UNIT 7 EMERGING TECHNOLOGIES

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7.1 INTRODUCTION

Advancement in communication technology has contributed to the overall development of people across the world. Now, everybody talks about the communication technology revolution, the role it is playing and also it is going to play in the future. You will agree with us that many of the functions performed by the human beings could be replaced by electronic equipment (Halal, 1992). The emerging communication and information technologies are gradually covering the entire span of human activity. You might have come across many expressions, such as electronic shopping, education, banking, trading, political polling and voting, home entertainment, TV networks, electronic medical treatment, etc. The new option of interacting globally is beginning to dramatically alter the world of works. Multinational corporations are now able to conduct their business activities around the world with ease. The potential of emerging technology can be judged by the fact that a large sum of money, time, creativity and efforts has been poured in information technology industry.

Education has been benefited by communication technologies in various ways and at various levels. From both the sociological and the economic points of view, communication technology has made an impact on education training. A number of institutions in the developed countries are offering courses through various communication technologies such as interactive TV, computer conferencing, internet and other modern media. Some distance education/open learning institutions in the developing countries are also now offering courses electronically. As a result, a chunk of learners are pursuing their study through communication technology: both the popular and modern media.

In earlier Units of this Block, you have studied the growth, potential and limitations of popular media, such as radio and TV. In this unit, we shall take you a step ahead and discuss the essential features, role and applications of modern or emerging media in the educational process. However, the emphasis in this unit is laid on those technologies which have strong bearing on education: conventional as well as distance/open learning situations. The creation or adoption of new technologies and their applications is evolutionary in many forms. Some of the technologies discussed in this unit may not be popular in education these days.
Nevertheless, in the changed scenario there is every possibility that today’s students would look for more sources of information, thus tapping the potential of new technologies, as per their needs and requirements. Keeping the potential of the various technologies in view, we shall discuss three major technologies in this unit. They are audio-video technology, computer technology, and telecommunications and networks. These technologies are not mutually exclusive. Their applications overlap each other’s domain. Before discussing different types of technologies, we shall try to give you an overall picture of emerging technologies and their perceived impact on education and training.

Experience has revealed that the communication technology strengthens the hands of the teacher, makes his/her teaching more effective. But remember that it is pedagogy, and not technology, that is important. Technology in the classroom does not automatically guarantee better results for students unless it is planned, designed and implemented creatively/effectively. Technology should be studied and adopted to take full advantage of its capabilities. You, therefore, should look for new ways of teaching using technology. You can also try to utilise some existing or emerging technologies in your teaching and assess their pedagogic effectiveness in your classroom.

7.2 OBJECTIVES

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

- discuss the role of emerging technologies in the changing scenario of the teaching-learning process;
- discuss the nature and essential features of different emerging technologies in the field of education; and
- explain the role and uses of various technologies in a variety of teaching-learning situations.

7.3 FUTURE TRENDS: EMERGING TECHNOLOGIES IN EDUCATION

The new communication and information technologies have profoundly affected our social structure. There is a growing interdependence between technology, information (message) and society. At the policy level the use of communication technologies in education and training has been identified emphatically. The CABE (Central Advisory Board of Education) Committee on Distance Education (1994) recommended the urgent need for the use of electronic media in the educational process in view of its vital importance, particularly to support distance education. It also recommended undertaking some experiments with new technological systems/developments, with an eye on the future and in keeping with the technical skills and advanced infrastructure available in the country.

Convergence of emerging communication and information technologies is taking place these days, thus maximising the strengths of individual technology. Telecommunication clubbed with computer technology has revolutionised the area of human communication. The capability to exchange information on a global basis is possible through a powerful communication tool: the satellite. Computer technology has provided tremendous capacity to store and exchange information. The human-computer interface has made communication further efficient, in terms of cost, time and reliability. This is the reason why communication technologies are becoming popular in receiving and transmitting messages, data, voice and images.

The computing and telecommunication technologies are not leaving the education sector untouched. These are enabling the teachers to develop multimedia in which text, voice, pictures, simulation, etc. can be integrated and delivered through computers as an interactive learning package. The technologies will enable us to develop what are often called virtual classrooms, virtual universities, virtual conferencing, virtual laboratories, etc. (Takwale, 1995).

Emerging technologies appear to offer the opportunity to gain access to knowledge and closer to real life. This would lead us to a learning society. This is a single new development that can revolutionise the future of education. Virtual reality and simulation will provide the ability for people to enjoy experience that we could not get otherwise. This is an experience without risk and promoted learning in a new way. So, communication technology will provide a new
strategy for education, for training experience. We are not talking about the technologically
developed countries only, virtual classrooms or institutions are now getting established in the
developing countries also, like Thailand, Malaysia, India, etc.

To compete and survive in the competitive world of education it is essential to create, adopt
and utilise new technologies, which will allow efficient flow of data, voice and images to all
those who want to remain updated in the fast changing world. With this, education will cross
the country’s border and will change the world into a ‘global village’.

To cater to and be responsive to the education and training needs of the people in the country
and also to reach out to them, we can depend on innovative communication technologies. If
you look into the future trends of development, the education and training requirements in the
years to come would be much more information intensive, catering to the needs of individual
students. Fortunately, these days due to rapid developments in the area of digitisation, signal
processing, compression, miniaturisation, VSATs, etc. communication technologies are
becoming available to the general public, (Kasturirangan, 1995). In this way more and more
people (students in this case) would be benefited by the new technologies. In our view,
technology has the potential to revolutionise training and learning.

New technology almost always addresses the changing paradigms of education and training.
It changes the way the teacher teaches and students do their work. It provides them new tools
to increase the productivity in terms of learning outcomes. It makes learning easier, more
effective and more enjoyable. In brief, technology brings the following changes (Hathawy,
1990):

- **Teacher's work**: A shift from the role of the sole dispenser of knowledge to students to
  one of helping students acquire knowledge from a variety of sources will be clearly
  visible once new technologies are used. Appropriate use of technology in education
  necessitates changes in the way teachers organise and implement teaching activities and
  students engage in learning activities.

- **Treatment of students**: New technologies can provide more individualised learning to
  the students in terms of content, length and time.

- **Facility design**: Appropriate applications of technology in education may alter the
  requirements for facilities. Educational practice may opt technologically enhanced
  learning approaches. Educational facility designs can provide greater flexibility in using
  learning materials, provide for better student access to a variety of information sources
  within and outside the school and be accessible for a greater period of time.

- **Productivity**: Technology enhance learning system can both increase productivity and
  provide products for export i.e. courseware developed could be marketed. Productivity is
  measured in terms of both quantity and quality, more and better.

The potential of technology must be exploited. Technology can be used to alter the way things
are done in education. When technology is used to alter the way education is delivered, a
number of benefits should accrue, as mentioned above. It is worth to mention here that we
should try and understand how technology can be used effectively in education and determine
the right roles for teachers and right role for technology.

### 7.4 AUDIO-VIDEO TECHNOLOGY

As this unit deals with emerging communication and information technologies, we did not
include popular educational media: radio and television etc. in our discussion. However,
innovative applications of radio and television in teaching and learning are included.

#### 7.4.1 Interactive Broadcasting

As you know, the broadcasting mode, both radio and TV, is being used for education at the
primary, secondary and higher education level in the country for a long time. However, the
delivery of information has remained unilateral (one-way only). The ability to interact is a key
feature of face-to-face teaching. It is, therefore, important to decide what actual or equivalent
levels of interaction are possible in other forms of delivery of information i.e. in distance and
open learning system. One of the main characteristics of emerging media is the potential for
interaction. Now, efforts are being made to make the broadcasts interactive i.e. two-way
communication. The students, though physically separated from the teacher and the school, can not only hear him but also clarify their doubts, ask questions or raise queries. You might have seen various radio programmes (usually known as phone-in programmes) in which the experts answered the question(s) asked by the listeners. Radio is a mass medium and is being made more interactive. The listeners participate in the interactive broadcast through phone-in system. IGNOU is also using interactive radio broadcast for tele-teaching.

### 7.4.2 Teletext and Videotext

The teletext and videotext are dedicated information services/systems. Both the technologies are available in the country and are being used for business purposes by corporate houses. Let us discuss each of these in detail.

**Teletext:** A teletext is an electronic publication delivered to the home television set either through a television broadcast or a cable television network. It is composed of a text as well as graphics and is read as it appears on a television screen, similar to the way the printed text is read (Mirabito, 1994). A teletext magazine is composed of news, sports, railways and air travel timings, and special interest features.

There are generally 100 or more pages of information, and a topic index organises the stories (information) into specific subject areas. To gain access to teletext you need a standard television set, a decoder and a keyboard. The keyboard resembles a television remote control and is used to select the page you want to view.

Educational communication can be supported by the teletext. The service can be used to advertise various educational activities being organised by the institute. It can make television viewing a more interactive and active experience.

Despite past and future promise, teletext service could not emerge as a viable communication tool. Some experiments on the educational use of teletext were conducted in developed countries but its potential has not been fully tested in India. The service is not being used for educational purposes in India. We, in India, however, can use teletext for disseminating information to students, particularly to those who are located far off from the school. It has potential for distance education/open learning system. The distance education operations such as schedule of admission, dispatch of learning materials, examinations, delivery of student support services, etc., can be transmitted through the national channel of Doordarshan, catering to the information needs of the distance learners. The pages of teletext magazine can be increased to accommodate a variety of educational information. New electronic devices could also support higher-resolution images and enhance user interface to speed up access to various information. The teletext service could receive a further boost through narrowcasting and slanting program towards educational and professional interest groups.

**Videotext:** A videotext system is a two-way, graphic-oriented, interactive service comprising thousand of frames or pages of information (Mirabito, 1994). The user can retrieve the graphic and alphanumeric information from the computer via a standard telephone line.

England’s National Prestel Service and Canada’s Teledon are examples of videotext system being used by the subscribers for a variety of communications, including educational.

### Check Your Progress

**Notes:**
- a) Write your answer in the space given below.
- b) Compare your answer with the one given at the end of the unit.

1. What is interactive broadcasting?

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7.5 COMPUTER TECHNOLOGY

The major communication technologies: print, audio and video, are converging today at the computer, a fact which stirs excitement among educators who imagine their students as users. The convergence of these media makes the learners more than users, it invites them to be managers or controllers, of a large body of information that is easily available on a computer. We shall discuss in brief, the various computer-based technologies available for educational purposes in the following sub-sections.

7.5.1 Computer

A significant benefit offered by the computer technology is the ease and speed with which it can manage the learning process. The computer, therefore, is a useful tool for education and training. The technology will exert even greater influence on education in future. Computer technology can perform the functions of a classroom teacher. It can be used for a variety of instruction/purposes: individual instruction, home studies and independent learning. It is easy for both the teachers and the students to understand difficult and abstract educational concepts by computer animation, graphics and clear colour presentation.

New developments have resulted in widespread usage of computers for information access, education, training and communication. A study conducted in USA concluded that computer-based tools could reduce the time to learn by 30 percent. The finding is based on defence training, but this may provide indication of the potential benefits for general education.

Virtual reality: A new development taking place in the field of computer is virtual reality. This field of computing has emerged as a result of advancement in computer graphics for generation of display devices (Keura, 1998). Virtual reality (VR) aims at providing computer generated virtual environment which can be used as the most advanced tool of visualisation for a large number of scientific applications such as study of computer structures, near realistic simulation of natural phenomena and conducting hazardous experiments. The student can interact with a life-like artificial world that can be perceived, explored and manipulated at will. The various objects in the artificial world created by the computer behave in the same manner as the objects in the real world. In real life we perceive objects by our senses: seeing, hearing, touch, taste or smell. In virtual reality, computers are used for creating visual environment, audio environment and tactile environment for taking care of input to the three senses. Computers create images by using advanced graphics techniques. The VR is a tool of human being-machine interaction which is going to revolutionise education and training.

7.5.2 Videodisc

The videodisc is a product of the optical disc family. It has tremendous capacity to store information, data, visuals and voice. Videodiscs have been adopted by libraries, researchers, and schools for storage of information. A videodisc can store thousand of still visuals, data and information. A videodisc player makes it possible to view a single picture (also known as frame) for the time required by the student. The videodisc player reads the same frame where the image/picture is stored.

A videodisc player can be interfaced with a computer to create an interactive environment. The advantages of videodisc are summarised as follows:

- Videodisc is a flexible medium giving control to study paths, access at any point in the programme, and feedback as required.
- Random access.
- Information read without physical contract giving exceptional durability.
- Permit rapid, almost instantaneous, access to various segment to a programme.
- Good display quality.
- Slow motion and reverse display.
- Each frame identified by frame number.
- Superior freeze-frame viewing.
Videodiscs have certain limitations too. Important among them are as follows:

- Comparatively high costs usually associated with production.
- Most videodiscs are a fixed medium – can be neither recorded nor edited using standard video production facilities.
- Unfamiliar to most teachers and teacher educators, consequently there are limited applications in Indian context.

**Compact disc-interactive (CD-I):** CD-I is an optical storage system primarily geared to educational markets. It is a sophisticated audio-video tool that supports a variety of playback format. CD-I can also support animation, video and photographic quality images.

CD-I is an interactive tool. A student can interact with the database of information through CD-I player and remote control device. Instead of watching and listening to a pre-arranged presentation, much like a video tape, the student can select the information he wants to hear and see and the order in which it is to be played (Mirabito, 1994). Based upon the student's needs and requests the computer would retrieve and display specific information stored on the interactive disc.

**Uniqueness:** The combination of the two technologies (its functionality and use, and the enabling technology) provides a medium which has the potential for providing unique educational materials as adjuncts to the teaching and learning process. Well designed programmes can effectively enhance the learning process. This is achieved through the active participation of the learner and the level of visual realism obtainable through simulation and surrogacy.

As an educational tool it has been enthusiastically received by learners and is clearly enjoyable to use, but it has not yet proved to be cost effective and evaluation of its educational benefits is to be assessed.

**Evidence of effectiveness:** In the educational context, it is far easier to find evidence of an enthusiastic response to the medium than to find hard evidence of its effectiveness following an objective and carefully executed evaluation. In the training context, there is no doubt that it is highly effective in improving retention compared to other forms of instruction in appropriately chosen topics.

There is also no doubt that CD-I has the attributes required for providing the most effective types of learning environments, and that potentially it is an effective adjunct to conventional teaching. Like all new educational technology products, there is a pressing need for evaluation of the effectiveness of CD-I programmes before their widespread introduction into the curriculum. Evaluation, however, requires substantial time and resources if anything more than an informal survey of attitudes is to be attempted.
CD-I has many characteristics. Some important ones are summarised below:

**Versatility:** CD-I is an extremely versatile medium. In one application it may serve as a pictorial database for a museum collection of photographs held as video stills and, in another, enable managers to take part in a realistic simulation game. It can serve as an entertainment source by giving access to a selection of videos, or it might serve as a training programme for motor vehicle mechanics, for example.

CD-I is at its most powerful when operating in a simulation mode. This may take the form of a dialogue with a teacher, a realistic representation of surrogate travel, the conducting of an experiment, the management of a commercial or business venture or the manipulation of real equipment interfaced to the CD-I system. The great advantage of the higher levels of functionality is that the education lists can teach the student, for example, how to be a physicist, a traveller, a manager, or welder, not merely what physics, travelling, management and welding are about.

**Views of CD-I:** As a medium, CD-I may also carry a range of quite different applications. It is, consequently, not surprising to discover that interactive video means different things to different people. It may be seen as a totally new creative medium by video producers, or as video-enhanced computer assisted learning (CAL) by educationists, or abstractly as one component of a multi-media information system by computer scientists. Each of these views is valid, so that evaluations of interactive video in a general sense are of little use unless considered in terms of some particular form, functionality and application.

For the educationist, it provides a potentially richer learning environment for the learner giving all the control to him including access to an extensive audio-visual library held in video form.

**Speech recognition:** Speech recognition is an innovation in computer technology. This feature allows a computer to recognise human speech or words. It translates the spoken words into information and makes it easier for people to do their job and learn. Some research and development activities are going on in developed countries to use this capability of computer technology for educational purposes. The student can instruct the computer to perform an operation instead of relaying on the keyboard or other interface for inputting instruction. The system initially diastases the voice of the user and then it recognises various words before the assigned instruction is carried out. This language processing system has provision to differentiate certain words, having similar pronunciation. The system simplifies various operations and help the student simultaneously perform more than one task. Thus speech recognition system is a very natural interface since it employs one of our most common communication tools, i.e. speech. The systems could recognise the student and could reply by means of the stored speech, where a number of phrases are recorded separately and then assembled into meaningful sentences.

Some agencies in developed countries are engaged in research and development activities related to speech recognition. Conversation computer systems are being developed. The technology could be very useful for visually challenged students. The technology can be linked with an optical character recognition (OCR) system. An OCR can recognise text from publication and other printed documents. The information can subsequently be reproduced in computer-generated speech, thus making the material available to visually challenged students. In this way, human-computer interfaces become meaningful and productive for students with disability.

### 7.5.3 Electronic-mail (E-mail)

E-mail has become quite popular all over the world. The business world has long since realised the advantages of this device, as it provides the facility called E-mail, D’Souza (1992) reported five essential advantages which e-mail has over traditional communication modes, as discovered by business institutions. They are:

- Reduced cost
- Reduced paper handling
- Faster communication
- Improved communication
- Integration of data communication with records managements
E-mail is primarily a store and forward messaging service. The messages/data are sent and stored electronically into the user's mail-box 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. That is like the normal postal mail, but unlike conversations, as the senders and the receivers do not attend to the communication act simultaneously. Thus communication through a e-mail is asynchronous or non-simultaneous.

To be able to use the facility of e-mail, four main components are necessary. They are:

- A telephone line
- Computer (mainframe, mini or micro)
- A modem (equipment to convert whatever is typed into electronic signals)
- Communication software.

One of the biggest advantages of e-mail service is its adaptability with regard to all kinds of data terminals like desk top or portable computers, fax, telex, visuals display units, printers, all of which can be utilised to send or retrieve data via e-mail. The confidentiality of the data is maintained as well as guaranteed delivery is possible as no one else can take data. Certain data can be further locked by use of additional passwords.

E-mail, as a new technology, has innovative instructional possibilities. Professor D'Souza's (1992) studies on the potential applications of e-mail in the academic settings have identified three broad areas where e-mail has proved or can prove quite effective. These are:

- **Pedagogy:** Through e-mail the students can have easy access to information resources which contribute to updating and greater learning. It has the capacity to present to the student many kinds of information sources. Moreover, e-mail can remove time and space barriers of the conventional classroom teaching. Sitting at home the teacher can respond to students' problems concerning assignments, projects or readings. It also provides one-to-one communication between the student and the teacher. Thus, it can offer more individualised attention to the students with specific learning needs.

- **Research:** With widespread computer networking among educational and research institutions, researchers can use e-mail to access data. They can exchange their research papers, proposals, formats, and so on quickly and conveniently. Thus, e-mail keeps them in touch with professional and experts and can enable them to access a variety of databases in almost any academic field in any part/institution of the country.

- **Administration:** As mentioned earlier, e-mail is being used for day-to-day communication, such as to receive or send messages at a convenient time, in a rapid, error-free and cost effective manner; read messages numerous times; save messages for future reference, etc. Mere speeding up the flow of existing information may be sufficient justification for using e-mail. The value of e-mail can be increased when coupled with other devices such as word processing, data-bases, etc.

As computer networks continue to grow and expand, domestic as well as international e-mail can be a valuable tool for communication, writing, research and routine administration.

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Check Your Progress

Notes:
1. Write your answer in the space given below.
2. Compare your answer with the one given at the end of the unit.

2. What is meant by virtual reality?
3. Write any three advantages of videodisc.

4. What are the educational applications of E-mail?

7.6 TELECOMMUNICATIONS AND NETWORKS

The concept of telecommunication has also been extended to the field of education, where learners can enroll for open learning/distance education courses and can interact with 'electronic' instructor/teacher. The learners can select textbooks and down load and review course. Depending on the system, the teacher can be available for consultation during specified hours or through e-mail (Mirabito, 1994).

Telecommunications technologies are playing a significant role in dissemination of information and promoting education at a distance. We shall discuss some telecommunications technologies in this section.

7.6.1 Communication Satellite

Satellites can be a sole distribution source but are often used in combination with other systems, including terrestrial links such as microwaves, cables and transmitters. Satellite distribution and the emerging technologies associated with it are increasing the number of people learning at a distance. But we should remember that the satellite should be used for what it does best, in terms of reaching remote students, in terms of delivering learning materials that could not be sent to the students through other means, and allowing, as far as possible, for two-way communication between students and teachers and among students.

You might be aware of the experiment, popularly known as SITE (Satellite Instructional Television Experiment, 1975-76) in which satellite was extensively used to reach and teach, besides rural adults, primary school children living in the rural area, including remote locations and difficult terrains. Thereafter since 1982, INSAT (Indian National Satellite) is being used for education and development. Institutions such as NCERT, UGC, IGNOU produce educational TV programmes for broadcast on the national channel through INSAT.

Satellite technology can be used to provide two-way communication. In last one decade, the Indian Space Research Organisation (ISRO) conducted various experiments using satellite for two-way interactive communication between the teachers and the students. Two-way interactive communication through satellite, popularly known as teleconferencing (one-way video and two-way audio), has been operationalised in the country since February, 1995 with two teaching ends (uplink facilities at IGNOU Campus, New Delhi and the SAC, Ahmedabad) and more than one thousand learning ends scattered all over the country. The facility is being used by the various institutions for education and training at a distance. Due to wide coverage and round the clock availability of the satellite, it can cater to the educational and training needs of people, irrespective of the place of their location, age and creed.

With satellite-based communication and computer technology, education systems cannot be monopolised by a few. Various experiments have been and are being conducted to establish satellite-based communication networks, paving the way for free flow of information inside and outside the country.
7.6.2 Telephone and Fax

Both the telephone and the fax are increasingly being used for educational communication.

**Telephone**: Telephone is a useful means of communication in education at a distance. It is being used widely in education in the developed countries for tutoring and counselling. Telephone lines are used for a variety of communications, such as fax, video-text, voice mail, internet etc. We shall discuss important technologies where telephone is used in a major way in this unit.

Flink (1978) mentions four ways of using the telephone in education:

- **Teleteaching**, which is operated by a two-way loudspeaking telephone in the classroom, and students not present may listen to the verbal activities going on in the classroom and also participate in the discussions.
- **Telelecture** is also operated by a two-way transmission. The teacher may present a lecture to individuals or groups located at a distance. Two-way communication is possible for all participants.
- **Dial access**, is an information service rather than a teaching/learning system. The system provides to the students with brief information on specific topics. The students can dial the school or the source for requisite information.
- **Teletutoring** is a system where an individual student can communicate with the tutor and receive individual help and support during his studies.

Baath (1979) researched into which educational functions the telephone can perform in distance education. Baath’s research was carried out in relation to different theoretical models for teaching. We quote here some of Baath’s conclusions:

- The greater potential value of telephone contacts seems to lie in the opportunities to establish individualised contact.
- Telephone tutoring could help the tutor get to know the individual student.
- Telephone tutoring could, above all, help the student get started.

With regard to cognitive learning goals, individual guidance over the telephone would appear to be valuable as a medium for fulfilling the following Gagne’s teaching functions:

- activating motivation
Educational Technology:  
State of the Art

- directing attention
- stimulating recall of relevant prerequisites
- providing learning guidance
- providing feedback

Moore (1981) seems to agree with Baath that telephone teaching has a large potential in learning at a distance. According to Moore:

"Like correspondence education, radio, television, computers and print, the telephone provides opportunities for formal learning at a place convenient to the learner."

"... like other distance teaching media, the telephone can disseminate teaching by rare or scarce authorities over a wide area."

"The telephone differs from the other media in being more highly interactive, and therefore permitting a lesser degree of structure by the instructor..."

"An especially valuable characteristic of educational telephone is the potential of meeting highly specialised needs, and in this it can be contrasted with broadcasting."

"The telephone has the characteristic of immediacy."

Telephone is being used by the various educational institutions all over the world. The Open University (OU) in UK, for example, developed the Cyclops System which used telephone lines for voices between study centres and the Open University Headquarters. The OU uses three kinds of telephone tutorials: one-based conference calls linking up to seven students with a tutor, study centre-based calls linking students at one or more study centres with a tutor, and one-to-one student-tutor calls. IGNOU uses telephone lines for asking questions and raising queries by the students in the teleconferencing sessions. You will read about teleconferencing in Section 7.6.3.

Telephone would be a good medium for distance education if it is accessible to students at affordable/reasonable cost. As per the latest data there are about two telephones per one hundred persons in the country and it is expected that by the end of this century there would be four telephones per one hundred persons. Thus, the density of telephone infrastructure is very low in India in comparison to technologically advanced countries. Moreover, telephone network is concentrated in the cities, and government and business houses. Some areas such as villages, hilly tracts and difficult terrains, etc. are not adequately covered by the telephone network. Moreover the tariff for distance calls is too high for a student to afford.

Fax: Fax is a device and process consisting of a scanner to convert hard copy to an electronic signal which is then sent by modem on a standard telephone line to the receiving end where the signal is decoded, reassembled and printed. Fax is also a useful instrument used for transmitting visual images instantly. The number of fax is increasing at a fast pace in all over the world including India. Its application for educational purposes is, however, limited. In IGNOU, the distance learners can ask residual questions (including those which could not be answered) in the teleconferencing sessions through fax. Sometimes the questions demanding long answers can be responded through fax after the session is over.

7.6.3 Teleconferencing

Teleconferencing is an umbrella term that describes an electronic link or meeting between participants at two or more locations. Unlike telephonic conversation which links two users, teleconferencing links more users located at different places through audio-video and/or computer technology. It is an important device of our overall communications system and is emerging as a valuable tool for education and business meetings.

Before we discuss the potential applications and types of teleconferencing, we would like to highlight the need for two-way communication technology. One of the most obvious markets for interactive technologies application is education. All educators agree that interaction is one of the effective ways of getting/giving feedback in the educational process. In other words, feedback (that is interaction between the teacher and the students) is essential component of the teaching-learning process. The ability of the student to interact with both the learning
materials and the teacher varies. Like face-to-face interaction, mediated-interaction also varies from one-to-one consultation between a teacher and a student to one-to-many i.e. between a teacher and a classes or group(s). It is obvious that due to cost and accessibility to emerging technologies one-to-one interaction between the teacher and the student is expensive than one-to-many when queries raised by the students or answers given by the teachers are shared by large audience, classes or groups.

Teleconferencing provides a variety of advantages to teaching-learning at a distance or autonomous learning. It can be used for brain storming, questioning, role play, group discussion, case studies, problem-solving, etc. It can be used to keep the students and teachers informed about important developments and innovations in the body of knowledge. It can link various schools, learning centres or homes with the main institution (teaching end) thus, can help teachers in providing quality education to member/participating schools or students. The guest lectures can be arranged through teleconferencing. The guest teacher can make live presentation and be able to 'electronically' meet the students in a classroom-like situation. Thus teleconferencing makes it possible for the participating schools or learning centres to draw upon the best resources and experts in the specific field of study, who may not be available to all schools or students under normal circumstances.

Like any communication technology, the application of teleconferencing in the teaching-learning process will depend on the accessibility, cost and pedagogic effectiveness of the technological configuration being used. Nevertheless, if systematically designed, planned, implemented and utilised, the teleconferencing sessions can provide valuable resource to the students learning at a distance. We should remember that teleconferencing, for that matter any communication technology, will not eliminate all face-to-face contact, which is called for on different occasions. Depending on the nature of the knowledge or skills to be acquired by the students, an on-site contact may be appropriate. In this situation, the teacher (expert) can actually sit down with students, and make adjustment according to the need of their needs.

Besides facilitating education and training at a distance, teleconferencing can be used effectively for conducting business meetings, and managing and monitoring the various operations of an organisation/institution with multi-campuses. It relieves the participants from the difficulties of travelling distance locations and saves enormous time and money for them.

![Teleconferencing programme of the School of Education, IGNOU](image)

(Source: Menon, M.B (1995) Utilisation of New Technologies in Distance Education (Report of project sponsored by Spencer Foundation, Chicago), School of Education, IGNOU, New Delhi.)
There can be different types of teleconferencing, different types of technological configurations. For your purpose we discuss three types of teleconferencing system being used in India these days. They are:

- Audio conferencing
- Video conferencing
- Computer conferencing

These types have been classified according to the use of the technological configuration. Let us discuss each type in detail.

**Audio conferencing:** An audio conferencing can be thought of as an extended telephone conversation, but instead of talking with only one person, you may be talking with several or more students, located at multiple sites (schools). Audio conference is a convenient way to bring people from diverse locations together to participate in effective discussions. An audio conferencing is an effective communications tool for sharing information/ideas/experiences and is inexpensive to design and implement. An audio conferencing can be used for various purposes. It can create an inexpensive communications link between a physical education class and a sports reporter on the play ground or a medical science class and an operation theatre in a hospital which may be far off from the school or the students.

In audio conferencing the students can hear the teacher and ask questions through the same system, i.e. audio. Neither the teacher nor the students can see each other. Moreover, the motivated students are likely to be benefited more as they would actively participate in the discussion. The teacher, therefore, has an important role to play in creating a favourable learning environment and sustain the motivation of the students. The level and quality of language used by the teacher also determine the effectiveness of the system. In a developing country, like India, audio conferencing can prove to be an effective means of distance learning.

Audio conferencing has certain limitations too. Being an audio medium, it is a unisensory medium i.e., it involves learning through listening only. It may not be useful for teaching those topics which require visual support such as movement of a process, demonstration of a skill, colour of an object, etc. This limitation, however, can be overcome to some extent by backing up the teaching with the printed text such as workbooks, diagrams, handbooks, manual, etc., and supporting on the backing materials in the teleconferencing sessions. The teacher can refer to the diagrams, etc., in his/her presentation and in turn the students can ask questions or seek clarification on them (diagrams, etc.). In this way, the teacher can guide/direct the students to conduct experiments at the learning centre or home (of course with the help of science kits available with the students) through real-time interaction.

**Video conferencing:** As the term indicates, in this system students can see the teacher or both the teacher and the students can see each other. Depending on the use of technology, there can be two types of video teleconferencing. They are:

- Two-way video conferencing
- One-way video conferencing

Let us discuss each type in the following paragraphs.

(i) **Two-way video conferencing:** Two-way video conferencing is a teleconference where, as implied by the name, video or visual information is exchanged. In the two-way video conferencing students can see and hear the teacher and fellow students located at different learning centres, and can learn in an interactive environment and exchange views/ideas. A primary advantage of the two-way video conferencing lies in its replication of a face-to-face meeting. Students can react to each other’s body language and visual clues in interpersonal transactions. A two-way video conferencing can accommodate a range of information, including graphics and possibly scanned documents.

The video conferencing can be either motion or non-motion operations. The term motion implies that teachers can appear on television screen in a lifelike manner. It can range from full motions, where transmission may look like conventional broadcast television, to limited motion, where movements may be jerky and there is a deterioration in the picture quality. The non-motion or freeze-frame video conferencing, the second category, consists of a series of still images that appear on the screen. Even though the visual element is not lifelike, an audio hookup could support a conversation (Mirabito, 1994).
Two-way video conferencing is a costly affair. We need to create the necessary infrastructure to transmit and receive visual signals at both the learning and the teaching centres. Besides, we have to equip the teaching and the learning ends with camera crew and technical staff to manage the two-way video conferencing.

(ii) **One-way video conferencing:** In one-way video conferencing, the audio-video information can be a one-way information or can be a one-way stream from the institution/teaching end to its learning centres or schools. These centres or schools may communicate with the teaching end in turn, with a telephone or other audio-based hookup. The connection can be used for question and answer sessions the discussion on relevant points and for the clarification of specific details.

The potential of one-way video conferencing (point-to-multi-points) has been demonstrated in India through various experiments conducted by some educational institutions. The system can be used for teaching different topics, including sciences. For example, dissection of frog or conduct of an experiment by the expert can be seen or understood by the students located in different schools or at homes. The transplant of heart and the specialised surgical procedures can be relayed for medical students to view and learn a valuable medical technique through the real-time meeting.

**Computer conferencing:** The term computer conferencing refers to computer-based meeting, for exchange of pictures, words, graphics etc., between multiple sites. Special hardware and software systems are used to support computer conferencing activities in both real time and non-real time. Real time, in this context, implies synchronous communication in which messages can be sent and received as you view the screen and interact with the system and the other participants tied in the network. The non-real time elements i.e. asynchronous communication, in contrast, may encompass a series of longer messages, a central database of information and a record of current and past comments and all the participants can see (Mirabito, 1994).

### 7.6.4 VSATs

The very small aperture terminals (VSATs) is a compact satellite dish mated with the necessary electronic hardware to create an earth station. The earth station consists of a small antenna (generally less than 2.4 meters in diameter) and other devices to interface between the antenna and the end-user equipment. The end-user equipment could be one or more personal computers (PCs), telephone, a PBX, a video receiver/player, or any combination of these (Amritkar, 1995). VSAT can receive or, in another configuration, receive and transmit signals. A VSAT can link a few, or if necessary, hundreds of sites, including geographically remote locations.

A VSAT supports a variety of network configurations, and a large information including computer data, can be transmitted on different speeds. The VSAT is more flexible and less expensive than many land-based communication networks.

The advent of VSAT, now a decade old, has broken the barrier of distance and difficult terrains. A VSAT-based wide network creates a highly reliable, error free and flexible information highway compared to terrestrial alternatives available. In the Indian context, due to non-developed terrestrial links, VSATs are becoming an ideal mode for communication. VSATs can form a healthy backbone and can play a vital role in basic telephony.

VSAT is useful for institutions/universities with multicampuses. Due to its dependency on wireless communication transmission medium, VSAT has overcome many problems of telecommunication. It is a viable technology when terrestrial lines are costly and difficult to install. It has, therefore, become very attractive to existing terrestrial networks in terms of availability, performance, variety of services, cost per byte transmitted and cost per incremental capacity growth. As a result, now there is no need to invest in high capacity transmission lines, which are very difficult to create to cover the entire country. VSAT can provide cost effective, reliable telecommunication over large geographical areas, replacing or supplementing traditional terrestrial lines (Amritkar, 1995). Telephone and services such as e-mail and data transfer via VSAT do not require the use of radio frequencies.

VSAT is being used to transmit voice and data. It, however, can be designed to carry voice and visuals also. Video conferencing through VSAT may be feasible in future. However, the system may cost high and there will be a time lag in communication. The problem of time lag can, however, be solved by LEOS (Low Earth Orbit Satellites) which can be placed at a height of only 800 kms.
VSAT can be connected with computers and LAN (Local Area Network) to keep the main school in touch with learning/training centres. It has a number of advantages over terrestrial line-based telecommunication (Amritkar, 1995). The main advantages are as follows:

- It is more reliable, the call completion rate is very high (99.5 percent).
- The cost of expansion is not dependent on distance.
- The user incurs a fixed cost for VSAT services, irrespective of distance.
- Communication need not pass through ground facilities.
- Transmission of huge data in less time across long distances is feasible.
- Being a modern telecom technology it is suitable for a large country and with areas of difficult terrain.

Jha (1995) identified the following advantages of VSAT system over the terrestrial network:

- The cost is uniform and does not depend on distance, hence useful for hilly, remote and ill-connected areas.
- Response time is much lower than dial up-link.
- Speed of transmission is much time higher.
- LAN to LAN connectivity via VSAT is unique for data transfer.
- Point-to-multi-point communication is possible.
- There is no interruption due to frequent changes in weather.

Besides these advantages, according to Chowdhary (1996) the strategic benefits of VSAT are:

- Cost management: Institutions can fix their communication costs and make them predictable: So each year communication budget can be planned accurately.
- Greater productivity: A single transmission medium and the centralised monitoring and control provide higher quality and better management. There is a single point of contact for operation, maintenance, rapid fault isolation and trouble shooting.

There are certain hinderances in the growth of VSAT technology in the country. Important among them are:

- Lack of interconnectivity with PSTN (Public Switched Telecom Network),
- High costs of satellite dishes, and
- Slow growth in demand for the services.

These and some other issues are affecting the growth of VSAT services in the country.

Check Your Progress
Notes: a) Write your answer in the space given below.
     b) Compare your answer with the one given at the end of the unit.

5. How is satellite used in educational activities?

6. How is the telephone helpful in teaching-learning activities?

7. Differentiate between audio conferencing and video conferencing.
7.6.5 Internet and Intranet

Internet

The internet is an electronic mail system and library access facility. It is a mail system because it allows us to send and receive messages. It is a library access system because it allows our request for information, provided we know what we are looking for. It is a wonderful means allowing access to information, amorphous mass stored in databases. With advent of internet there emerges a belief that there is another structure to support teaching and learning. By sharing information it facilitates an educational process.

Internet is growing at a very fast pace all over the world. India is no exception in this regard. Internet is a set of various intranets created by the various agencies. In other words, it is a network of networks, a huge source of inter-connected information. Internet makes information on any topic under the sun available to its users linked with networked computers. The users can interact with master computer to navigate for required information. Internet is being used for both the delivery of distance education and assisting regular/conventional classroom courses. Internet also transforms two-way communication, reducing barriers of time and space. The scale of its coverage, its immediacy, the quality of presentation and the ability to interact with it and through it bring new dimensions to the world of knowledge, thus creating new communities of learning.

Internet brought a change in the teaching-learning process. The students control the content and the process of their learning. The earlier paradigm was that teacher must use technology to teach students. The new paradigm involves students using technology to learn. The students go beyond the experiences of teachers, beyond books in the library. They may find conference papers as yet unpublished, press releases and news items from any part of the world (Jenkins, 1998). The latest information/content in the area of their interest can be downloaded and used as and when required. Thus use of internet places the focus on the student. This in turn focuses on aspects such as student’s prior knowledge and experience, readiness and motivation to learn.

There is very little experience of delivering courses via the internet. The logical choice is that, the strengths and weaknesses that apply to computer-based learning will apply to most aspects of teaching and learning through the internet. It enables the student to study/learn at a time convenient to him/her. Thus, it provides individualised instruction and is capable of providing almost instant feedback.

Intranet

New communication technologies have created networks for sharing educational resources. The networks allow one-to-one, one-to-multipoint, or multi-or-multipoint communication between students and teachers, and among students. Depending on the coverage of the area i.e. the size of the networks, there can be two types of communication networks: local area network (LAN) and wide area network (WAN).

LAN is confined to a limited physical area, such as various schools in a town, or various departments or units of a university, and share information and infrastructure. Thus, LAN can create an integrated learning environment where students can plan joint projects, can discuss their problems/queries related to their study. LAN can link the students to wide area network (WAN).

WAN links various institutional centres or campuses located in different parts of the country or outside the country. Various centres or campuses of an institution or various institutions are networked to share information, ideas, data, resources, etc. The interconnection of LAN and WAN can make communication more effective, catering to the local needs as well as global needs of the students. In other words, the students can access various LANs through WAN. Due to technological developments various networks (LANs and WANs) have been created all over the world, linking inter connected servers.

LAN and WAN can be interconnected among themselves and with internet, thus making communication global. In this way a communication network can be created which interconnect all the networks in the world, converting it into a ‘global village’.

Many communication networks have been created in the country to disseminate and share information. These networks are being used for the various purposes. Some of these networks are discussed below:
INET: The public data network (INET) has been expanded to 25 cities, out of total of 89 major cities planned for the INET. This network service is available from any STD telephone throughout the country.

HVNET: The Department of Telecommunication (DoT) has launched a high-speed satellite network called HVnet which provides high-speed data and voice communication capability between computers and data terminals from any point in the country. This network makes use of high-speed VSAT technology. This eases the problem of remote area communication. Growth in data communications among business partners and within organizations has given a boost to the culture of computer to computer communication. The network offers the following services (INSAT, 1997):

- Switched data service between VSATs.
- Access to international data network through the gateway packet switching system of VSNL.
- Voice facility including connectivity to Public Switched Telephone Network (PSTN).

Intelligent Networks (IN): The Department of Telecommunication has introduced IN services in the country. The final testing of these services has been tried out services such as toll-free long distance calls, etc., offered by an educational institution have been introduced. This network allows an educational institution to subscribe to a common number so that a call made by a student from anywhere in the country or region is routed to a predefined destination. All charges for a call to the toll-free number will be paid by the institution, and not by the student. Many institutions in developed countries, such as Open Learning Agency, Vancouver; Athabasca University, Athabasca, Canada, etc., have allowed their students the facility to call them free of cost, thus helping students in their study. Even in India, IGNOU has a toll-free telephone through which the students can participate in teleconferencing sessions, can ask questions, or raise queries on the presentations made by the experts. These advances in telecommunications will transform the way people communicate and will facilitate the development process.

ERNET: The Department of Electronics (DoE) has been running an educational network, called ERNET. This is an education and research network linking about 20,000 users. It connects all the five Indian Institutes of Technology (IITs), Indian Institute of Science, Bangalore and about 350 educational institutions. The network facilitates active exchange of information and access to databases. Thus, it provides a basic infrastructure for education and research. Efforts are underway to connect all the colleges in the country so that young scientists and research scholars can have direct access to information of their interest.

DELMET: The participating members and libraries and documentation centres from the various databases/union catalogues in Delhi and outside have created a network called DELNET. There are 74 members of DELNET. Every member library has loaded their data onto a computer, which is connected to DELNET through e-mail system. The member libraries have on-line access to huge database of all the participating libraries catalogue — referred to as union catalogue. Interestingly, DELNET provides a courier service to transfer books/documents from one library to another. The network is shown in Figure 7.4.

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**Fig. 7.4:** Delnet: The Growing Network
**TEXNET**: Texnet offers the service of on-line advertising bulletin board where buyers and supplier can advertise or browse through data on trading, manufacturing and retail chains of the textile products.

**Telemedicine network**: Escorts Heart Institute and Research Centre (Delhi) launched in 1996 a round-the-clock telephonic heart monitoring service by means of which heart patients can transmit the ECGs over phone to doctors at the hospital and get instant help in the case of emergency. The patients who subscribe this facility are given cardiac beepers, which they can keep with them all the time. While facing any problem, the patient can place the beeper on his chest and record his ECG within fifty seconds at the press of a button. Electrocardiography can be transmitted to the fully computerised heart care unit at the Hospital.

Escorts Heart Care Foundation Hot Line Service started by Heart Care Foundation of Indian and Essar Cellphone Company in association with Mool Chand Hospital, Delhi is available round-the-clock to help heart patients in emergency. The hot-line provides answer to routine queries about heart diseases. This unique hot-line phone counselling is available in Delhi and nearby areas providing patients instant information about cardiac first aid in case of emergency. Indraprastha Apollo Hospital, Delhi has also created a similar network, which in addition to ordinary telephone lines is accessible through hot-lines and fax.

**TDCC**: Training and development communication channel (TDCC), a two-way audio and one-way video communication system was established and operationalised by the IGNOU and ISRO in February 1995. TDCC with teaching-end facilities (studio and uplink) at the IGNOU Campus, New Delhi and at the Space Applications Centre, Ahmedabad links all the IGNOU Regional/Study Centres and State Open Universities in the country. TDCC is being used on a regular basis for distance teaching and training, and business meetings. The efforts are on to share and use physical, intellectual and human resources for raising quality and widening outreach of open and distance education programmes in the country (IGNOU, 1997).

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**7.7 LET US SUM UP**

In this unit, we discussed emerging communication and information technologies. Our discussion centred around three major areas of emerging technologies. These are audio-video technology, computer technology and telecommunication technology and networks. Under audio-video technology, we discussed interactive broadcasting, telejext and videotext. Under computer technology we discussed computer, videodisc, compact disc-interactive, e-mail and multimedia. Under telecommunication technology, we discussed communication satellite, telephone and fax, teleconferencing and VSATs. Teleconferencing is also of three types: audio conferencing, video conferencing and computer conferencing. Lastly, we focussed on internet and intranet and provided some examples of intranet.
7.8 UNIT-END ACTIVITIES

1. List various telecommunication and information technologies available in your school and nearby schools. Assess the utility of these technologies for instructional purposes.

7.9 ANSWERS TO CHECK YOUR PROGRESS

1. Interactive broadcasting is a two-way communication between the students and the teacher in which they not only hear him but also speak to him to clarify their doubts, ask questions or raise queries.

2. Virtual reality provides computer generated virtual environment which can be used as the most advanced tool of visualisation for a large number of scientific application like realistic simulation of natural phenomenon, conducting hazardous experiments.

3. The three advantages of videodisc are:
   a) Videodisc is a flexible medium giving control to study paths, access at any point in the programme, and feedback as required.
   b) It has slow motion and reverse display facilities.
   c) It has also facility of random access.

4. E-mail has three major educational applications:
   a) Pedagogy: Students can have easy access to vast amount of information resources through e-mail.
   b) Research: Researchers can use e-mail to access data, and to exchange with their research guides and experts.
   c) Administration: E-mail is also used in day-to-day administration. Sending and receiving messages at a convenient time, in a rapid, error-free and cost effective manner are possible through e-mail.

5. Satellite is used for education and development. In SITE programme, satellite was used to teach primary school children in the rural area. Satellite technology is also used to provide two-way communication. The ISRO conducted various experiment using satellite for two-way interactive communication between teachers and students.

6. Telephone is helpful in teaching-learning activity. Teaching through telephone activates motivation, directs attention, stimulates recall of relevant prerequisites, provides learning guidance and provides feedback.

7. An audio conferencing is an extended telephonic conversation in which one talks with several or more students located at multiple sites. Students can hear the teacher and ask questions through the same system. In video conferencing, students can see as well as hear the teacher or both the teacher and students can see and hear each other.

8. Internet is an electronic mail system and library access facility. It is a mail system because it allows us to send and receive messages. It is a library access system because it allows us to request for various information. Intranet is network of communication technologies. Networks can be of two types: local area network (LAN) and wide area network (WAN).

7.10 SUGGESTED READINGS

Baath J.A. (1979): Correspondence Education in the Light of a Number of Contemporary Teaching Model, quoted by T. Rekkedal (1989), The Telephone as a Medium for Instruction and Guidance in Distance Education, Norwegian Centre for Distance Education, Norway.


