contractor, Fulk, Monge & Singhal (1986) have reviewed research on cultural assumptions that influence implementation of communication technologies. They reached the following two conclusions.

First, the implementation of communication technologies is greatly facilitated in a homogeneous culture. In other words the successful implementation of communication technologies depends on a match between the values of the two countries: the donor and the borrower.

Secondly, the implementation of technologies is successful, only when it is used to support the activities of the traditional culture, and allows development according to the values and norms of that culture. These conclusions stand true for all cultures.

For instance, the Satellite Instructional Television Experiment (SITE) project proved successful because the television programmes were shown to the villagers without disturbing their cultural equilibrium. The viewers discussed television messages in a group (teleclub) in the light of the existing practices in the rural society. On the basis of their discussions, they either accepted or rejected the messages broadcast. In this way the utilisation of the television programmes was successful, and it could bring about changes in the viewers' knowledge, skills and attitudes.

2.3.4 Technological factors

There are various technological considerations that influence the growth and adoption of communication technology in a country. New communication technologies are not free from technical problems. There are a number of studies that find technology itself functioning as a barrier in its own growth.

You might have come across instances where you faced a lot of difficulties in handling, using and maintaining new gadgets. For instance, lack of a regular flow of electricity can make technologies defunct. One of the major reasons of under-utilisation of the television programmes in the villages in India during the Satellite Instructional Television Experiment (SITE) and the Indian National Satellite (INSAT) project was the irregular supply of electricity. Some problems, particularly relevant to the application of technology for educational purposes are as follows:

Appropriateness: The technology chosen should suit the geographical conditions of the country. Those developing countries which are large, and have a difficult geographic terrain, need technologies that suit them. For these considerations, India's policy of having her own communication satellite to cover the entire country is justifiable. The microwave or cable networking have limited coverage and are too expensive to afford for large scale operations.

Accessibility: We are sure that communication technologies will not be accessible evenly throughout a country for educational purposes. Many households, mostly in poor societies of rural and urban sectors in the developing world, will have none in the near future. The accessibility of modern communication technologies such as the computer, videotext, video disc, videophone, etc., to public will remain extremely limited for many years to come. This does not mean that we are pessimistic about the situation. Far from that, we are of the opinion that the communication technology will be used first for commercial purposes, and not for educational ones in many of our countries. Certain constraints such as lack of

sufficient money, lack of interest amongst educators and administrators, lack of sufficient software/courseware, lack of political will, etc. will invariably affect the accessibility of a technology to the educational sectors.

Handling : An electronic device will become redundant if we do not know to operate it. There are devices which, of course, can be operated with simple know-how, but there are some sophisticated devices, which need special efforts and skills to handle them. For example, though a computer is easy to operate, it needs specialised training to use them. More so, because the technologies are changing fast, one finds it difficult to keep oneself up to date in handling and maintaining them. Updating to new operating systems for example is a case in point.

Maintenance: It has been observed quite often that various technologies are imported or adopted from the developed countries without having made adequate arrangements for maintaining them. Once such devices develop technical problems, they become defunct for ever. The reasons for poor maintenance facilities may be due to lack of expertise, lack of resources/infrastructure, non-availability of spare parts, or indifferent attitude of users. For instance, even the most popular/common of devices such as the television set installed in a rural primary schools in many poor countries, are not covered under an effective maintenance scheme.

Software/Courseware: It is a fact that there is a dearth of relevant software/courseware for educational sectors all over the world, including the developed countries. Besides, there is a serious problem of quality software in the developing countries. Most of these countries depend on the courseware imported from the developed countries. Such courseware may not suit the socio-cultural and educational needs of the students of the borrower countries. One of the concerns here is the language of the courseware, which may be difficult for the students to follow. As a result, the actual utilisation of such courseware becomes doubtful.

We must admit that designing and producing educational courseware is a complex task, which involves a lot of expertise, equipment and financial support. Designing courseware for the modern communication technologies, such as the computers, videotext, video disc, etc. is a challenging job. How efficiently the students learn from a lesson depends on how skilfully the courseware has been designed.

Though some developing countries have reached a level of sophistication in producing general radio and television programmes, they do not have a sufficient stock of the educational programmes. The non-availability of the relevant courseware hampers the growth and development of the communication technology in the educational sectors. It is, therefore, necessary to seriously plan and design appropriate software for the new communication technology, (for instance, the talk-back system) otherwise it will take unreasonably long time to get the new technology introduced.

Check Your Progress 2

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

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

- i) What are the four major economic considerations that influence the use of communication technology?
- ii) What are the main cultural and technological factors that influence the adoption and growth of communication technology in a country?

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2.3.5 Educational factors

There are certain educational factors that influence the growth and adoption of the communication technology. These factors are linked with socio-cultural and economic considerations prevailing in a society.

Teachers, the important component of the educational system, play a crucial role in the adoption of a technology, or an innovation. We should remember that teachers can mar the success of any media at the institutional and actual operational level. They may or may not be willing to make necessary changes in their role, or to deviate from their existing practices as demanded by the technology. Their attitude toward technology is thus an important determinant. Communication technology demands a change in the role of teachers. They should realize that they are no more the only source of information required to transmit knowledge. In other words, new communication technologies will ask the teachers for new roles of teaching managers, facilitators, individualisers of teaching, advisers and so on. This is not something new we are talking about. A number of research studies on the educational media have provided empirical evidence to show that these devices demand that the teachers should play new roles.

There is an undercurrent of scepticism among some educators that the adoption of a technology may lead to further elitism in education: widening the gap between those who have access to resources and those who do not have. Adoption of technology needs a lot of resources, and every institution cannot afford to have such costly devices. Moreover, the government cannot make technology available to every student to work with. Thus adopting technology in education will rapidly create a new elite class, if it is introduced selectively.

Attainment of learning objectives is the main function of communication technologies. Besides the other attributes of software/courseware, the language of instruction is a determining factor for its success or failure. Even the same courseware produced by a foreign and a local agency in the

same language produces different impacts. In an Indian study, for example, conducted by the University Grants Commission (UGC) Research Advisory Committee for INSAT-IB programmes, it was found that the programmes (in English) imported from other countries contributed little to the comprehension of the subject matter as compared to the programmes (in English) produced in India. The students faced problems in comprehending the language, mainly because of the pronunciation of the foreign experts. It is pertinent to mention here that the UGC imports a number of programmes from the U.S.A., the UK, Japan and other countries, but they are not used fully by the Indian students due to problems caused by differences of language and culture.

Besides, there are some additional factors that influence decision-makers to ignore or adopt technologies for educational purposes. Some of these are as follows:

- The teachers are usually not involved in planning and preparing the courseware (there is a difference between software and courseware- 'software' refers to computer programming while 'courseware' refers to all teaching materials that store information, e.g., radio and television programmes) for the students. The perception of the producers may differ from that of the teacher. This is the reason why teachers do not look at these devices with favour.
- There is another problem with the courseware. From the qualitative point of view, the scope of the content of the courseware may be limited, and the presentation of the content may be inadequate. From the quantitative point of view, it is very difficult to cover the entire syllabus by one technology (medium). Therefore, other media are required to achieve the educational objectives in their totality, but it is very difficult for many countries to adopt the multimedia approach to teaching-learning.
- There is a dearth of variety in the courseware in developing countries. The material borrowed from the developed countries may not be suitable for the students of developing countries; the software may not suit the needs of individual students.
- The teachers and the students may feel that the written and spoken communications are still popular in education. The students' dependency on the books and the teachers' lectures discourages them to make use of the modern communication technology. For instance, the Japanese, in spite of being a super industrial society, continue to depend on teachers for teaching-learning purposes. Thus education still suffers from a kind of intellectual imperialism, i.e. the teachers feel that they are the only competent means of teaching the students.
- Some communication technologies are more effective for pedagogic purposes than others. Educationists prefer the technology, which has the potential to solve educational problems and can consequently improve the quality of instruction.

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.

As a teacher you want to introduce computers in your institute. List the problems you may face in doing so.

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2.4 COMMUNICATION POLICY

Let us start our discussion by touching upon issues related to communication policies. In many countries in the world, broadcasting was started by private agencies but in due course of time, it was taken over, directly or indirectly, fully or partially, by the government agencies. The radio broadcasting system, which needs less resources was also started under the private initiative of an individual or a group of people. On the other hand, the television, being an expensive medium for private initiative, started on a very limited scale. Another interesting fact is that in some countries, such as, the U.K., Italy, Netherlands, the Philippines, etc., religious groups were given license to broadcast for the people.

In India, the electronic mass media — the radio, television and telecommunication, are regulated by the Government of India, which has complete monopoly over the broadcast system for the whole country. These media are being used to serve the public and political interests in a manner not very different from the press, which is under private ownership. Over the last decade, there has been a big controversy over the control and use of the radio and the television in the country. A series of debates at various public platforms including the Parliament were held (and are still being held) to discuss the policy issues related to the electronic mass media. There is a clear trend favouring the view that the electronic mass media should be an independent body accountable to the public, free from any political interference.

Due to the availability of the direct broadcast facility and also the need for more and more programmes to feed the transmission, the Ministry of Information & Broadcasting has allowed the private, public and autonomous agencies to produce programmes. As a result, the Ministry of Human Resource Development through the UGC, the Central Institute of Educational Technology, and the IGNOU, the Ministry of Agriculture and Rural Development through the agriculture universities, and the Ministry of Health and Family Welfare have started producing instructional programmes for their respective target group. However there is a long way to go.

So far, we talked about the organisation of the mass media in general. Let us now come to the main issue, i.e., communication policies.

Policies are applications of theory to reality, usually in the form of social, political, economic and cultural action. In fact, large-scale communication action requires a coherent and well-defined policy. Unesco (1972) has defined communication policy as "sets of principles and norms established to guide the behaviour of communication systems".

Communication policies, in general, have been an issue of long debate and of controversy throughout the world (Melody, 1986). The communication technology is not an incidental service. The policies that govern it emerge from social pressures. In other words the policies concerned depend on the social role we expect the communication technologies to play in the complex process of transformation that the society is going through. Their implementation should speak explicitly of the purposes to be achieved, the plans to be followed and the activities to be performed. In order to implement activities related to communication technology, one has to consciously mark out strategies to achieve social goals. They should promote a better informed and more participatory citizenry. Keeping these facts in view, the policy makers should chalk out an overall policy framework in the public interest, and address themselves to issues of communication disparity both within and among nations.

However, in practice communication policies have also been created under pressure from the technological innovations. The first concern of these policies is to find the ways of ensuring that the distribution of information and communication does not encourage class divisions in the society, and that the benefits are spread uniformly among all the classes, but in effect, the politically and economically dominant classes usually shape the policies in their favour.

This requires a re-examination of the role of information and communication in a democratic country. In a democratic society, it has been accepted as obligations for the government to keep the citizens informed and make the sources of information accessible to them. The aim of communication is to approach people through all the available media for the cause of social development. Besides our constitutional commitment to freedom of speech and expression, communication is envisaged as a support for social development. The radio and TV are being used for social development including formal and non-formal education (Chatterji, 1987). Dr. Vikram Sarabhai, the famous Indian scientist, envisaged the use of the TV as a means of education and social change, and as a result SITE project was conducted in the rural areas to serve the nation as whole. Therefore, a broad-based approach to framing policies about communication is not only desirable, but also necessary.

Various policy decisions on communication have been taken from time to time. The policy on the print medium has a longer history than that on the electronic media. The rules and regulation for the use of the electronic media, particularly, the radio and television, are being framed in India.

Various committees/commissions have deliberated on the issue, but we are still in the process of finalising them.

Having said this much on the communication policies in general, we now move on to some specific issues which are of immediate concern to us.

Communication policies and development: One of the areas of priority facing the developing countries is development — social, educational, cultural and economic which to a large extent depends on the nature and distribution of communication/information. Because communication is a resource to enhance social development and education, the policies on communication should be designed to give a desired structure to the overall or integrated development of society, i.e., communication should be linked with the overall developmental goals of the country. The approach to the development should decide the type of communication system needed. It has to be a system that can ensure the active involvement of the people in achieving the goals of development. Here, the communication technologies are the means, and not the ends, for development. In other words, control over the technologies is tantamount to potential control over development.

One important point that we should keep in mind is that the communication policies and development strategies, considered as essential means of solving many of a country's problems, should be designed first and foremost to ensure that the media of 'information' become the media of 'communication'. Because communication presupposes people's access to the means of information and their participation in the common cause, different media should be involved in the process of development, which cannot be achieved fully unless 'education' is one of the major concerns of these policies under consideration.

Indian space research and application programmes are based on the primary purpose of using communication for development, i.e. improving the quality of the Indian life. To benefit the maximum number of the people, various communication technologies are being adopted and used in India. The proclaimed objective of our broadcasting services has been to provide support to mass education and development. As per the policy decisions taken, the technologies such as the communication satellite, audio and video, etc., are being used for a wide range of information resources for the welfare of the people, thus taking them towards the 'information age'. With limited resources, India has set up three main priorities (Narula, 1986).

- To accelerate the pace of development by informing, educating and motivating the people for development;
- To ensure that these technologies benefit a large number of the people; and
- To provide efficient communication facilities to the masses.

Narula wants to highlight the fact that the main efforts of the government have been directed towards making the technologies available to the country reach the majority of the people, convey optimum and relevant information, and prove physically and financially accessible to the people. Thus it is based on the assumption that the technologies will reduce the

communication gap and the gap in developmental benefits among the people.

Communication policies and demographic factors: The communication policies must also take into account the demographic factors and their consequences at different levels of development strategies (UNESCO, 1980). The population of the country should be taken into consideration while framing the policies with a view to providing for appropriate solutions for the expansion of resources, facilities, equipment, etc. with the changing times.

UNESCO (1980) recommended that the communication policies, particularly in the developing countries, should take into account the population growth and its effect on various development and educational strategies. We all know that the Indian education system, for example, is facing problems due to increasing population, which in turn affects the allocation of educational resources. The ways and means to communicate must provide an infrastructure to satisfy the requirements of various population sectors which are growing alarmingly. Effective communication policy will definitely help in this regard to promote education.

Integrated approach to communication policy

Mowlana and Wilson (1988) while analysing communication policies and planning for development, recommend an integrated approach. According to them since communication is closely related to development, the strategies a country take in communication should be considered in a system view point covering all economic, political, cultural issues at national, international and global levels. As such, communication policies should consider the following elements:

Stages in the process of communication: (i) the source, (ii) the process of production, (iii) the process of distribution, and (iv) the process of use. Distribution and use have become most crucial areas in communication policies because of the technological advancements.

Factors affecting communication: They include issues related to (i) ownership and control, (ii) capital formation, (iii) bureaucracy, (iv) technology availability, (v) message integration, (vi) message development, etc.

Balance of modern vs. traditional channels: The communication policy should see to it that traditional and indigenous communication channels rooted in a culture and society are not divorced due to the modern technologies. Instead the communication system and policy of a country should be such that both modern and traditional channels complement each other.

As such, an integrated approach to communication policy assures effective development in a society which is the prime aim of communication technology.

Check Your Progress 4

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

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

- i) What are the three main priorities India has set up to use communication technology for social development?
- ii) Which is the most important demographic factor we should take into consideration while framing a policy of communication.

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2.5 LET US SUM UP

After going through this unit, you would have achieved the objectives stated earlier in the Unit. Let us recall what we have discussed so far.

- Communication has a long history, as long as that of the human race. At the primitive stage people developed simple ways and means of communication. In due course of time new sophisticated technologies were invented and used to expand the ability to communicate effectively and efficiently across longer distance over longer periods of time.
- The invention of printing technology was a revolution in the area of communication. It was, however, first used for the reproduction of religious works. As early as 868 A.D., the teachings of Lord Buddha were printed by the Chinese. It took centuries before the mechanised printing press came into existence.
- Due to advancements in communication technologies, the process of printing became mechanical. More recently, computers and laser technology were added to printing technology. Today, we have the most sophisticated electronic devices to produce, store, maintain and distribute the printed text.
- The printing press first came to India by chance on September 6, 1556. It was set up by a Christian Missionary and used for printing religious books.
- The audio-visual media are the products of the twentieth century. The audio media came in the 1920s and grew very fast after the World War II. They are now used for entertainment, education and information all over the world. The visual media came later in the sequence but expanded very fast. Now most sophisticated technologies, such as, video cassettes, cable TV, computers, videotex, video disc, videophone, facsimile, etc. are used for communication the world over. The

communication satellites are geared to bring the world together for the welfare of human beings.

- The growth and transfer of technology is confronted with a number of problems. The factors, such as, political will, economic strengths of a society, cultural determinants, technological complexities and the educational system itself, influence the growth and utilisation of communication technologies. These factors play a very important role in the case of developing countries, which depend on the developed countries for both expertise and financial assistance.
- Communication policies have been an issue of debate all over the world. In most of the countries in the world, the print medium is owned by private agencies. They have clear guidelines, code of conduct and regulations to follow. There is a constant pressure on the electronic media, especially the radio and television, to have their own policy guidelines that are still in the process of development/finalization. The important policy issue is to make communication technology accessible to every citizen. India, and all other developing countries, for that matter, are trying to make the optimum use of communication technologies for development. But there is a long way to go in the uses of technology to improve the quality of life by increasing productivity, educating people for better health and hygiene, population control, etc.

2.6 CHECK YOUR PROGRESS: THE KEY

1.
 - a) Desk Top Publishing
 - b) CD Audio
 - c) Digital Audio Broadcasting
 - d) Digital transmission
 - e) Multimedia capabilities
 - f) Convergence towards interactive services.
2.
 - i) The four major economic considerations are
 - financial strength of the society
 - attitude of the policy makers towards communication technology
 - budget allocation for communication technology
 - cost efficiency of the technology
 - ii) The main cultural factors are — language, beliefs, arts, values morals, customs, laws, attitudes, habits, etc.
3. Your answer may be as follows:
 - Authorities, including the head of the institution may not agree to cooperate
 - Difficult to afford the cost
 - Dearth of trained teachers
 - Lack of appropriate software
 - Problem of use and maintenance
 - Lack of storage facilities

- Unfavourable teacher attitude
4. i) The three priorities should be to:
- Reach the majority of people and inform, educate and motivate them.
 - Ensure that the technologies convey relevant information for the benefit of masses.
 - Make communication technologies accessible — both physically and financially — to the masses.
- ii) Population of the country is the most important demographic factor we should consider while framing a policy on communication.

UNIT 3 APPLICATIONS OF COMMUNICATION TECHNOLOGY

Structure

- 3.0 Introduction
- 3.1 Objectives
- 3.2 Uses of Communication Technology
 - 3.2.1 Reaching
 - 3.2.2 Teaching
 - 3.2.3 Specific uses
- 3.3 Applications of Communication Technology: Problems
 - 3.3.1 Socio-political factors
 - 3.3.2 Human and administrative factors
 - 3.3.3 Economic factors
 - 3.3.4 Equipment-related factors
- 3.4 Skills of Using Communication Technology
 - 3.4.1 For education
 - 3.4.2 For development
 - 3.4.3 For entertainment
 - 3.4.4 For commercials
- 3.5 Communication Technology and Society
- 3.6 Let Us Sum Up
- 3.7 Check Your Progress: The Key

3.0 INTRODUCTION

In this course on Communication Technology for Distance Education, we are dealing with various technologies, which are applicable for the development of communication among people. We have already discussed the issues of communication in Unit 1. You have studied about the growth and adoption of communication technologies in detail in Unit 2. You have also studied about some important problems facing the growth of communication technology, with special reference to developing countries. The previous unit gave you an overview of the issues pertaining to the policy on communication technology in relation to education.

People talk about communication revolution quite frequently. We do feel and know that something very spectacular in the field of communication is happening. But many of us may not be in a position to grasp the whole gamut of the technologies under consideration. In this unit however, we shall talk about and discuss their implications. 'You don't need to know how the motor works in order to drive a car... One may not need to know about the technical aspects of a computer's functioning, but in this age one must know what computers can do and how they function (Rogers, 1996). As a distance educator you should know about new communication systems and about the ways in which they can be adopted to impart knowledge to the students pursuing their studies through the distance mode of education. Therefore, in this unit we shall focus on the applications of various

communication technologies, the theoretical aspects of which we have already covered in the previous two units.

3.1 OBJECTIVES

The primary aim of this Unit is to familiarise you with various communication technologies, which are employed for various purposes. After going through this Unit carefully, you should be able to

- classify the communication technologies according to the requirements of various target groups;
- describe the uses of these technologies, especially for purposes of education;
- describe various social and human problems as a result of the application of technologies;
- describe the skills required to meaningfully use communication technologies for various purposes; and
- summarize issues related to communication technologies and society.

3.2 USES OF COMMUNICATION TECHNOLOGY

People in various organisations are making use of communication technology, which has given us efficient tools of communication, capable of widening and enlarging mankind's horizons. Communication technology has influenced the lifestyle and habits of all who are exposed to it. Let us discuss some specific uses of communication technology. Our emphasis here is on its educational uses.

Our focus in this Unit is on the uses of communication technology for education particularly for distance education. There is a danger here. We tend to get carried away by various aspects of the application of communication technology. We therefore confine ourselves to those aspects of technology, which are useful for educational purposes.

3.2.1 Reaching

The desire to reach more and more people at a particular given time is there in every individual. Consider the ancient scripts, paintings, cave-inscriptions, etc., they are the manifestations of the inner desire of human beings to reach more and more fellow people and communicate to them their joys and sorrows, thoughts and visions.

Modern communication technologies have given us the facility of reaching a large number of people. In a large, populated and predominantly illiterate country like ours, communication technologies can provide tremendous reach for disseminating audio-visual information. With improved and low cost satellite delivery technology, the reach of All India Radio (AIR) and Doordarshan (Govt. sponsored television channels in India) for example,

has increased tremendously, covering almost the entire country. Thus technology turns the whole world into a global village.

With the help of terrestrial transmissions network and satellite-based communication radio is able to extend its reach over the entire length and breadth of India. We have discussed audio components in Unit 2 of Block 2 in detail.

With the telephone and its improved versions, people all over the world can reach each other instantly. Telephones with fax machines have made the communication systems more efficient. People from distant places can send and receive messages / information without any delay in the transit.

Computers, of course, have brought tremendous efficiency within the reach of people. Huge amounts of information stored in tiny microchips can be reached by a stroke in the key board. Similarly videotext technology adds the possibility of having access to more information by turning the home television into a computer terminal. This technology can retrieve textual information, figures and graphics from remote data bases, and also allow people to have access to various frames of information on the home television screen connected to a computer data base through wireless transmission.

People can, without going through the hassels of travelling and other problems associated with attending conferences or meetings, have the same functions done through teleconferencing. There are three main categories of teleconferencing, namely, audio-conferencing, video-conferencing and computer-conferencing. In audio-conferencing the participants can only hear each other. In video-conferencing they are stationed in different locations but can see and hear each other's view on the screen of television. Similarly computers can be used for linking various locations of conferencing. There can be various combinations of the technologies to suit the requirements of the content being taught and the technologies available with the institution and the participants involved.

The development of the Internet and the World Wide Web provides tremendous opportunity for reaching people world wide. Electronic mail (E-mail), which is cheap and instantaneous has become the order of the day. The use of listservs allows us to communicate with a large number of like minded people any where in the world, with a connection to the Internet.

So far we discussed technology from the viewpoint of reach and access. You may stop reading this unit for a while and quietly try to visualise in your mind the extent of reach and access people have among themselves, with and without communication technologies. And see how you are surrounded, rather wired by modern communication technologies.

Check Your Progress 1

Notes: a) Compare your answers with those given at the end of the unit.
b) Space is given for your answer.

- i) Name five communication technologies, which are used to reach a large audience.

- ii) Tick (✓) mark the best word/expression.
 - a) The reach of broadcast is increased manifold when it is hooked to
 - ☐ radio
 - ☐ antennas
 - ☐ satellite
 - b) A fax machine is connected with a
 - ☐ telephone
 - ☐ television
 - ☐ radio

3.2.2 Teaching

Till the recent past, the process of educating someone was considered to be only speaking, and/or listening to the teaching in a face-to-face situation. The conception that learning takes place in classroom situations only, does not stand valid anymore now. The features of distance education have proved that learning is possible anytime, anywhere. In fact, with the growth and development of the communication technology the barriers of time and space to the teaching-learning process have been broken and this process has been liberated for the good of humanity. Communication technologies have entered the scene and started sharing the burden of both the teacher and the book, and made teaching and learning enjoyable.

Communication technology has strong multiplier effect. With the growth of communication technologies the nature and the dimensions of teaching have changed. In order to impart education, a person need not necessarily be a lecturer or a teacher in the conventional institution; he/she can be a news analyst who may present his/her thesis or analysis on a given theme through radio or television. A social worker need not go from village to village in person and give long painful talks about a social problem, such as women's rights or exploitation of rural folk or the use of repressive state machinery by the political system in power. A social worker can use audio cassettes on the issues close to his/her heart and distribute them among the target audience to disseminate his/her messages. A health worker can better impart messages about diseases, preventive measures, the process of nursing, etc. by displaying posters, film-strips, audio and video films among the target audience.

Consider another example. A very low power radio station was set up by a Catholic Bishop in the Northern Luzon of the Philippines primarily to impart biblical teachings. The audience was mostly fishermen. These fishermen sometimes continuously sail in the sea for days without knowing what is happening on the shore. During this time they are to be reminded of the teachings of the Christian faith. Suppose a message as follows is sent to the sea in between religious teachings for a nominal fee "Mr. Lopes, your old mother is very sick. She desires to see you now. Please come home immediately. The members of your family are on the beach waiting for you". This is exactly what that particular radio station was doing. Communication technologies can be tapped for aiding the teaching-learning process, imparting developmental messages and knowledge about various issues and problems.

Advanced communication technologies such as videotext, teletext, video disc and computers are being used for education in developed countries. Being expensive and sophisticated, these technologies are not frequently used in developing countries, for educational purposes. Some developing countries are, however, engaged in experimenting with and utilising them though in a small way. With the reduction in cost the situation is fast changing, and more areas and people are covered by radio now.

Broadcast technology has been and is being used for education and development in the developing countries in general and in India in particular. For example, the radio is being used as the countrywide classroom, an instrument to eradicate illiteracy and for development as a tool to improve the quality of life in India. So is the television.

3.2.3 Specific uses

The importance of communication technologies in education lies in its student-centredness. The student can use various means of communication, to seek information or clarification to resolve doubts or queries. For example he/she can use the telephone for this purpose. The students can listen to radio to increase their knowledge, watch TV to learn new things, and use computers to gather, process and store information. The student takes the help of the videotext and teletext to gather specific information to enrich his/her store of knowledge. These are all possible only if technologies are available to the student.

Let us discuss some specific educational uses of communication technology besides what we discussed in sub-sections 3.2.1 and 3.2.2.

Course planning: Computer can help immensely in designing and planning of courses. Computers connected with a database, for instance can provide basic information about prospective students and help rationalise the purpose of launching a particular course. Proper course planning is a very serious and complex task. Feasibility study is necessary and the computer with all its technological versatility is a boon for such a venture. Here, a word of caution is necessary. We should remember that the effectiveness of a course plan is not dependent on the computer but on the authority who manages the computer. Computer is a device in the hands of the teachers

and students to perform the task of designing and learning a course efficiently and effectively. The advantage it provides is that it can complete and perform tasks much more efficiently and faster than human beings could ever do manually.

Course management: Course management is an important process and it starts simultaneously with course planning and continues till the declaration of the results, i.e., the successful completion of the course(s) by the students. In course management, the computer plays a crucial role. The computer can store all the data generated in the process of planning and implementing the course. The feedback from the students and the counsellors can be conveyed through telephone, fax, mail or study centres and all the information can be stored in the computer. A final analysis of the quality of the course materials or impact of the course is possible since these can be recalled from the computer and necessary improvements can be incorporated to increase the effectiveness of the course.

Again, it is not the computer which manages the courses but the human being behind the computer. The quality of the management will wholly depend on the person(s) having authority and upon those who handle the machine.

Student support services: Distance education, with the growth and availability of electronic media, has taken a very gigantic leap in the 1980s. Earlier, distance education mostly depended on the print material and occasional face-to-face interactions between the teacher and the students. The remarkable expansion of communication technology opened up new ways to impart education and have a dialogue (two-way pedagogic communication) with the students. A sensible use of the electronic media can give tremendous support to the distance learners. In fact, student support is the mainstay in the successful implementation of distance education system. Regular teleconferencing can be a vital student support service using communication technology.

Print material: Print material is the primary instructional input in the distance education system in almost all distance education institutions. Here too, the impact of the modern technology in terms of quality, efficiency and cost has been extremely beneficial. With laser printing and desk top publishing, the print medium has undergone a second revolution. Earlier, print materials were cyclostyled (often of very low quality) and despatched to the students for their home study. These materials were often without any pedagogic support built into them. Sometimes only the list of the reference books were mailed. The formulation and development of the mode of writing for distance education together with the advances made in the printing technology have brought in a great change in the quality and instructional utility of the print materials.

Radio broadcasting: Radio has been used extensively for education and development purposes. If a country is to democratise education by bringing it to the doorstep of all the citizens of the country, radio can be of immense help in achieving the objective. This would make distance education more accessible to the students.

In addition to the course-based programmes, distance teaching institutions can also provide vital administrative inputs through radio broadcasts. These would minimise the time gap and ensure faster communication. A more detailed treatment has been given to this theme in Unit 2 of Block 2.

Telecasts: Television has an edge over radio. In addition to the audio facility, the actual experts, subject matter, places, events, etc. can be seen on the television screen. Television is more appropriate for teaching science subjects especially since the laboratory can be brought to the study table of the student. Expensive experiments, actual field or sports, microscopic elements, old footages, technical instruments, eminent personalities — the students can reach all these by means of television. We shall discuss the video components in Unit 3 of Block 2 in this Course.

Through radio and television broadcasts students can come into contact with the most talented teachers of the country. And this single factor alone can minimise the gaps between the 'haves' and the 'have-nots' among students or between the rural and the urban students.

Audio and video cassettes: Students can have access to the audio and video programmes at the study centres. If you as a student, for some reasons cannot watch a particular broadcast/telecast, you can go to your study centre and watch it there. The cassettes are very handy. You can buy them and benefit from them as and when you desire. They provide the facility of learning at your own place. You can replay, stop, fast forward and learn better from the messages.

Telephone: Telephone is mostly used for interpersonal communication. A students' service hour could be opened so that a student may call his/her teacher/counsellor/University administrator and clarify his/her problems or issues. The telephone line is used for various communication devices, such as fax, e-mail, computer, etc. Telephone can also be useful if audio-conferencing is conducted for the students. For video-conferencing the process is complicated, however, the audio channel through the telephone line remains vital in both the cases.

Computer: Computer assisted instruction, popularly known as CAI is very helpful in distance learning. Computer diskettes can acquire, process and store a large amount of information for dissemination. But the computer is not yet being used extensively for teaching learning purposes by distance education institutions in India. However the computer revolution is changing things very fast. Now courses are also available on the network. The power of computer is versatile. With its multimedia capabilities to handle sound, picture, video, text and interactivity, it is becoming more powerful for educational implications.

Videotext and teletext: These devices are advanced communication technologies. The home television can be connected with a master computer and the desired information can be retrieved from the master computer. Teletext also uses the home television and gathers information as desired from the transmission of the master computer. In both cases a master computer is required.

Check Your Progress 2

Note: Check your answer with the answer given at the end of the unit.

Given below are two categories — one has clusters of users / audiences / people / institutions and the other has clusters of communication technologies. Please match the user clusters with appropriate technology clusters.

Category A	Category B
i) A village school without electricity	A. Radio, television, video cassette player
ii) A small company in a medium sized town	B. Telephone, videotext, telex, television, radio, fax machine
iii) A very big commercial firm in a metropolitan city	C. Telephone radio
iv) A family of four, earning Rs. 15,000- a month, living in a rural locality	D. Radio, posters

3.3 APPLICATIONS OF COMMUNICATION TECHNOLOGY: PROBLEMS

In the preceding section we talked about some general applications of the new and advanced communication technologies. No doubt, these technologies have enormous possibilities and potential to serve people. As mentioned earlier, despite the provision of such a huge network of AIR and Doordarshan, why for example, could India not solve its population problem by educating the masses? Why do we have the largest number of illiterate people in the world? With telephone network spread all over the country, why do we find it so difficult to get information passed on to the target groups? You might yourself have come across new technologies that are supposed to do wonders for us and take us to new heights. But some of the new technologies just cannot be implemented because the situations, both physical and mental, may not permit them to operate. Various hardware, software, cultural, social and economic problems are there to be confronted. In the following sub-sections we discuss some of the problems of applying communication technologies in the Indian context, as an illustration.

3.3.1 Socio-political factors

Many good things have happened or are happening because of political will and the backing of the public. The 'will' of the people supported by the 'will' of the political leaders can make the things move.

Many of you might have heard about development communication. The concept originated in the late fifties and early sixties. The theory is that developmental messages such as about improving soil and agricultural products, checking population growth, improving health by protecting the

environment, etc. can be disseminated through various means of communication. By doing so we in the developing countries would be able to leap forward at least some by decades in the developmental process.

In India, it is said that telephone networking did not expand in the past because some people at the top deliberately did not want it to expand. Scholars say that development communication failed in the 60's and 70's because there was not enough political support. Whether these are facts or mere opinions, it is an undisputed fact that the communication technologies will not benefit people unless there is a strong political will to support them. A very significant example can be given to illustrate this point. With the enthusiastic support of the Rajiv Gandhi Government in 1985, the computer revolution entered India. Since then the computer industry is growing by leaps and bounds. It is becoming more and more acceptable in educational institutions. Similarly the telephone accessibility has also increased. In other words, because of governmental support, the computer and communications industries in the country have grown.

There are various direct and indirect problems which may crop up as a result of the application of the new communication technologies. Let us discuss some of these problems here.

Decentralization and isolation: The communication technologies like satellite, television, radio, telephone, computer, videotext, etc. if adopted by the Indian society on a large scale, could make the country a well informed one. Information is a resource, which makes a person a better decision maker and probably more independent. Besides, the present pattern of flow of information from the centre to the periphery could change, as the well informed, independent citizen may bring about a change in the information flow structure, which in turn may bring about a change in the political structure of the society. The present power equation between the centre and the periphery will be questioned and challenged, and may force some fundamental changes in the political equations of the nation. Further the change may introduce a very problematic topsy-turvy period of transition. However, the desire to establish a truly democratic and egalitarian society must accept such a transition. At the same time, the availability of a large number of communication channels (the large scale use of computers, telephone, fax, etc., in an office) may empower the citizens to work independently. They may isolate the members of the same office working in small cubicles. The absence of physical communication may create psychological isolation that could give rise to social problems.

Information 'haves' and have-nots': The elite of the society usually uses any new technology first. The infrastructure and the cost of the equipment do not permit the economically poor people even to dream about adopting a new technology. This widens the gap between the 'rich' and the 'poor' of society. This in turn influences the application of technology in a country. Most developing countries do not have the necessary infrastructure of terminals, networks, communication channels to be able to take part as equal partners in the world wide enterprise of knowledge production and distribution. According to Bruce Girard, former director of Latin America's computer radio Pulsar, 95% of all computers are in the developed countries;

ten developed nations with only 20% of world population have three quarters of the telephone lines. According to Arunachalam (1997) "teledensity in India today is about 1.5 lines per 100 person. Till 1994, it was less than one per 100 persons. And most of the telephones are concentrated in the metropolitan areas. Many scientists do not have telephones on their desks; those who cannot make calls outside their towns/cities, let alone overseas calls. Many universities do not have e-mail or Internet facilities. Some have 1.2 or 2.4 kbps connection. With such low bandwidths and poor terrestrial telephone connection, one can at best send and receive e-mail messages but cannot surf the net or do online searches. The simple truth is the information super highway is not bringing the fruits of cyberspace to all. There are far too many people in the developing world who have not been touched by the information and communication revolution — the have-nots and the know-nots who risk being always left behind."

Interpersonal relationship: As mentioned earlier, the communication technologies create a well-informed society, but in the process they isolate individuals from each other. The frequencies of the use of technologies create barriers between persons. And thus, the interpersonal bonds become weak. For example, watching television may lessen the interactions among the members of a family. Yet we realize that we have to adopt technologies. It is necessary to find genuine solutions to problems discussed above, rather than avoid adopting technologies and live like primitive people while the rest of the world is already far ahead of us.

3.3.2 Human and administrative factors

You may recall the discussion we had about the applications of communication technologies in distance education, especially in the student support services. However, if the students do not have access to the technology being implemented, the situation may cause serious administrative problems. The situation will immediately create two classes of students: the 'haves' and the 'have-nots', which in turn will cause various human problems. For example, when Indian Railways introduced computerised reservation system, thousands of employees had to be oriented and trained to use computers. This must have caused a lot of administrative problems, as the employees who had worked manually for years had to adjust to the new situation and adopt new functions of highly intelligent machines — they must have resisted the change. However, such situations are common to any change and therefore, as educationists it is our duty to implement change in planned manner to avoid resistance and allow the benefit of technology revolution.

3.3.3 Economic factors

The application of any communication technology is a costly affair. The investment runs to millions of dollars. This causes a lot of stress on the exchequer of the countries concerned, particularly if they are developing countries. Such a huge investment requirement forces many of them not to use the technology.

The common people often are unable to reap the benefits of technologies as they are unable to buy the necessary gadgets. The benefit of the expansion of the Doordarshan network for example gets devalued when people do not have access to the TV sets. It causes pain and hardship for an ordinary citizen to acquire a TV set. And this is true of other communication technologies as well. The economic capabilities of the people become a hindrance to access to technologies.

3.3.4 Equipment-related factors

The problems pertaining to the equipment arise mostly with the application of imported technologies. The equipment, i.e. the hardware is imported from various foreign agencies or from developed countries. Thus, for maintenance the adopting countries will have to rely on the foreign agencies. This dependency causes havoc as the officials of the adopting countries cannot have total control over all the aspects of such technologies. Sometimes, the import of spare parts and consultancy services get entangled with the legal procedures of the country causing unusual delays and frustration.

3.4 SKILLS OF USING COMMUNICATION TECHNOLOGY

Technology develops and grows according to the needs and character of a particular society. However, these days we are experiencing that the walls separating society and communities are crumbling down. The interaction, the inflow and outflow of goods, materials, information and people among the nations are frequent and almost barrier-free. The communication technologies and the communication revolution have made all these things happen so easily and quickly — of course, the change is far from complete yet.

Transfer of communication technology is so common an aspect of dealings among nations that many countries are pooling their resources together to fund research projects for invention of new technologies. This transfer of communication technologies has promoted countries to train people to acquire new skills required to use communication technologies for education, development, entertainment and commercial purposes.

3.4.1 For education

The purpose of using communication technology must be very clear. Unfortunately in most of the developing countries the purpose is not well defined and the parameters are not clearly spelt out for use by both the institutions/teachers and the users. The teacher or educationist must be thorough in his/her plan and strategies to achieve the purpose/goal. This will help the teacher utilize optimally the potential of the technology(ies) implemented. He/She can use various means of communication as a unified force to impart knowledge, skills and desired attitudes to the students. The use of every device/medium must contribute to the overall cumulative

effect. Sometimes, using a single technology may serve the purpose. Technologies, therefore, should not be used simply for the sake of it. One must learn not to use technologies aimlessly.

The skills required to use communication technologies can be broadly classified into three types:

- a) Hardware related, i.e., the know-how about the working of all the components of the equipment.
- b) Software related, i.e., the purpose for which a technology is used. Comprehensive knowledge about the software/content and its various formats which could be employed to achieve the purpose.
- c) User related, i.e., the target audience, and individuals who need to know how to make use of the hardware as well as the software.

Let us examine, in brief, the skills required for using the popular communication technologies in the light of above details. We shall, however, discuss in detail the individual communication technologies at relevant places throughout the course.

Radio and television

Hardware related skills required by engineers/technicians are to:

- install, operate and maintain the transmitters, antennas and studios;
- record the software programmes in appropriate formats to suit the discipline-based requirements;
- repair or change the dilapidated part of the hardware.

Software related skills required by educationist/teachers are to:

- have clear knowledge as to how the hardware operates,
- know about instructional designs,
- know the specific potential and weaknesses of the individual medium being used,
- determine good quality of voice, visuals, music, etc., and
- write scripts.

User related skills required by the students are to:

- know the functioning of the operating systems
- operate the technology, and
- know the techniques of learning optimally from the media.

Computer

Hardware related skills required for teachers are to:

- operate a computer using keyboard/mouse;
- repair simple faults, like loose communication; and
- take care of the computer.

Software related skills are to:

- make use of various software programmes;
- develop programmes to suit the requirements of individual students.

User related skills are to:

- develop the ability to use the computer; and
- know about computer assisted or managed learning.

3.4.2 For development

All communication technologies that we have mentioned so far in relation to imparting education are applicable to development purposes also. The skills required to apply communication technology for development purposes would be similar as far as the a) hardware, b) software and c) the users are concerned.

3.4.3 For entertainment

Communication technology used for education and development purposes may also be used for entertainment. There is no clear cut demarcation between educational/development and entertainment related uses of communication technologies. An attractive educational programme may be entertaining as well. We advocate that educational programmes should be entertaining, and interesting too. We have to remember, however, that the entertaining component of an educational programme should not destroy its educational value. The programme producers should design their materials in such a way that they attract and hold students' attention for optimum learning. Without the motivational element, no educational programme will be effective. Computers are being used for games and simulations which present strong educational inputs, such as reasoning and scope for problem solving. The skills required would be the same enumerated earlier. The software input is also crucial for a successful entertainment programme.

3.4.4 For commercials

Communication technologies have made commerce the pivotal concern of our society. The success of any commercial venture will depend very largely on the communication media used for promoting it. The technologies would remain the same but their usage would vary according to the requirements. Media selection and message processing are very important for the use of communication technology for commercial purposes. Talented software professionals are required to promote commercial products.

You have already observed in day-to-day life that various means of communication such as print, audio, video, etc., are being extensively used for commercial purposes. A number of agencies, public and private, are engaged in producing programmes for commercial purposes. Commercial entertainment prevailed over the original promise of educational and developmental use of electronic media. However, a socially conscious, committed institution can fulfil the original promise by presenting interesting educational/developmental programmes.

Check Your Progress 3

Notes: a) Write the code of skill (H, S or U) in the box given in front of each statement.

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

The following is a set of ten statements. Each statement is related to one of the following skills — Hardware skill (H), Software skill (S) and User skill (U). Now you have to indicate in front of each statement, the skill it belongs to.

- i) Repairing the needle of the meterband in a radio set is a ☐
- ii) Directing a television drama is a ☐
- iii) Switching on the knob of a television set is a ☐
- iv) Using 'a computer' programme is a ☐
- v) Checking a photograph is a ☐
- vi) Dialing a telephone number is a ☐
- vii) Producing a greeting card in a computer is a ☐
- viii) Reading news for radio broadcasts is a ☐
- ix) Taking a long shot, mid shot, and a close up with a video camera is a ☐
- x) Putting on a video film is a ☐

Activity

Take an evening off from your other activities. Monitor/watch the television programmes and document each of the programmes by topics and duration including the advertisements. Having done this, try to calculate the time given and identify the topics devoted to education, development, entertainment and commercials.

3.5 COMMUNICATION TECHNOLOGY AND SOCIETY

After working through the above activity, you might now be quite interested in knowing more about the sociological aspects of communication technology. We shall discuss in brief the linkage between communication technology and society. Let us raise the basic issue. What is technology?

When we talk about 'technology', we usually refer to machines. Just close your eyes and think about 'technology'. What are the images that come to your mind? Most probably they are huge gadgets/machines, computers, electric stoves, television, radio, video cassette recorders/players, camera, air conditioners, electric fans, bulbs, and the like. May be you did not consider weaving, pottery, fishing nets, wheels drawing water from the well, bullock-carts, etc., as technologies. But, these are also technologies.

Technology is an application of science. It can be defined as a process of execution whereby you give your input, follow a given procedure to get a specific output. As you repeat the input and the process, surely you could

get the same output repeatedly. Rogers (1986) described technology as a design for instrumental action that reduces uncertainty in the cause-effect relationships involved in achieving desired outcomes. Similar designs with corresponding purposes used in communication are known as communication technologies. In this context, communication technology is defined as a device by which individuals collect, process, store and disseminate knowledge and information.

Now, having talked about the basic concept of technology, we move on to discuss the relationship between communication technology and society. But before that, check your progress.

Check Your Progress 4

Notes: a) Fill in the blanks. Whether these are hardware, software, application or technology.

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

- i) Technology isof a machine for a specific output.
- ii) A radio set is
- iii) Manufacturing a radio set is
- iv) Farm forum of All India Radio is

Many people think that a particular type of society gives birth to a particular technology. There is another group which thinks that it is the technology which gives birth to a particular type of society. The debate may continue, but it is clear that human societies do not work in a linear order. There are innumerable forces working in and on a society. Interactions among these forces give rise to the character of a society. The need and the character of the people of a society help in the evolution and adaptation of various technologies. Every sub-group of the larger human society is distinct and has its own character and needs. Therefore, importing things from the other group cannot satisfy the requirements of a society. They must evolve from the society itself in order to be meaningful and useful in the society concerned. However, with improvements in mutual understanding among different societies, technologies developed by one society can be used purposefully and successfully in others.

The urge to communicate with one's fellow beings is a basic characteristic of human beings. And the members of each group of the human race have successfully managed to establish an appropriate way of communicating among themselves. The systematic construction of sounds gave rise, over a long period of time, to languages. The distant and unique character and needs of every society gave rise to various languages with their own vocabularies, phonology and syntax.

As the needs and character of a society develop, so do the communication strategies of the members constituting the society. In fact, the strategies and the patterns of communication have become so important, that it

(communication) is no longer considered the 'other element', but the pivotal element of the society. Keeping the fundamental concept of technology in view, we may say that the history of communication technology dates back to the time when people invented language of signs and drew figures on the cave walls to pass on their thoughts, messages and feelings to future generations.

Living on the threshold of the 21st century and amidst fast advancements in communication technologies, can we say that every society will have its own communication technology as per the character and requirements of its members? Will the character and requirements remain as distinct and separate as before? Don't we aspire to have modern (some may call them 'western') technologies such as radio, television, computer, satellite, cable television, videotext and other facilities for our own use to solve problems that we are facing today? Most of us may react positively, as one does not have to invent the wheel all over again. But, the basic question is, how? These have to be decided jointly by decision-makers — educators, sociologists, politicians and enlightened public.

The needs of the country are to be listed on priority basis. And then, we should look for the appropriate solution. Technology should be considered only when it ties up appropriately with the solution or promises to increase efficiency and productivity, or to improve the quality of life. Otherwise communication technology and the society may not have a fruitful relationship. Let us take the case of the population problem of the country. India adopted the family planning programme as early as 1960s. Huge amounts of money and resources were allocated for the implementation of various projects for this programme. Various communication techniques and technologies to make the people aware of the dangers of unchecked population growth were used by various agencies — government and voluntary. Probably, the people are aware of the problem now, but they (parents) still have three or more children per couple on an average. This may be, at least partly, because our media or our media strategies did not educate people appropriately and hence failed to motivate them to adopt family planning — the ordinary rural folks could not identify themselves with the people (characters) shown in the advertisements in this regard.

We are presently in a society which is driven by the information and not the technology industry. As such it is called we are in an information age. The information age is predominantly a byproduct of developments in computer and communication technology. The possibilities of teleworking, telecommuting, virtual conferences and other such situation in an information society will definitely isolate people from each other. But at the same time it could help us to remain in harmony with nature. As such, the potentialities of the evolving technologies can help us in sustainable development of the society.

3.6 LET US SUM UP

Let us recall the themes and sub-themes which we discussed in this unit.

- We have identified and explained the uses of communication technologies. Radio is a popular communication technology used for various purposes — to eradicate illiteracy, impart basic health education, provide support to disseminate information about different developmental programmes and efforts, etc. It is being used to communicate with more and more people. Similarly, television, telephone, computer, audio-video cassettes are being used to reach people for a variety of purposes.

The concept of teaching has changed radically with the discovery and growth of communication technologies. Radio, television, computer, audio-video cassettes, etc. are now being employed increasingly for pedagogic purposes. Further, as a matter of principle, these communication technologies are used to plan, prepare and manage courses in distance education systems.

- Students use various means such as printed materials, radio broadcasts, telecasts, audio-video cassettes, computers, videotext, and video disc. The same lecture/ lesson or the content of the same lecture is not merely repeated through various channels. Instead, every channel is used optimally with a definite purpose and the whole process is organised so as to have a positive cumulative effect. As a result, a judicious use of technology with well-defined aims has a very rewarding influence on the students.
- There are hassles and problems in using communication technologies. The use of communication technology may alter the whole political situation in a country. It may cause structural turmoil within a political system. The political will to implement or not to implement communication technologies can have major consequences for a country.
- These technologies tend to widen gaps between 'haves' and 'have-nots'. They disturb the social relationships and cause economic hardships for a country and its people for want of technical expertise, non-availability of spare parts, courseware/software, etc. All this is relevant to or applies, in the case of a developing country that borrows technology from outside.
- Proper training is required to use communication technologies effectively. Various skills are to be acquired for the proper use of any technology — the skills to manufacture the gadgets, and the skills to use the gadgets for specific purposes. The most important skill, however, is that related to software. The technology may be there, but if we lack the skills necessary for using it for various purposes, even the best technology becomes valueless.
- The relationship between society and communication technologies is another important concern. Communication technologies originate, develop and operate in a society. The needs of people and the character of society determine the types of technologies they may develop and need for purposes of communication. In recent years, with the tremendous growth of technologies the barriers among nations have collapsed, giving rise to new kinds of relationships among them.

Technology transfer has become easier than it was before, and developing countries should take advantage of this environment. Of course, careful planning and abundant caution have to be exercised to bring home this advantage.

3.7 CHECK YOUR PROGRESS : THE KEY

1. i) Your answer should be something like this —
Radio, television, video, videotext/teletext
ii) a) Satellite, b) Telephone,
2. The probable answers are as follows:
i) A village school without electricity D. Radio, posters
ii) A small company in medium size town C. Telephone, radio
iii) A big commercial firm in metropolitan city B. Telephone, a videotext, teletext, television, radio, fax
iv) A family of four earning Rs. 15,000/-a month, living in a rural locality A. Radio, television, cassette player
3. i) Hardware skill (H)
ii) Software skill (S)
iii) User skill (U)
iv) Software skill (S)
v) User skill (U)
vi) User skill (U)
vii) Software skill (S)
viii) Software skill (S)
ix) Software skill (S)
x) User skill (U)
4. i) Application.
ii) Hardware
iii) Technology
iv) Software

UNIT 4 FUTURE OF COMMUNICATION TECHNOLOGY

Structure

- 4.0 Introduction
- 4.1 Objectives
- 4.2 Communication Technology in Developing Countries: A Challenge
- 4.3 Assessment of Communication Technology
 - 4.3.1 Achievements
 - 4.3.2 Limitations
- 4.4 Future Trends
 - 4.4.1 Communication network
 - 4.4.2 Satellite communication
 - Satellite radiotelephone projects
 - 4.4.3 ISDN
 - Advantage of ISDN
 - Broadband ISDN.
 - 4.4.4 Internet
 - 4.4.5 Technology for people with disabilities
 - 4.4.6 Networked society
- 4.5 Let Us Sum Up
- 4.6 Check Your Progress: The Key

4.0 INTRODUCTION

As the title of this unit indicates, it deals with the future possibilities and promises in terms of the applications of communication technologies for educational purposes. Our attempt is to identify and comment on some basic issues pertaining to various communication technologies, in order to generate awareness about the uses of such technologies for distance education.

It needs to be noted here that the Unit gives you an account of the present state of communication technologies, but technologies change so quickly that it could well be that some of the discussion here is already outdated when you read it.

You have read about the growth and the application of communication technology in Units 2 and 3 respectively. You have also studied various possibilities for using communication technologies for education, information and entertainment. Besides, you have already been exposed to the possible problems we face in using communication technologies for various purposes, including those of education.

This unit takes you a step further and reflects on the current and projected uses of communication technologies in education and training. Here we present some information about the educational uses of communication technologies, with emphasis on the prevailing conditions in the developing countries including India.

Some of the technologies we have discussed here are not available for educational purposes, though they are being used by people elsewhere e.g., for business purposes. Nevertheless, we hope these technologies will be used for educational purposes as and when the appropriate climate for such uses is created.

We are using the term communication technology and communication technologies just for the purpose of making clear the singular and plural usage of the term in different areas. We do not have any other specific intention in using either term.

4.1 OBJECTIVES

Having gone through this unit carefully, you should be able to:

- describe the trends in communication technology in the developing countries;
- identify the strengths and weakness of communication technology, with special reference to the developing countries;
- explain the future trends in communication technology with special reference to its applications in education; and
- describe the possible uses of communication technology for students with disabilities.

4.2 COMMUNICATION TECHNOLOGY IN DEVELOPING COUNTRIES: A CHALLENGE

In recent decades the world has taken giant strides into the information age. The diversity and the capabilities of various media — print, radio, television, data processing and telecommunication — have increased enormously and these devices are playing an ever increasing and significant role in the economic and social growth of a country (Baur, 1982).

Communication technology has immense social implications. It is concerned with every aspect of human life such as education, environment, health, safety, quality of life and so on. The contribution made by communication technologies has been decisive for the socio-economic progress of every country we know of. In both the developed and developing countries, the human resource and information industry, according to Haque (1991), are seen as criteria to judge their status as information societies, linking information with quality of life. Hence the level of economic development of a nation will probably be the determining factor for the different media of information delivery systems in a society.

The continuing development of communication technologies has significantly expanded the range of communication services and enhanced the efficiency of telecommunications, so that today almost any type of information — voice, text, data, or image — can readily be exchanged with people anywhere in the world. And yet the increase in the demand for

information, whether commercial, entertainment or educational, continues to grow rapidly in both the developed and the developing countries. With rapid developments in communication technologies, attractive options present/provide better and cost effective ways of meeting the current and the future requirements of communication/education.

Most developed countries are currently moving into, (though some of them have already moved into it), the information age, which depends on the rapid exchange of information. In other words, the requirements for communication technology in developed countries are constantly increasing. What is expected in the future is individual person-to-person telecommunication in voice, text and images, information transfer between technical systems, retrieval of information stored in central locations and access to information and knowledge processing in the future (Armbruster, 1986). The conditions in the developing countries, however, are not so promising. Nevertheless, the demand for communication technologies has increased in recent years in these countries as well.

We agree with Verges (1992) that information is a basic resource for today's human survival. The influence of communication technologies has opened the door to the information age, in which information has become not only one of the essential resources for social progress, commercial outcomes, research and quality of life but the most important of such resources. The information age has provided immense benefits for every country. In the coming years, telecommunication centres will become focal points for social interaction, public awareness and life-long education in the developing countries.

The information gap between developed and developing countries is reflected in their access to communication technologies and the growing importance of information in all aspects of human life. Access to information, and to the facilities to produce, store and transmit information makes the difference between societies (Hudson, 1989).

In India, communication technology has entered a period of rapid growth. It is being used with good results in production units, planning and development process, education, human resource development, banking, telecommunication, rural development, weather forecasting and management functions, to list only a few of its common uses. Indians have excellent environment for the successful manufacture and use of communication technology in many more areas. To take advantage of this favourable environment they need better access to communication technologies, besides the will and requisite initiation to use them with vision.

Despite their diversity, developing countries share certain basic characteristics. The problems faced by most developing countries are essentially economic, political and social. Their economic and social problems are compounded by the explosive growth of their populations. They also suffer from illiteracy, poor technical training, extensive prevalence of child labour, poor status of women, etc. Introducing and using appropriate technologies can solve these problems.

One of the important points to be emphasised is that communication technologies are not easily available. They have to be invented, produced, adopted, mastered, controlled and implemented. The people (producers as well as consumers) are required to be mentally ready to produce and use such technologies. In other words, the application of communication technologies depends on the existing capabilities of people. The required readiness is lacking in a vast majority of developing countries. Secondly, we have to ensure that the new technologies introduced in the socio-economic structure of developing societies should not destroy their existing cultures. The point that we want to bring home is that intelligent application of new technologies in developing countries can indeed contribute to speeding up the process of development, without invading the socio-cultural system of the country.

Research and development is yet another area of concern. Developing countries have to pay due attention to research and innovation to make communication technologies flexible and suitable for the masses. It seems that only those countries that maintain a strong scientific base will be able to acquire competitiveness and the required momentum to keep up with the headlong pace of progress. Thus to see developing countries to step towards full industrialisation, the investments (i.e. resources) are to be diverted to advancement and innovation in communication technologies. These countries must devise new strategies for mobilising their all too scanty resources, including science and technology, in the most effective way to promote indigenous means of development. Universities and institutions of higher education can play a crucial role in the innovation and transfer of technologies.

However, we should not forget that despite the limitation of resources and the limited adoption of the new communication technologies, developing countries have visions of catapulting themselves into the information age bypassing the long industrial phase that the developed countries have gone through. New communication technologies are being introduced in many developing countries that are going through rapid change in technology, communication and lifestyles with far reaching social consequences. Despite a poor economic climate, communication technologies have been growing fast in the developing countries. Many of them now have access to a variety of communication technologies. Besides, they are ready to invest further to make sure that they are not deprived of the benefits of the information age. Thus, some countries are making significant progress towards becoming information societies. India is a clear example.

Communication technologies have made a significant impact on the means and methods of education and development. The future holds great promise for new developments and advancements in communication technologies in developing countries too. It is to be hoped that communication technologies will be increasingly demanded by educational institutions.

To conclude, there are numerous issues pertaining to the development of communication technologies in relation to the emergence of a new type of society in the developing countries. We, in these countries, have before us a

great challenge and also a great opportunity. It is vital for us to ensure that technology makes a definite contribution to our development.

Check Your Progress 1

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

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

Why is research and development an area of concern to technologists in developing countries?

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4.3 ASSESSMENT OF COMMUNICATION TECHNOLOGY

We have touched upon various strengths and weakness of communication technologies in Units 2 and 3 of this Block. We shall now critically assess some of these strengths and limitations in the following subsections.

4.3.1 Achievements

The use of communication technologies is likely to reinforce traditional methods and media of instruction. Media can improve the flavour of the message to be conveyed and knowledge to be gained. Besides, they provide alternative methods of conveying the content. Effective and efficient communication technologies offer a substitute for a face-to-face meeting/teaching.

Technologists are engaged in providing the students with the means and facilities necessary to make their learning a success without overburdening them. But we have to keep in mind that communication technologies demand different roles from both the teacher and the student.

One of the major contributions of communication technologies to education is the *individualisation* of learning. Individualised learning is planned so as to allow for self-paced, mastery learning. Human element is provided through the use of group work and activities, which fulfil the demand of social interaction. However, before adopting a technology or a combination of technologies, we should ensure that it works effectively, improves the pedagogic process and hence helps to meet the terminal objectives set before the students, the institution and the country. At this point of time, however, we would like to emphasise that communication technologies not only aim at making educational opportunities more accessible, but also make them extremely attractive to the students. They motivate and hence

involve the students in learning; attract and hold their attention for optimum learning, and help them retain knowledge thus gained. With appropriate technologies, learning is no more confined to the four walls of the school. It can take place anywhere and at anytime, irrespective of age, sex or socio-economic and demographic constraints. Creating an informal learning environment especially designed to provide a solid educational experience, which is easily used whenever the students choose to learn, is a genuine contribution of communication technologies. Thus, it is hoped that communication technologies, coupled with flexible homework (i.e. assignments), and learning schedules (i.e. study habits/skills) will provide more productive time for education, training and work. As a consequence, possibilities of life-long learning will generate birth-to-death curriculum and dependable delivery systems. This is the area where we, as educators, have to contribute substantially in designing the most appropriate curricula to meet the changed requirements of the masses. If the futurists can be believed, societal needs in the 21st century will be very different from those which most of us experience now. Learning will be a life-long, multi-faceted process that will focus on students' specific needs at a given time in a given situation.

4.3.2 Limitations

Communication technologies have come in and will remain with some inherent problems particularly for the developing countries. Wellenius (1989) opined that the slow growth and poor performance of telecommunication services in the developing countries are mainly attributable to three inter-related factors. These are as follows:

- Shortage of investment capital, i.e., overall scarcity of resources for investment and the cost of expanding and modernising telecommunication infrastructure are the main reasons for its poor performance. The use of communication technology in the developing countries has always been criticised for being too costly to afford.
- Ineffective organisation and management of the operational aspects of educational systems which are heavily dependent on communication technology — inadequate internal organisation and management results in high expansion and operating costs, poor maintenance and limited capacity. The effectiveness of communication technology depends on its implementation and utilisation. If it is not properly and adequately implemented, it is not reasonable to expect returns and effective outcomes envisaged by their developers.
- Inadequate sector policies constitute the third and the most pervasive constraint on the development of telecommunication. As a result, there is a lack of incentive for improving performance and generating investment for the expansion of telecommunication in the area of education and training.

Besides, the following are the other five reasons, which work against communication technology:

- *Planning, Monitoring & Evaluation.* The implementation of communication technology is normally not planned with clear-cut objectives to be achieved. The monitoring mechanisms with respect to their utilisation are also either not designed or not strictly monitored to adhere to required standards. Also there is no continuous evaluation to provide feedback services to improve the system.
- *Quantity:* The number of telephone connections, access to TV, VCR, etc. is very important for success of communication technology. Poor teledensity and inaccessibility of modern gadgets to people in general makes the application of communication technology most elitist.
- *Quality of services:* For example, the quality of telecom services are noisy and unreliable, as the technology used in most of the developing countries is not contemporary.
- *Price:* The cost of communication technology is very high and for most in the developing countries, it becomes difficult to use. For example, in India the cost of telecom facilities are 100% higher than the fair price of these services elsewhere in the world (Shah, 1997).
- *Instructional Design knowledge:* Most of our teachers are comfortable with lectures or the 'talk and chalk' method. Use of communication technology makes them very uncomfortable and hence the immediate objection to its utilisation for educational purposes comes to the forefront. Though every one will accept it as entertaining media, there are only very few who accept communication technology for teaching-learning purposes. What is required is a receptive mindset and a proper attitude. Therefore, the training of teachers on instructional design to use new communication technology is highly essential.

Providing telecommunication access, particularly access to computers for the students, who are scattered across the country as well as the neighbouring countries, has been both a logistic and a technical problem. Besides, the creation and utilisation of modern electronic devices are difficult, challenging and often dangerous for those who do not belong to a technological culture.

The successful implementation of any educational media in a country depends largely on the preparedness and the readiness of the implementers — the teachers — who constitute an inevitable pivotal component of any innovation in the educational enterprise (Mnoja, 1992). Their involvement in and attitude towards the use of technology is a major factor in its success. For example, Perraton (1981) reported that television use in El Salvador led to a strike by teachers.

Pioneers of new communication technologies hoped that one of the major uses of their inventions would be to bring education to the masses — at least to those who want to have it. But we have to take another look at the entire education system in the country and review whether we succeeded in exploiting fully the potential of technologies available to us for educational purposes. We might come out with discouraging findings. You may start

your investigation with the most popular mass media — the radio and television.

Check Your Progress 2

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

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

Identify three major contributions of communication technology to education. Also identify three major problems in implementing such technology in a given situation.

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4.4 FUTURE TRENDS

Though we cannot predict the future, yet with careful examination of the present trends, the resources available, and the enthusiasm for implementing innovations, we can make some estimates as to what the future of communication technologies might be. Much depends on the actual use of the technologies for education and development at the present moment. The challenge of today's educators is to guide technologies towards a developmental/educational path allowing access to technologies by all the interested users/learners. This is a fact that advanced communication technology is available or is being made available to business houses for commercial purposes. But our (educators') concern is to keep pace with technological developments and ensure the optimum utilisation of appropriate technologies for pedagogic purposes, about which we don't have much to say.

One fact is clear beyond doubt — we are entering an era, which will be characterised by widespread 'use of technology'. High speed processing or more user-friendly devices are being developed/created world-wide and possibilities are being explored as to how technologies can be used to meet their objectives with reduced costs.

Let us take a look at some of the recent advancements in communication technologies and their future projections.

4.4.1 Communication network

The success of communication technology will be determined primarily by the nature of transmission networks, i.e., the means of allowing access to technology. The public in general and educational institutions in particular is making ever increasing demands for telecommunication networks. They

need the most sophisticated electronic devices/system such as videotext, video-disc, videophone, rapid access to documents, data processing, intelligent support, individualised services and so on. You might have observed that to promote their business, business person would like to have all the possible communication technologies to react as quickly as possible to any market demands in any part of the country or the world. This is possible through efficient and effective telecommunication network. It should be possible to also make it available for educational purposes.

As mentioned earlier, the progress of a country depends on the capabilities and the flexibility of its telecommunication network. It is hoped that by the year 2010 most of the Indian homes, offices and places of work would be connected by radio, television and telephonic networks. This futuristic vision is based on the rapidly developing electronic networks in the country. Devices such as satellites, computers, fibre optics and so on will allow the transmission of video images, text, sound and pictures at a faster speed. The chances of acceptance and success of such devices are quite high, because an appreciable number of people, institutions and business houses already have them on a reasonably large scale, to the extent which, however, is not an easy task for want of resources. The technological options available includes satellite, optical fibres, VSATS, ISDN, etc. For example, Fibre optic cables can be used to make technological networks more accessible to users, who can have immediate access to information through networks, which are flexible and cost effective. Fibre optic cables with their large communication capacity will meet the diverse needs of people whose increasing telephone, mobile television, etc., are now developing into a means of mass communication. You can instruct your student directly by means of the cordless phone in your pocket.

Communication network can be controlled by human interface or/and by machines, such as, computers. These requirements will grow in the future because of trend towards the increasing emphasis on distance education/open learning, to meet the communication requirements of information society (Baur, 1992). However, three basic issues will always remain in the fore-front. These are bandwidth, connectivity, and cost effectiveness. Bandwidth refers to the capacity of a system to transfer large amount of data at high speed. The more the bandwidth the more data transfer. Similarly connectivity means, interactive connectivity and this is where the user can interact with any one, at any time, anywhere. And finally, of course, the cost, which will go down in the years to come. In the next sub-section we will be discussing a few technologies, which have one and more of these characteristics. We are sure that technologies having these characteristics will be more predominant in future.

4.4.2 Satellite communication

One of the most pressing areas of today's concern and debate is the future role of communication satellites. Receiving signals directly at home from a satellite orbiting at 36,000 km from the surface of the earth is widely perceived by the public today as an innovation. An enormous diversification of services (such as telecommunication, remote sensing, etc.) offered

through satellites exist to cater for demands of communication. This certainly indicates the scope of and need for communication technology.

With the advent of communication satellites, communication itself, which is at the root of human civilisation, has gone through a dramatic transformation (Rao, 1991). Communication satellites have virtually shrunk time and distance enabling people even in the remotest corner of the world to share their experiences with each other. Rao (1991) revealed that only 13 out of a total of 130 satellites in geo-stationary orbits belong to developing countries, while 3/4th of the population of the world lives in the developing countries. He opined that by the year 2000, counted at the present rate of growth, with around 3000 communication satellites in the geo-synchronous orbit, the share of developing countries is unlikely to exceed ten per cent. He predicted that the extent to which space technology is in the next 40 years (from 1991) and its diffusion to benefit grassroots in developing countries would essentially determine the possibilities of global survival.

Telephone by satellite has long been seen as the solution in the areas of low population density, which need telecommunication services. Remote telephone by satellite offers many benefits. Telephone through satellite operates just like an ordinary public telephone network, bringing signals straight into the corporate telephone networks. Unlike terrestrial cable systems, satellite telephony is not vulnerable to long distance environmental factors, etc. The world-wide success of telephony by satellite is amply demonstrated by its diverse use these days. For example, coal mines in China, the police in Taiwan, the Indian Government, and networks in Germany, Denmark, Canada and CIS, etc., make use of satellite telephony system for communication purpose (Hughes, 1982).

Satellite radiotelephone projects

With the potential of satellites, the world of telecommunication is set to revolutionise the entire global network. This technology involves the use of large number of low earth orbit satellites and compact hand held terminals. Using advances in mobile satellite capabilities and technology, it is aimed at introducing a range of affordable, increasingly portable and convenient global personal communication services. Such a system makes global personal communication independent of national networks, such as VSNL of India. Unlike conventional telecommunication networks, the satellite-based system will track the receiver telephone anywhere in the world. These systems are being designed to transmit voice, data, fax, paging and multimedia based information at a high speed. At present there are a number of competitors in the satellite radiotelephone sector. Table 1 gives a broad picture of these projects and their services.

4.4.3 Integrated services digital network (ISDN)

Integrated Services Digital Network (ISDN) is perhaps the most important development to emerge in the field of communication since 1980s, and will in all probability, continue to dominate developments in the future. The early phone network consisted of a pure analog system that connected telephone users directly by an interconnection of wires. This was very much prone to breakdown and noise, and did not lend itself easily to long distance

connection. However, telephone system has already begun to change converting its internal connection to a packet-based digital switching system. Still the final connection to end-users is basically twisted cable in most countries. Optical fibre will replace this in future. ISDN is a system of digital phone connection which allows data to be transmitted using end-to-end digital connectivity and support a wide range of services, including voice and non-voice services, to which users have access by a limited set of standard multi-purpose user network interfaces.

Table 1
Some satellite radiotelephone projects

Project Name	Main Investors	Industrial Partners	Operators	Cost of Project in US \$	No. of satellites	Date of service start-up	Type of services	Cost of communication
Globalstar	Loral Space and communications and Qualcomm	Aerospatiale, Alcatel, Daimler Benz, Hyundai, Ericsson	France telecom, Vodafone, Air Touch communication.	2.5 billion	48 (low orbit)	1998	Telecom	\$0.05 to 0.65/min
Iridium	Motorola	Lockheed, Raytheon, DEVCOM, Siemens	O.tel.O. STET, Sprint, Korea Mobile, Telecom corp.	3.8 billion	66 (low orbit)	1998	Telecom	\$ 2 to 3/min
Odyssey	TRW and Teleglobe	Mitsubishi, Magellan, Panasonic, Northern Telecom.	—	3 billion	12 (Medium orbit)	2000	Telecom.	\$ 1/min
Teledesic	Microsoft and McCaw Cellular Communication	AT&T	—	9 billion	840	2001	Inf. highway, videoconf, multimedia	—

Source: World Communication Report, 1997

With ISDN, voice and data are carried by bearer channel (B channels) occupying a bandwidth of 64 kbps, (kilo bits per second). A data channel (D channel) handles signalling at 16 kbps, or 64 kbps, depending on the service type. There are two basic types of ISDN services. Basic Rate Interface (BRI) having two 64 kbps B channels and one 16 kbps D channel and Primary Rate Interface (PRI) with 23 or more B channels plus one 64 kbps D channels. To access BRI service, it is necessary to have an ISDN phone connection and the customer must be within 5.5 km of the telephone switching centre. Beyond that special repeater devices are required.

Once you subscribe to an ISDN connection, a simple two wire telephone line, called U-interface is extended to your premises from the telephone exchange. This is terminated into a device called NT1 (Network Terminator) to which multiple ISDN devices can be connected through S/T interface, which allows to connect up to seven ISDN devices.

Advantages of ISDN

Speed: The speed of data transfer is amazingly high. Also a modem is not required, as the data is already digitised and do not require a modulator demodulator (modem). Normal modems have a maximum speed of 56 kbps, where as ISDN supports speed beyond 64 kbps.

Multiple devices: Previously it was necessary to have one telephone line for each device to be used. For example, one for fax service, one for e-mail, etc. ISDN allows the use of up to seven devices in one single connection.

Broadband ISDN

Broadband ISDN (BISDN) is defined as a network capable of supporting data rates greater than the primary rate supported by ISDN. The main aim of BISDN is to support video and image based services. The broadband channels proposed for BISDN are:

- H₂ channel, 30 – 45 Mbps
- H₃ channel, 60 – 70 Mbps
- H₄ channel, 120 – 140 Mbps

The services on BISDN can be both interactive as well as distribution oriented. This will allow real-time teaching using video conferencing at low costs.

4.4.4 Internet

The phenomenal growth of the Internet with its multimedia capabilities makes it a technology of the future. We shall discuss this in a special unit in Block 5, Unit 3. Here we mention certain specialities of this technology, which is highly important to review it in futuristic parlance. Started as a purely text-based system to send and receive message (e-mail) it is now a fully multimedia based system with capacity to deliver video, sound, picture, images etc. The interactivity that this technology provides is tremendous. Today many universities of the world are using this to deliver courses. Internet will revolutionise the whole communication system through three basic services — the e-mail, the World Wide Web, and the Internet phone. Certainly, every educational institution will be influenced by these developments in the 21st century.

E-mail: E-mail is primarily a store and forward messaging service. The messages/data are sent and stored electronically into the user's mailbox and remain waiting till they are retrieved. E-mail uses computer, text-processing and communication tools to provide a high speed information exchange service. The e-mail utility on a computer system enables one computer-user to communicate with another user or a group of users via the user's terminal.

E-mail, unlike paper-based communication, is fast and can transmit information (mail as the term indicates) in seconds or minutes across a continent. Replies can flow back just as rapidly. E-mail is text-based. Unlike fax or telephone, e-mail has no picture or sound component. Information can be conveyed only in the form of a text like the normal postal mail, but

unlike conversations, as the senders and the receivers do not attend to communication act simultaneously. Thus communication through a e-mail is asynchronous or non-simultaneous.

WWW: The World Wide Web (WWW) unlike e-mail is Graphical User Interface (GUI) based and also allows audio and video to be used. According to Mason (1998) the "Web is the most phenomenally successful education tool to have appeared in a long time. It combines... text, text-based interaction, multi-way interactive audio and video".

Internet phone: Using the Internet you can talk to someone on real-time mode. This is called web phone or Internet phone. This technology is currently in the developing stage and thus the quality of sound remains somewhat of a problem. Also there is as yet problem of interportability standards. You and your friend must all have the same software now to talk to each other. However, it allows international calls to be metered as local, thus being a very cost efficient method.

4.4.5 Technology for people with disabilities

The most important application of any technology is to make life easy, and who needs this more than the people with disabilities? We are falling behind in providing necessary assistance (communication or education) to the deaf, physically or the visually disabled. There are millions of people in the developing world, who require special and improvised communication technology.

Some efforts are going on in the developed countries to meet the communication requirements of the disabled, particularly the deaf and the blind students/learners. ACCESS (1992) reported that the Database Company, U.K., recently unveiled the dataphone — a telephone that does a lot more than just talking to the caller. It allows the institution and the caller (the student) to type messages simultaneously for a live text conversation. Besides, its variable modern and flat screen makes it possible for it to be turned into a terminal to access external database. But that is not all. Combined with database is a calculator, a personal organiser/computer and message pad, a diary and a clock/calendar. It can also be connected with a printer, and when combined to a data reader, it can send fax messages in digital form to another dataphone or personal computer. The screen of the personal computer can be split to accommodate outgoing and incoming messages, and store the incoming text to be read when you are back in the office or your study. An interesting feature of the system is that it is very useful for communication between deaf people. Telecommunication network would enable the deaf and the non-deaf to communicate using telephone networks. The computer would convert speech into text and the text into speech. The message can be typed and the typed message can be converted into a synthesised voice. Taking these fast changes in technologies into account, it is hoped that using speech generated text, a deaf person will be able to use telephone to converse with other telephone users without the assistance of any special operator. One more variation: written/printed messages, such as fax messages, will be converted into voice and delivered to you over your cordless or car phone. These services have

proved technically feasible and could well become a reality within this decade. Many more new services and improvements will be available in the 21st century.

This was an example provided just to give you an idea of the future possibilities in telecommunication to meet the communication needs of the disabled students. There are many more experiments going on to optimally exploit the potential of communication technology to make education accessible to the disabled. For this, technologists are engaged in developing appropriate telecommunication devices. For instance, devices are being developed to provide a flexible keyboard that makes computers more easily accessible to the physically disabled. The inexpensive learning devices to help young disabled students — including mentally retarded persons — to communicate and develop thinking skills have come to be known as **enabling technologies**.

Wagner (1992) explores various means to help the disabled. He opined that a search for technology to assist people with disabilities is a major concern of society. Wagner (1992) presented another example in this connection. The goal of Johns Hopkin University Search for Computing Applications to Assist Persons with Disabilities, U.S.A. was to apply computer creativity to help people with disabilities overcome barriers to communication, education or employment. The University provides incentives for the development of such devices. As a result, US technocrats are engaged in suitably modifying the available technology to make the operation of computers easy for disabled users — such as to accommodate the natural posture of the user. Such devices will bring in a revolution by enabling independent communication among people with cerebral palsy, muscular dystrophy, arthritis or other physically impairing conditions. Moreover, at the same time, the devices would also help in preventing disabilities. For instance, many people who use a computer every day suffer from carpal tunnel syndrome resulting from repetitive hand and wrist movements in awkward positions. Modified devices will reduce/prevent such health hazards.

Check Your Progress 3

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

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

- i) Outline briefly three major educational uses of communication satellites.

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- ii) Describe briefly the special features of ISDN.

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4.4.6 Networked society

Having discussed a variety of communication technologies that are likely to influence the educational scenario in the future, let us turn now to a broad framework — networked society. It is certain that we are moving fast towards a society which will be a network of people, information, resources and so on. In this sub-section, we present to you a lecture by an eminent computer and communication technologist. It is a futuristic paper that fits our requirement in this unit. While going through this, give special attention to the following :

- try to relate the concepts, technologies etc. to education;
- think of how educational transactions would take place in a networked society;
- make an assessment of your own situation vis-à-vis the technology options.

Though the kind of scenario discussed in this paper may not be feasible in all developing countries in the near future, it seems more certain and realistic when we make comparisons with regard to the developed nations.

Networked Society: Vision and Technology Option¹

Prof. T. Vishwanathan²

THE WORLD IN TRANSITION

The world is perceived to be in transition at present. To appreciate the phenomenon of transition, it is necessary to peep into the theory of creation a little. Let us take a glimpse at the **big bang theory** of the formation of the Universe. In its simplest form, the theory says that the Universe started with a big bang from an egg-like shell and since then had been expanding continuously. In the first few seconds the shape of expansion was so large that very little was known about the formation. Since then, the rate of expansion is diminishing and it continues to diminish further and further. The logical conclusion is that one day in the distant future, the rate of expansion would become zero and a process of contraction would start. Initially, the rate of contraction will be very low and increase as the time passes. After a very long time the rate of contraction may become so high that the whole universe will condense into an egg-like shell in a few seconds of time. Then there is no creation or universe. The egg-like shell may remain dormant for a very long time before it bursts forth once again with a big bang.

Now compare this with India's ancient theory of creation stated with the concept of *Pralaya* and *Mahapralaya*. As per this theory, every cycle of creation has four *Yugas* in it; *Satya Yuga*, *Tretha Yuga*, *Dwapara Yuga* and *Kali Yuga*. The end of each of the three *Yugas* is marked by land mass becoming water bodies and water mass becoming land bodies. During *Mahapralaya* everything is involved and the entire creation turns into an unmeasurable stretch of light. In modern scientific terms, this ancient theory may be stated as follows:

"The creation and dissolution of the Universe proceeds in cycles. Each cycle has four minor cycles in it. At the end of each minor cycle, life on the earth comes to an end and the water bodies and land masses are interchanged. At the end of a major cycle, the entire universe goes through a process of dissolution and everything reaches a state of light (*Jyothi*). After having been in the state of light for a long time, the Universe projects itself to start a new cycle."

The ancient Indian theory goes much farther. For example, it states that each minor cycle is divided into four quarters. Every day mantra that is chanted in many families even today in India talks of the present age being the part of the first quarter of the fourth minor cycle (*Kali Yuga*) of the 28th cycle of creation. According to Indian Almanac (*Panchanga*) we have spent over 5000 years in this quarter and 1,25,000 years are still remaining as part of this quarter. These are interesting figures that are not to be brushed aside just like that. The findings of paleobotanists often agree with these figures.

According to Indian scriptures, the creation is a play of God (read as **Nature** if you like). God sets in motion a play, which may last a few centuries. At the end of it, the current play is terminated and a new play is set in motion with a transition period. This postulate is substantiable by the fact that major changes come about in the world every few centuries.

There is a little doubt that the world is currently in transition. The present world order is going out and a new world order is setting in. Unlike many other upheavals in the world, the current transition is happening in a very smooth manner. One might term this as a **silent revolution** in the making. What one witnesses as economic crises, political instabilities, scandals and scams in different parts of the world are perhaps a part of the chaos that usually precedes a new order.

What is in store for us in the new world order is anybody's guess at present. However, a few indicators seem to be apparent, which include:

- Humane aspects of Science and Technology
- Restoration of human values and societal considerations
- Information Technology (IT) at the centrestage
- True partnership with nature

It is in this context that one must view the evolving networked information society.

NETWORKED INFORMATION SOCIETY OF TOMORROW

Rapid advances in information technology have unleashed forces, which are shaping and affecting the basic structure of our society. New perceptions on how to organise work, how to produce and trade, how to manage and how to create wealth have placed knowledge, information and connectivity at the centre-stage of human endeavour. What occupation will people pursue? Will there be offices for people to go and work? Will the networked society automatically solve some of the problems of environment such as pollution that threaten the very existence of humanity at the present time? What will be the impact of the networked information society on the culture of people all over the world? With the Global Information Infrastructure (GII) evolving and the networks spanning all over the globe, will the concept of borderless nations become a reality? These are major societal issues to be addressed but certain macro shifts appear to be visible.

Office-centred to Home-centred

In the networked society, the homes rather than the offices are likely to be the activity centres. Going by the indication of the fact that 35% of the corporate workers in the United States are telecommuters today, it appears that the networked society would definitely result in less-travel society if not travel-less society. Physical location may become irrelevant for being able to receive or deliver services. This would bring about radical changes in work culture. Flexihours of working coupled with innovative management of resources and manpower promise enhanced productivity. It is estimated that on an average, the working persons in the world spend over 20% of the active time in a day on travel. With travel time saved, home centred activities would lead to better creativity, innovation and productivity. Telecommuting culture with home-centred activities would eventually lead to a home-centred economy.

Work Community to Social community

The present society is characterised by community formation based on centres. Persons who work in the same office or factory tend to form a bond of such as association, union or a club. Social activities are usually centred around such formations. In a home-centred environment, the communities will comprise of groups from among people pursuing different jobs and professions in life. Under those circumstances, a true social community is likely to emerge.

Mass Production to Production by Masses

The last few centuries have been characterised by mass production with large industrial houses being set up. This has led to power brokering between work force and the management characterised by strikes, lock outs etc. In a networked society, small community dwellings, which are self-contained would emerge. The community needs will be met locally from products available in its natural surroundings. The concept of associations and unions may vanish in the networked society. This would also imply that production will take place locally with a large number of persons engaged in producing goods that are required. This is an interesting scenario for largescale employment and for overcoming the present problems of unemployment.

Other Factors

There are a variety other macro shifts that one may discuss and debate. These include:

- Centralised to Distributed
- Driven Society to Driving Society
- Group Education to Personalised Education
- Competition to Co-operation
- World as a Corporate
- Libraries to Electronic Knowledge Houses
- Broadcast to Interactive

CHARACTERISING NETWORKED INFORMATION SOCIETY

The network society can be characterised as "A" raised to the power of five:

- anyone
- anytime
- anywhere
- any information
- any format

A full-fledged networked society implies that every human being on the planet has an access to the network. Network connectivity to home would become an essential infrastructural facility much as electricity or water supply connection.

When the networked information society is fully developed, it should be possible for a person from the poorest of the villages in the world to access information resources in the richest of the cities in the world.

Network infrastructures which are expected to operate 24 hours a day and 365 days a year would make time zones and holiday patterns irrelevant in the life style of people. Cost of accessing resources across the nations may become independent of time of access or day of the week. What would matter is the need and convenience of the person accessing information. "Any time" facility would foster the growth of "on demand" culture enabling greater flexibility in the life style of individuals and communities.

"Anywhere" has implication for persons who are accessing information resources being accessed. It should be possible for a person from anywhere in the world to access an information resource located anywhere else in the world. The concept of location independent access would become a reality when a person would be able to access information from anywhere in the world irrespective of his

place of residence. Implementation of such a scheme would call for universal identification of individuals, which remains permanent for the lifetime of the individual. In fact, a child may be assigned an universal code as soon as she/he is born and would be identified by that code by that code throughout his/her life on the planet. These ideas sound somewhat far fetched but are not unrealisable.

With more and more emphasis towards right to access information, any information should become available to any individual on the planet. Some information may be priced where as some other may be free but access to any information should be a reality. A shift to this scenario is already visible in the information policies of different nations.

A networked society should pose no transborder barriers and be able to communicate information in any format that is assimilable by the recipient. Real time machine translation may become a reality. In this context, an intermediate language to represent knowledge becomes very important.

The present day communication environment is predominantly broadcast in nature: newspaper, magazines, journals, television, radio etc. In the networked society, the environment will be predominantly interactive.

COMMUNICATION TECHNOLOGIES

There are three communication technologies that are expected to play complementary roles in shaping the networked society of tomorrow; Optical fibres, satellites and short-haul radio. Each is capable of meeting certain important requirement of the network society: optical fibres provide the bandwidth, satellite communication provides quick remote area connectivity and the short-haul radio links promise to be excellent last-mile links. Thus, all of them are expected to co-exist happily in tomorrow's world.

Optical fibre

Optical fibre is fast replacing the traditional copper wires in certain segments of telecommunications because of its extremely high data carrying capacity. Unlike copper wires, fibre has the advantage of total immunity to electromagnetic interference and is lightweight and inexpensive. Theoretically a single optical fibre can support a bandwidth of 10 tera (10^{13}) bits per second. However, the performance of the commercially available systems is limited to about 5 Gigabits per second. The main hurdle is in the electrical-optical interfaces whose operating speeds are limited by today's technology. With continuous advances in photo electronic technology, bit rates of the order of 20 Gigabits per second or higher are likely to become feasible in the near future. Even so, we are nowhere near exploiting the full capacity of the fibre. Perhaps, this is a boon in the sense that the growth path in the fibre technology appears to be unlimited at least for a century or two.

The video services envisaged in the networked society demands bandwidths, which can only be provided by the optical fibres. The world is estimated to have buried about 1.8 billion kilometers of copper cable in the earth since the beginning of modern telecommunications in 1879. It is almost impossible to replace all this copper by fibre for the networked society in short span of time. The segments where fibre can be easily introduced are intercontinental, intercountry and intercity trunk links.

Taking fibre to home or to the street kerb appears to be a long-term dream. Although, Japan is hoping to bring fibre to home in the near future. Clearly, as of now, the optical fibre promises to provide the estimated bandwidth requirement of the networked society.

Satellite systems

While laying fibre appears to be a formidable task, establishing connectivity via satellite links is by far the quickest. Even remotest areas can be brought on to the world network map in a matter of few hours by using satellite links. But the satellite

bandwidth is limited. There are about 100 communication satellites in the sky at present and by the year 2000 there would be about 500 of them. The aggregate bandwidth of all these satellites would be about one-hundredth of bandwidth that can be offered by a single fibre. Clearly, the strength of satellite communication lies in providing quick connectivity but not large bandwidth.

Most operating communication satellite transponders use either C-band or Ku-band frequencies. In case of C-band, the uplink is in the range of 6 GHz while downlink is in the range of 4 GHz. Ku-band has 14/12 GHz as uplink/downlink frequencies. C-band signals are relatively immune to atmospheric changes but are affected by interference from microwave signals. Conversely, Ku-band signals, though immune to microwave interference, are affected by atmospheric changes. Ku-band offers much higher bandwidth capability compared to C-band. Research is in progress to move further up in the frequency spectrum to Ka-band in the frequency range of 18-30 GHz in quest for higher bandwidth capabilities.

Very Small Aperture terminal (VSAT) based networks using communication satellite are becoming popular the world over for data communication. A number of VSAT service providers who offer turn-key solutions have appeared in the market. Data channels, i.e. outroutes and inroutes with different bandwidths and structures can be set up to run different applications. Outroute is normally used for broadcast traffic while inroute is required for interactive traffic. A quarter transponder in C-band, i.e. 9 MHz bandwidth supports a data rate about 1 Mbps. Most of the user-end VSATs support 64 or 128 Kbps data rates as of now.

Signal delay which comprises about 1500-2000 milliseconds for a round trip in 2-hop VSAT networks using geosynchronous satellites is a constraint for real time applications involving voice and video. A new generation of satellite communication based on low-earth orbit (LEO) satellites is likely to alleviate the problem of large turn around delay. The LEO satellites with orbits in the range of 600-1200 kilometers altitude have smaller transmission power requirement, lower build and launch costs and negligible transmission delay. However, dozens of LEOs are needed to provide continuous coverage to all areas and the implementation cost of such a system may become prohibitive. Motorola's Iridium system (66 satellites), Loral Corp's GlobalStar (48 satellites) and Teledesic Corp's (840 satellites) are some of the projects which are being watched with great interest.

Reasonable data rates, low error rates, easy installation even at remote sites and low cost are some of the advantages that VSAT-based satellite communication offers to the networked society. As a result, satellite-based connectivity is growing and satellites are establishing themselves. Developing countries stand to gain by adopting satellite technology for entering the connectivity map of the world in relatively a short time span of a few years.

Short-haul radio links

Fibre can provide the bandwidth and the satellites the connectivity to remote areas. But, how about the connectivity to home? Problems in laying fibre preclude its reach to home in the near future. Limited bandwidth of the satellite would not allow a dish to be mounted on the top of every house except for one way broadcast reception applications. The networked society which demands interactive connectivity needs a different solution for bringing the end-user (homes and offices) on to the network. This is where short-haul microwaves radio links have a great promise.

Microwaves have been on the scene for quite some time but only in recent years their role and potential in modern communication systems were explored and put to use. Microwaves communications involves point-to-point radio transmission between line of sight towers at frequencies ranging from 1 GHz to 30 GHz of the electromagnetic spectrum. Super microwaves with frequencies ranging from 30 GHz to 300 GHz are evoking a lot interest in communication circles, in view of higher bandwidth availability.

In most of the countries, the frequency range of 2 to 4 GHz is not covered under regulatory rules and hence a radio link in this band can be set up fast without any clearance issues. Radio links once established are highly reliable and cost effective. Unlike VSATs there are no recurring charges on bandwidth utilization. Advancement in radio modem technology has facilitated high bit rates on radio links. Commercial systems are available today which support bit rates upto 8 Mbps comfortably.

The present areas of applications of short-haul microwave systems include intra-city transmission, radio LANs, home-to-fibre connectivity, LAN-to-LAN links and others. As a result, short-haul microwave radio links promise to eliminate the 'last mile' problem posed by the present cable technology and bring high bandwidth links to homes.

BROADBAND INFRASTRUCTURE

Many of you would appreciate that what we witness as Internet services today represent only the tip of the iceberg that would unfold in a fully developed networked society. Everyone knows that today's Internet services are predominantly text and data oriented with only sprinkles of graphics and still pictures. Tomorrow's services, placed broadly under two categories of Interactive services and Distribution services, would handle fullfledged voice, motion video and all other forms of information. Support of such services call for a broadband infrastructure and the most promising worldwide infrastructure is Broadband Integrated Services Digital Network (B-ISDN).

Broadband ISDN

Integrated Services Digital Network (ISDN) is perhaps the most important organised development in the field of telecommunication in the 20th century pioneered and guided by CCITT (International Consultative Committee for Telegraphy and Telephony). Integration of many services on a common digital network, which is the basic idea behind ISDN, calls for digitalisation of transmission, switching, signalling and end equipments which form the major subsystems of any telecom network. Over the last 40 years all these subsystems have been fully digitalised making available the promised end-to-end digital connectivity of ISDN. Two user network interfaces, viz. basic rate interface and primary rate interface are offered by ISDN supporting aggregate bit rate of 144 Kbps and upto 2048 Kbps respectively. Although ISDN is just moving from planning stage to prototype and implementation, CCITT's vision of the networked society has resulted in much of the present planning and design being directed towards broadband ISDN. It appears that much of the world may skip the implementation of ISDN and move directly to B-ISDN.

Conceived as a blueprint for future networks, B-ISDN would support channels operating at bit rates as high 155 Mbps at the user premises. B-ISDN connection will support both circuit mode and connectionless services of a single media, mixed media and multimedia. Whereas narrowband ISDN makes extensive use of the existing network infrastructure, B-ISDN would require major changes in the network infrastructure and the methods by which the network is operated. The promising features of B-ISDN that make it suitable to function as GII are that B-ISDN

- uses internationally standardised user interfaces and protocols
- provides end-to-end digital connectivity supporting high bandwidths (at least 2.0 Mbps initially and evolving to 155 Mbps)
- efficiently supports a variety of both packet-switched and circuit-switched applications.

Integration of wideband services on a common network not only calls wideband medium but also an efficient switching technique. Asynchronous Transfer Mode (ATM) based on cell switching concept is most favoured switching technique for B-ISDN.

Asynchronous transfer mode (ATM)

Asynchronous Transfer Mode (ATM) is a set of international standards that define a new method for sending large quantities of voice, data and video information simultaneously over network. It is a packet-switching technology where information is broken up into fixed length packets or cells each of 53 bytes including 5 bytes used for addressing and directing the data through the network. Since packet size is fixed switching can be done entirely in hardware, which is much faster than software switching. This system allows low overhead, very high speeds, negligible delay, and constant time interval among cells. The latter two characteristics are crucial to real time voice and video. Therefore, ATM is ideal for a wide range of applications including traditional data communication, imaging, video, and multimedia. Of all switching technologies, ATM is the one that holds the promise of handling all types of traffic effectively and providing a common telecommunication switching architecture for both public and private networks. Conceived for implementation at high speeds (155 Mbps and above) on broadband public digital networks, its initial implementation will be on private networks at lower speeds (2.5 Mbps). First generation ATM products are already available in the market at the chip, board and system level. An interesting feature of ATM is its upward compatibility. ATM is capable of supporting its predecessor switching techniques like frame relay and Switched Multimegabit Data Service (SMDS). Both frame relay and SMDS are the forerunners of ATM designed specifically for high speed networks.

It is well known worldwide that developing countries like India have great strengths in systems and software areas. In my opinion, ATM systems, products and services represent a potential area of development in which countries like India can contribute significantly. If this happens, we would also see costs of telecommunications coming down to affordable levels. I must state that the present telecommunication costs are too high to be afforded by common man in most developing countries. For example, a cellular call cost seven times more than a cable phone in India, with the result only business segment is using cellular services. Even the Government of India considers cellular service to be too expensive to permit its own departments to use these services. It is, hence, very important that the cost of telecommunication services come down significantly to enable large populations in developing countries to make use of these services. Only then, the dream of realising a networked society would come true.

COMPUTER TECHNOLOGIES

Personal computers or computer-based systems would constitute bulk of end equipments in the networked society. With the continuing advancements in microprocessor technology, the personal computer systems are under going substantial changes. Two clear trends are already discernible with regard to personal computers for the networked society. On the one hand, emphasis is being placed on network capabilities in the personal computers and on the other hand, emphasis is being placed on powerful computing capabilities in the PCs. Accordingly, two classes of computers viz. network computers and multimedia personal computers, are emerging. Both classes of computers have to tackle the issue of multimedia information processing and management.

Network Computers (Net PCs)

Increased emphasis on network computing is bringing about metamorphism in conventional PCs to suit the connectivity and access requirements. Network personal computers or simply NetPCs are based on advanced microprocessors and are specially architected using hardware and software techniques to provide maximum efficiency under network environment. NetPCs would support a variety of sophisticated network access protocols and navigation mechanisms in an attempt to make network access as user friendly as possible. Network computing implies powerful server machines on the network instead of powerful client or end-user

systems. NetPCs are expected to free the users from a number of connectivity and access issues.

When multimedia applications are run on a network, different data types especially voice and video must arrive at their destination at the right time for the application to run effectively. This aspect assumes great importance as it calls for larger bandwidth links on the network. This is an area, which would require considerable attention in the future.

Multimedia PCs

On the line of network computers meant for the network environment, multimedia PCs will have specially designed architecture and configuration to handle multimedia applications. The emphasis on multimedia PCs is to provide adequate local computing power to run multimedia applications. The efforts are to bring the power of workstations to personal computers. Conventionally, workstations, which are based on RISC microprocessors have built in support for networking and run on operating systems that provide multitasking features. PC systems are now available with RISC microprocessors and built in network interfaces. PC operating systems are also advancing to match the operating systems of workstations. Dwindling hardware costs and popularity of graphic-based applications may make workstations as the entry level computer systems of tomorrow. In other words, today's workstations are tomorrow's personal computers.

Transputer PCs

A little reflection will show that a balance between network access and local computing power is what is desirable. The transputer technology which emerged from the United Kingdom promised to be an excellent approach to building both computing and communication capabilities on the chip. Guided by the parallel processing concept, the transputers were originally designed for high performance computing applications but the fundamental approach of giving emphasis to both communication and computing makes transputers an ideal choice as a platform for building future personal computers for the networked society. I am not aware of any major efforts in this direction around the world and I would like to see a shift from super computing area to personal computing in the field of transputers.

LANGUAGE FOR MACHINE COMMUNICATION

In 1984, an article was written by an American in AI (Artificial Intelligence) magazine, which states that Samskrit is ideally suited as an intermediate language for machine translation. That is, if we have to translate Japanese into English, first we translate Japanese into Samskrit and then to English. This model is shown in fig.1.

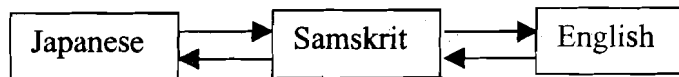


Fig.1: Intermediary based translation model

Fortunately, this first paper from the US on the Samskrit for machine translation generated a lot of interest in India that three conferences have already been organised on using Samskrit for computer applications. One of the most exciting applications is the use of Samskrit as a natural language interface for computers. When compared to English, Samskrit has many advantages for computers processing. This is due to the structural properties of Samskrit. For example, Samskrit is free from word ordering whereas English is not. The following Samskrit sentences mean only one thing irrespective of the order in which the words appear i.e. Lisa reads a book

लिसा पुस्तकं पठति (Lisa pustakam pathati)

पुस्तकं लिसा पठति (Pustakam pathati Lisa)

पुस्तकं पठति लिसा (Pustakam pathati Lisa)

पठति पुस्तकं लिसा (Pathati puatakam Lisa)

पठति लिसा पुस्तकं (Pathati pustakam Lisa)

लिसा पठति पुस्तकं (Lisa pathati pustakam)

Whereas, if the words are interchanged in the English sentence Lisa reads a book, the meaning changes completely; A book reads Lisa!! This one property of Samskrit alone leads to tremendous simplification in computer processing. There are also other properties of Samskrit that make it suitable for computer processing. Samskrit words are self-expressive as they all are derived from about 4000 basic roots. They are usually a combination of two or more roots. Once the meaning of the roots are known and a word is spilt into its basic roots, the meaning of the word becomes derivable and thus is self-expressive. In effect, this amounts to saying that the dictionary of Samskrit can be limited to 4000 words as long as the rules for combining roots and splitting words are unambiguous which, in fact, is the case.

There is a need to search for a suitable language for machine communication. English is not the ideal language. The structural, grammatic and semantic properties of Samskrit make it a suitable candidate for machine communication.

INFORMATION AND KNOWLEDGE MANAGEMENT

Communication infrastructure and powerful personal computers tell only one-half of the story of the networked society. Other important components include data, information and knowledge bases and the associated data management techniques and the navigation mechanisms required for accessing these 'bases'. It is now well established that there has been a continuous explosion in the generation of information on the earth in the last about 20 years. Indications are that the explosion will continue for many more decades to come. Perhaps, the ground is being prepared for the information society to evolve.

In order to substantiate the view point of information explosion, one tends to quote the annual publication figures such as one million journal issues, hundred thousands monographs, one million patents and tens of thousands of reports and dissertations. Such citations ignore a major source of information in the world today, viz the data from the bulk of information that would be generated in the coming decades. An estimate shows that all the planned remote sensing and weather satellites by the year 2000, would generate one terabyte of data per day. A little reflection will reveal that this is equivalent to about one million books of 300 pages each being published every day. If we compare today's volume with this, what we are generating is only a miniscule.

Apart from the current information, the world has been accumulating information over millions of years which are stored in different forms in different parts of the world. This information, when digitised would perhaps run into several million terabytes. All these statistics should give us an idea about what is in store for us in the ensuing information society. Perhaps, a large section of the population would spend its time in evolving effective and efficient data, information and knowledge management techniques.

Knowledge warehousing

Data warehousing covers data storage and archival techniques as applicable to large volumes of data. Advances in optical storage technology are expected to usher in phenomenal increase in the capacities of compact disks. Optical disks with capacities of 50 Gigabytes and more are likely to be available in the market soon with the Digital Versatile Disks (DVD) coming up and the blue lasers replacing infra red lasers. Clearly, optical storage is the most promising data warehouse medium for the networked society. While clear trends are visible to develop very large

capacity storage devices, efforts appear to be lacking in improving the access time from these storage devices. We are still in the milliseconds domains in accessing information from these devices. While storage architecture techniques like virtual storage may offer temporary solution to the problem of access time, the real solution would lie in improving the basic access mechanism for the optical storage devices.

Current data warehousing software efforts are directed towards corporate data resource, which needs to be managed effectively to maintain leadership in a competitive world. These efforts need to be scaled up by orders of magnitude before even the simple applications of the networked society can be managed effectively.

Knowledge mining

Data mining, also called knowledge discovery in databases, pertains to retrieval techniques used for handling voluminous mass of data. Very Large Databases Management Systems (VLDBMS) require new approaches to handling massive data the future databases would contain. Data mining ensures fast retrieval of specific data items from very large databases. It also attempts to enforce the condition that no stored data remains unretrievable.

Today's data mining techniques range from online application processing tools that query multidimensional databases to advanced artificial intelligence techniques like machine learning, neural networks, rule-based systems and genetic algorithms. To efficiently mine gigabytes and terabytes of data in a timely fashion, use of parallel processing techniques would become inevitable.

Data mining today is centred around local databases. For a networked society, data mining has to be implemented in large scale telecommunication networks. This is an area in which hardly any significant work has been done. In the networked society, the world would move from mining for coal or gold to mining for data, information and knowledge.

The present data mining techniques are not ideally suited for information and knowledge discovery and there is a need to look for new techniques. Traditional knowledge organisation and classification techniques used in libraries promise to offer to form a basis for innovative computerized techniques for information and knowledge mining.

POSSIBLE ILLS OF NETWORKED INFORMATION SOCIETY

Virtual reality is considered as the ultimate evolution of a networked society. It is not clear whether one should move towards virtual reality at all when we are very concerned about not partnering with nature adequately. As an example, in a virtual reality environment, a person may go for a swim in one of the most exotic swimming pools of the world and experience the pleasure and pain of swimming during Virtual reality session. At the end of the session, the fact would remain that the person had not actually entered the water. Should one take the society towards such a non-realistic virtual world? I feel that the role of virtual reality should be limited to training human beings to handle hazardous operations like operating a nuclear plant or flying a fighter bomber. At least, I am not in favour of the direction in which virtual reality is now evolving.

CONCLUDING REMARKS

There is little doubt that we are at the threshold of a new world order which may set in within the next one or two decades. A networked society would emerge as the central theme of living with the society's trade, economy, occupation, development, education, culture and leisure all centred around networking. There is a great promise for happier living in the new world order with the expected sea change in the value systems practised by the humanity leading to restoration of time-tested great traditional values.

The networked society promises to bring about a new style of existence for the humanity. Such an existence may be a solution for a large number of problems experienced by the society presently. However, ills, if any, of the new society is a matter that needs to be pondered upon. Even at the risk of being accused of being dogmatic, I would like to summarise my vision of the **networked information society as a panacea for all ills of the present society.**

I see nothing but a '**super golden millennium or two**' ahead for the humanity, the glimpses of which we would witness in our own lifetime. Let us all look forward to the great joyous living that the new millennium promises and prepare ourselves to do each one's bit in the process.

Thank you

Notes:

1. Plenary talk at the 49th Conference and Congress of International Federation for Information and Documentation held at New Delhi from 15-17, October 1998.
2. Director, Indian National Scientific Documentation Centre, 14, Satsang Vihar Marg, New Delhi-110067. Prof. Vishwanathan is a hard core technologist in the Computer & Communication field with nearly 30 years of experience.

4.5 LET US SUM UP

The advancements in the spread of telecommunication technology indeed offer practical and potential solutions to the difficult problems of human learning/interaction. This unit must have given you an idea of the future scenario of communication technologies. This short account of communication technologies for sharing knowledge and expanding understanding has been presented to indicate how communication technologies might be used in education. The major sub-themes touched upon in this unit are as follows.

- Most developed countries have either already achieved the status of 'information society' or are close to achieving it. New communication technologies are also being introduced in the developing countries; consequently, they are also on the doorstep of the 'information age'. However, the developing countries lag far behind the developed ones as far as access to communication technology is concerned. They have to divert considerable portions of their limited resources towards manufacturing, adopting, mastering, controlling and implementing these technologies for the welfare of their populations.
- Communication technology has contributed or is contributing to the effectiveness of education and its development. However, these technologies have come in with some inherent problems with which they will continue in the developing countries for quite sometime to come. These problems are lack of resources, inefficient organisations, inappropriate policy, poor utilisation, indifferent attitude of teachers and students, and the like.
- Communication technology has a revolutionary role to play, Satellites have enormous potential to cater to ever increasing and diverse demands of communication. Today's world has shrunk into a global village/society. More and more countries are acquiring communication satellites for domestic and international telecommunication.

- The size of the communication networks of a country reflects its socio-economic and educational status. These networks make the flow of information more quick and efficient. Integrated Service Digital Network (ISDN) and Broadband Integrated Service Digital Network (BISDN) are sophisticated and advanced communication technologies/system which allow users to send and receive voice, data, images and other value added services over a telephone line. Fibre optics has added to the effectiveness of communication systems. Besides, the marriage between the computer and the telephone has further revolutionised the telecommunication systems, making them still more versatile. Through this marriage these powerful devices complement each other to pave the way for highly efficient interpersonal/interactive communication.
- Communication technology has to play a crucial role for the disabled. Technologists are engaged in developing appropriate devices and technologies for disabled students to overcome barriers to communication, education and employment. This area is poised for major development in the near future.

4.6 CHECK YOUR PROGRESS: THE KEY

1. R&D makes communication technology more suitable for the requirements of the country concerned. It makes technology flexible and efficient, which in turn puts the country on the path of rapid development, socio-economic and educational.
2. Contributions:
 - Individualisation of learning
 - Access to learning resources
 - Creation of appropriate learning environmentProblems:
 - Lack of resources
(capital as well as human)
 - Ineffective management
 - Inadequate policies
3. i) Wide coverage
 - Fast and flexible communication
 - Variety of applications
(telephone, radio, TV, disaster warning, remote-sensing, weather forecasting)ii) ISDN communicates by means of a variety of delivery modes/media, e.g. voice, images, and data.

REFERENCES AND FURTHER READINGS

- ACCESS (1992) World's First Interactive Videotext Telephone, *ACCESS Newsletter*, June 1992.
- Ackroyd, B.A. (1987) News Gathering By Satellite, *Communication and Broadcasting*, No. 28.
- Agarwal, S.P. and Agarwal, J.P. (1990) *Information India 1989-90*, Concept Pub. Co., New Delhi.
- Altbach, Phillip (1987) 'Textbooks in Comparative Context'; in *Educational Technology*, Thomas R.M. & Kobayashi U.N. (eds). Pergamon Press, Oxford.
- Armbruster, H. (1986) Broadband ISDN Satisfies Increasing Telecommunications Needs, *Telcom Report*, Vol.9, September-October, 1996.
- Baur, H. (1992) Technological Perspectives of Telecommunications for the 90s, *Telecommunications*, Vol. 59 (Vii-Viii), July-August, 1992.
- Borderie, R.L. (1981) Initiation in Audio-Visual Communication, *Educational Media International*, No. 1.
- Business India (1992) Doing Away with Travel, Bombay, November 9-22, 1992.
- Chatterji, P.C. (1987) *Broadcasting In India*, Sage Publication, New Delhi.
- Contractor, N.S.; Fulk, J.; Monge, P.R. and Singhal, A. (1986) Cultural Assumptions that influence the Implementation of Communication Technologies; *The paper presented at the conference organised by the International Association for Mass Communication Research*, New Delhi, August 25-29, 1986.
- D'Souza, P.V. (1992) Electronic Mail in Academic Settings, *Educational Technology*, March 1992.
- DECU (1992) *Demonstration of Satellite-based Information Retrieval from a Database for Legal Research, Development & Educational Communication* Uni/ISRO, Ahmedabad. Mimeo.
- Egan, Bruce L (1996) *Information Superhighways Revisited: The Economics of Multimedia*, Artech House, Boston.
- Eyre, E.C. (1979) *Effective Communication* William Heinemann Ltd., London.
- Gopinathan, S. (1987) 'Cross-Cultural Transfer of Pring Media'; in *Educational Technology*, Vol 4.
- Haque, M. (1991) Information and Media Technology and the Third World, *Media Asia*, Vol. 18(4), 1991.
- Hawkrige, D. (1983) *New Information Technology in Education*, Croom Helm, London.
- Hilliard, Robert, L (1995) *Radio Broadcasting*, Longman, New York.

- Hills, P.J. (1986) *Teaching, Learning and Communication*, Croom Helm, London.
- Hudson, Heather, E. (1989) Overcoming the Barriers of Distance: Telecommunications and Rural Development, *Technology & Society*, Vol. 8(4), December, 1989.
- Hughes, D.M. (1992) High Hopes for Telephony Earth Station (TES), *Communications International*, Vol. 19(9).
- Jones, A.; Kirkup, G.; Kirkwood, A. & Mason, R. (1992) Providing Computing for Distance Learners: A Strategy for Home Use, *Computers in Education*. Vol. 18(1-3), January-April, 1992.
- Jonscher, Charles (1985) Assessing the benefits of telecommunications, *Intermedia*, Vol. 13(1).
- Kapoor, Gautam (1992) Asian States Take Different Routes to Similar Goals, *Communications International*, Vol. 19(5). May, 1992.
- MacBride, Sean (1980) *Many Voices, One World* Kogan Page Ltd., London/Unipub, New Delhi.
- Maherzi, Lotfi (1997) *World Communication Report*, Unesco, Paris.
- Mann, G.S. (1987) *The Story of Mass Communication*, Harnam Publication, New Delhi.
- Mason, Robin (1998) *Globalising education: Trends and application*, Routedge, London.
- Mcquail, Denis and Windahl, Sven (1981) *Communication Model*, Longman Group U.K. Ltd., London.
- Melody, K W.H. (1986) New Communication Technologies-rooms to negotiate, *Media Development*, Vol. XXXIII (2). 1986.
- Melody, W.H. (1990) Communication Policy in the Global Information Economy: Whither Public Interest?, In *Public Communication*, Ferguson, M.(ed.), Sage Publications, London.
- Mnoja, Teboho (1992) : Teacher Education form classroom Broadcast for the New South Africa, *Educational Media International*, Vol. 29(3), September, 1992.
- Mohapatra, S. (1992) Electronic Mail by Year-end, *The Hindustan Times*, April 18, 1992.
- Moses, Sir Charles and Maslog, Cripin (1978) 'Mass Media in Asia', *Asia Mass Communication Research and Information Centre*, Singapore.
- Narain, Iqbal and Gupta, S.K. (1989) *India in the Year 2000*, Mittal Publications, Delhi.
- Narula, U. (1986) New Communication Technologies in Developing Countries: A case of India, *The paper presented at the conferecne organised by the International Association for Mass Communication Research*, New Delhi, 25-29 August, 1986.

- Parhar, M(1993) *A Study of the Effect of Media on Student Learning*, Ph.D. diss., Jamia Millia Islamia, New Delhi.
- Perraton, H. (1981) Radio Broadcasting and Public Education in Africa, *Educational Media International*, No.4.
- Rao, U.R. (1991) The Next 40 years in Space: A View Point of Developing Countries, *Science & Culture*, Vol. 57 (8 & 9), August-September, 1991.
- Rogers, Everett M. (1986) *Communication Technology: The New Media in Society*, The Free Press, New York.
- Rogers, William (1984) *Communication in Action* Holt, Rinehart and Winston, New York.
- Schramm, W. (1973) *Men, Message and Media-A Look at Human Communication*, Harper & Row Publishers, New York
- Shannon, C.E. and Weaver, W(1949) *The Mathematical Theory of Communication*, Urban: University of Illinois Press.
- Sillars, Stuart (1988) *Success in Communication*, John Murray (Publisher) Ltd., London.
- Sondhi, K. (1980) *Problems of Communication in Developing Countries*, Vision Books, New Delhi
- Stein, Jay W. (1979) *Mass Media, Education and a Better Society*, Nelson-Hall, Chicago.
- The Hindustan Times* (1992) Reported the announcement of the successful launch of INSAT-2A in the Parliament made by the minister of State for Science & Technology, Govt. of India, July 10, 1992.
- Thomas P.M. (1987) *The Nature of Educational Technology, Educational Technology* (Vol.4).
- Tiffin, John and Rajasingham, Lalita (1995) *In search of the virtual class: Education in an information society*, Routledge, London.
- Times of India* (1992) Satellite to survey Villages soon, A report on Parliament Questions, December 10, 1992.
- UNESCO (1980) *Many Voice-One World*, Kogan Page Ltd, London, in association with World Association for Christian Communication.
- Verges, Martin (1992) Development of Information Technology and Media and the Maintenance of Language and Culture in Small Linguistic Societies, *Educational Media International*, Vol. 29(1), March, 1992.
- Vishwanathan, T (1992) *Telecommunication switching systems and Networks*, Prentice Hall, New Delhi.
- Wagber, C.G, (1992) Technologies for people with Handicaps, *The Futurist*, Vol. 26(3), May-June, 1992.
- Wellenious, B. (1989) The Impact of Modern Telecommunications, *Technology & Society*, Vol. 8(4), December, 1989.