

Concept and Scope of Educational Technology

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UNIT

1

Introduction

This is the age of information technology. The use of science and technology can be seen everywhere in our daily lives. Science and technology has been instrumental in bringing efficiency, improvement and perfection in the process and product of human work. In case of teaching-learning it also makes it more comprehensive and simple and helps to display more information in a lesser time while making the process more interactive. Educational technology (ET) in the wider sense includes the development, application and evaluation of systems, techniques and aids in the field of learning and teaching. The shape of future schools, colleges, and universities is bound to change radically due to technological impact in the years to come. There are hardly any areas left, where you do not feel the necessity as impact of technology.

Since this is the first unit of this course, we will make an attempt at understanding the concept and nature of educational technology. This unit will also help you to understand hardware, software, and systems approaches to educational technology. The scope of educational technology is another important learning point in this unit which will help you to understand Units 2 and 3 of this Block. Let us now consider the major learning outcomes of this Unit.



Learning Outcomes

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

- discuss the concept of educational technology;
- discuss the scope and importance of educational technology in the teaching-learning process;
- differentiate hardware, software, and systems approach to educational technology;
- classify different educational technologies;
- explain various aspects of educational technology; and
- discuss the possible applications of ET in your teaching, learning and training.

Concept of Educational Technology

You, as a practitioner should be using technology in your workplace to make your presentations more effective and communicative. But, for most people, the term 'educational technology' is associated only with the equipment and with the hardware, which is used, viz. over head projector (OHP), television, computer etc. However, the concept of educational technology should not be confused with the electronic gadgetry; it has a wider meaning, as wide as education itself. By this, it means that educational technology is concerned with the design and evaluation of the curriculum

and learning experiences provided within and outside the classroom, and also with the problems of implementing it. Technology has been a part of any learning process from the beginning, whether it was writing instruments, printed books, or audio-visual media.

Let us understand the meaning of the term ‘educational technology’ by splitting it into ‘**Education**’ and ‘**Technology**’. Technology refers to the systematic application of techniques and principles of science to achieve an objective effectively and efficiently. ‘Technology’ is that branch of advanced scientific study which involves highly designed and sophisticated engineering software and hardware. It deals with the application of knowledge for practical ends. Technology results in new designs and devices to improve human productivity. Education is the process of modification of behaviour, socialization, social efficiency, acculturation, and adjustment to the environment, harmonious and all round development of the human personality. Hence, educational technology is the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources. As a field of study, educational technology emphasizes communication skills and approaches to teaching and learning through the judicious use and integration of diverse media. Practitioners in educational technology seek new and effective ways of organizing the teaching-learning process through the best possible application of technological developments. These activities rely upon a body of knowledge for successful and ethical implementation, rather than as routine tasks or as isolated technical skills.

ACTIVITY 1.1



“Technology is more than computers and networks”. Justify it by providing its uses in any one area of human activity. Write in about 75 words.

There have seen a number of definitions of educational technology which have been provided by researchers and scholars over the years. Let us go through them to get a better understanding of the term “educational technology”.

- *Educational technology offers the means to reach large numbers in remote and inaccessible areas, remove disparity in educational facilities available to the disadvantaged, and provide individualized instruction to learners conveniently suited to their needs and pace of learning (NPE, 1986).*
- *Educational technology is a communication process resulting from the application of scientific methods to the behavioural science of teaching and learning. This communication may or may not require the use of media such as television broadcasts, radio, cassettes etc. (UNESCO, 2001).*

- *Educational technology is the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources (Januszewski & Molenda, 2008).*
- *Technology means the systematic application of scientific knowledge to practical tasks. Therefore, educational technology is based on theoretical knowledge drawn from different disciplines (communication, education, psychology, sociology, philosophy, artificial intelligence, computer science, etc.) plus experiential knowledge drawn from educational practice. Educational technology aims to improve education. Technology should facilitate learning processes and increase performance of the educational system(s) as it regards to effectiveness and/or efficiency. Educational technology is the use of technology to improve education. It is a systematic, iterative process for designing instruction or training used to improve performance. Educational technology is sometimes also known as instructional technology or learning technology (wikipedia, 2012).*

In the light of the concept of ET discussed above, we may conclude that educational technology is the systematic application of science and technology in the field of education. Science is search for profound knowledge. Scientists investigate the world around us. They observe how things work and based on this, develop ideas about ways to make them work better. Sometimes they try to test an idea as to find out how things work or do not work. The knowledge thus discovered is useful for many things that we do in our day to day life. It can help to build new machines, develop new medicines or cure diseases. Technology is the use of scientific knowledge to create new things. ET is based on the systems approach to education: the input, output and the process. It directs both the teachers and learners to formulate learning objectives, and to develop appropriate strategies of teaching and learning evaluation techniques. It helps in providing efficiency to the task of teaching and learning and facilitates effective communication between teachers and students. By now you would appreciate that educational technology is not merely confined to the use of audio-visual aids, software and hardware, nor is it limited to the use of the psychological principles and instructional theories, for bringing change in the teaching-learning process. It has a much broader scope. To conclude ET is:

- a science of using technology in education through which educational goals can be achieved;
- a mechanization of educational process in three phases of human knowledge i.e. preservation, transmission, and development of knowledge; and
- an attempt to use technology developed by using scientific principles, for making education, productive and meaningful.

ACTIVITY 1.2



Analyze the various definitions of educational technology (given above), and summarize in points.

The characteristics of educational technology are closely linked with its concept of educational technology. Let us discuss its important characteristics given below.

Modern discipline: Educational technology is a rapidly developing modern discipline that is ready to face the challenges of the near future. For example, we can actually deal in real time synchronous feeling (sharing of a two way communication online and getting feedback instantly) by using technology in education, The world over many institutions of higher learning have started using information and communication technologies, such as the internet, web-based learning, online learning etc.

Based on scientific advancement: The growth of educational technology depends on the developments in the field of science. It involves the adoption of scientific and technological innovations and inventions to solve problems confronted by the education sector. Advancement in scientific knowledge produces more and more sophisticated electronic devices.

Improving the educational system: Educational technology locates the problems in the field of education, finds remedy and ultimately aims at improving the educational system. It facilitates effective communication between the teachers and students, in order to accomplish learning objectives.

Based on research: ET makes use of the research findings of psychology, sociology, engineering, physical sciences and social psychology among others, and applies the same to the field of education.

Practical discipline: ET applies technical knowledge systematically to the field of education to attain the objectives of practical goals. It provides hands-on experience to both the teachers and the learners.

Effective classroom management: The application of a variety of educational technologies to classroom teaching and learning is both effective and efficient in terms of time effectiveness, systems approach, and attainment of objectives both by the teachers and the taught.

Mass communication media: Educational technology has the potential to impart education and training to large masses with varied backgrounds in terms of education, socio-economic status, language competencies, location, etc.

A means: Educational technology is a means to achieve an end but is not an end in itself. Better classroom performance is a product or output or an end in an educational process, but the treatment provided to the students in terms of using educational technologies in the teaching-learning process may be the 'means' for it.

Wider scope: As we have discussed earlier, the scope of educational technology is not only confined to the use of technological gadgets in education rather, it includes the development, application and evaluation of systems, techniques and aids in the field of learning. The scope of

educational technology encompasses educational objectives, selection of media and resources, management of resources, etc. thus, ET is a dynamic, progressive and effective tool in the hands of teachers, students, and educational administrators.

New conceptions are possible only due to such educational technologies as computer, e-learning, mobile learning, online learning, spread of synchronous experiences etc.

Placement: Educational technology accepts the ‘school’ as a system. In this system, the school’s infrastructure such as, the building,, furniture and teachers act as inputs while various methods, techniques, strategies, teaching and examination (all with the help of audio-visual aids) function in the form of a process. Lastly, the output is in the form of the capability of the pupils.

Engineering technology is used largely in the manufacturing sector that produces radios, CD players, tape records, CDs/DVDs, video-tapes and the television. Even though all these audio-video gadgets are used in the teaching-learning process, engineering technology is different from educational technology. These aspects of engineering technology are accepted as the hardware approach in education. In education, the stresses lie equally on software technology which makes the hardware meaningfully useful. Suitable programming makes educational technology both productive and efficient.

Some teachers feel that educational technology will replace the teacher. It is simply a myth. Educational technology cannot replace the teacher. Largely because of three aspects of educational technology; input, process and output. The teacher has a crucial role to play in order to achieve the desired learning outcomes with the support of educational technology.

ACTIVITY 1.3



1. *Define educational technology in your own words.*

2. *“Educational technology cannot replace the teacher”. Discuss in about 100 words.*

Technologies in Teaching and Learning

As technology has changed over the years, so, too, has its importance in the teaching and learning process. Educational technology performs two important functions - communication and information storage and these functions have evolved from the pre-mechanical to the mechanical and to the electronic and now digital forms. You can understand it by observing Figure 1.1 given below:

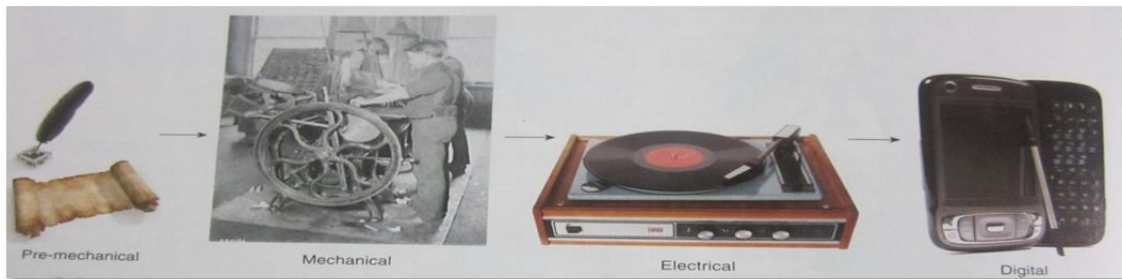


Figure 1.1: *Information and communication technologies: Pre-mechanical, mechanical, electrical, and digital era*

(Source: Katherine, John & Peggy, 2010, P.4)

Digital information communication technologies have become more accessible to the general public these days. In the pre-mechanical era, teachers used real objects and face-to-face communication with their students to describe the past, explain the present, and encourage thinking about the future. In that era neither technologies nor its products were used extensively in educational settings.

At the time of the mechanical era, it became possible to produce technological products in a large scale. The printing press was handy as it solved many difficulties that teachers faced in retrieving and using information over an extended period of time. Storing and retrieval of information could become easy for teachers, students, and the general public at large. During that era, books were the new information technologies.

During the electronic age availability of and accessibility to technological devices increased even further. The use of phonograph, radio, and television increased opportunities for communication. These technologies proved to be valuable tools for teaching and learning.

In the digital era, more sophisticated communication tools were developed. Word processors, digital cameras, e-mail, cellular phones, and an array of information and communication tools were developed. High power storage, retrieval systems and software became more accessible to the educational sectors. For example, you might access your textbooks through online databases or websites, or listen to entire books as audio files on your MP3 player. Further modern technologies came to be used in professional practices such as providing lifelong learning opportunities, promoting creativity and innovation, assessing students' instructional needs, evaluating their performances, encouraging the equitable use of existing resources, as well as facilitating professional growth and leadership through the effective use of digital tools and resources. In this process of development, the use of the computer for a variety of purposes is also remarkable. Let us summarize it in a tabular form.

Table 1.1: Computer technology in the teaching-learning process

First Phase: The computer as an object of study	
1977, Apple II is introduced	First micro computer brings computing from the scientific, mathematical domain to the home, school, and work settings.
1981, IBM releases the first PC	IBM releases DOS-based computers and coins the term PC, or Personal Computer, the new concept in computer technology.
1982, Educational software introduced and emphasis made on education	The computer is named Time Magazine's "Person of the Year," the individual who has had the greatest impact on world events during the year. Drill and practice educational software programme predominate. Computer literacy and learning about technology begins. New academic courses started in different universities.
Second Phase: The computer as programming tool	
1983, Logo Programming Language	Logo programming gains acceptance in education in an attempt to address higher-order thinking and problem-solving skills in students
TCP/IP, SMTP, FTP, HTTP	Standardized communications language, TCP/IP, enables communication between computers via network – the internet for the "common man" is born.
1984, Macintosh	Apple's Macintosh introduces the terms "desktop" and "icon" into everyday language and ushers in more variety in educational software.
1987, Hypertext	Hypermedia becomes readily accessible with the distribution of Hyper-Card software on Macintosh computers.
1990, Multimedia boom	Multimedia PCs are developed; simulation software and gaming grow in popularity and complexity; educational databases and other types of digital media are available on CD-ROMs.
Educational Emphasis	Learning programming languages and using "programmed instruction" such as drill and practice software.
Third Phase: Computer as a communication device and resource tool	
1991, WWW is born; 1993, Mosaic released	The release of Mosaic, a browser with a graphical user interface (GUI), changes the look of internet communication. "Suffering the web" becomes common place. This heralds a new frontier in website development, with an abundance of educational sites for children. Microsoft releases the Windows 95 operating system.

1996, First Ed Tech Plan, digital explosion	Local Area Network (LAN) used in local area schools and is connected to the internet. Information literacy: Learning with computers. Educational goals emphasize the acquisition of computer hardware and the development of network infrastructure. Technology tools grow at an exponential rate and become faster, smaller, and more powerful. Digital music, pictures, audio, video-the applications of this new wave of technology – are virtually limitless.
Fourth Phase – The computer as a learning and social tool	
Web 2.0	Teachers and students move from being consumers to becoming creators of online content using wikis, blogs, and other social networking tools.
Educational emphasis	ICT literacy: foundation information, communication, and productivity skills may remain similar while tools will continue to change. Technology will be a tool for solving educational problems.

(Source: Katherine, John & Peggy, 2010, P.11)



Computer as a learning and social tool

ACTIVITY 1.4



How can a computer be used as a learning and social tool? Conduct a survey in your area and prepare a report in about 500 words.

Approaches to Educational Technology

In the previous section, you studied about the concept and characteristics of educational technology. By now, you should have understood the concept of educational technology. The discussion made so far will also help you understand the approaches of educational technology. Let us now discuss the various approaches to educational technology. Educational technology may be classified into two categories based on “applicability and approach”. Each category can further be divided as follows:

On the basis of applicability

There are three applicability based approaches to educational technology. They are:

- teaching technology;
- instructional technology; and
- behavioural technology.

On the basis of approach

There are three types of educational technology on the basis of approaches. They are:

- hardware approach;
- software approach; and
- systems approach.

Let us discuss the types of educational technology on the basis of its applicability. We shall take up the approach-based explanation to educational technology in the next section. In Table 1.2 you will see the difference between teaching technology, instructional technology, and behavioural technology which you apply during the teaching-learning process.

Table 1.2: *Types of educational technology based on its applicability*

Parameter	Teaching Technology	Instructional Technology	Behavioural Technology
Exponents	Herbart Morrison, Hunt, Davies, Gage, Gagne, Brunner and Glaser	Skinner, Glaser, Crowder, Mager, Gilbert, Ausbel	Skinner, Flanders, Amidon, Anderson
Objectives	Development of cognitive, affective, and psychomotor domain	Development of cognitive domain	Development of cognitive, affective, and psychomotor domain
Components	Emphasis on content and communication content. Teacher and students are major components	Emphasis on structure of content, its organization and presentation. Students are the more active component	Communication is the more important component. Both students and teachers are active in the process of interaction
Place of Teacher	Manager	Helper	Secondary
Foundations	Philosophical, sociological, psychological, and scientific base	Psychological and scientific	Psychological and principles of cybernetics
Content	Theories, models, strategies, planning, organizing, and controlling of teaching	Task analysis, objectives, reinforcement strategies and criterion test	Theory of teacher behaviour, models, observation technique, analysis and modification of teacher behaviour

Significance	Development of teaching theory and making teaching effective & purposive	Development of instructional theory, making instruction effective and goal oriented	Development and modification of teacher behaviour, and producing effective teachers
Types	Memory, understanding, and reflective levels of teaching	Linear, Branching, Programmed instruction and Mathematics	Micro-teaching, Simulated teaching, and Interaction analysis
Applications	Making class teaching effective and purposeful	Self-instruction, Correspondence education, and remedial teaching	Teacher training and teacher education, producing effective teachers

(Source:Walia, 1997, pp. 118-119)

ACTIVITY 1.5



Analyze the above table and justify which technology(ies) will you use in your classroom?

Let us examine different types of educational technology on the **basis of approach**. We shall begin with the approach-based classification of educational technology.

i) Technology in Education: Hardware Approach

Technology in education is also known as the hardware approach to educational technology because it is concerned with electronic gadgets such as television, radio, language labs, teaching machines, Closed Circuit Television (CCTV), motion picture, epidiascope and various other projected media such as slides and Liquified Crystal Display (LCD) projectors which are used to teach learners. Technology in education includes tangible aspects of technology as the application of principles of physical sciences and engineering in the development of electro-mechanical equipment used for instructional purposes. By using hardware devices teachers can deal with larger group of students to discourse on teaching-learning experiences. Silverman (1968), called this technology ‘**relative technology**’ which refers to borrowing and to applying technology, machines, and devices in the process of teaching and learning.

ii) Technology of Education: Software Approach

The approach to educational technology involves a systematic, scientific application of appropriate scientific research, both from the physical sciences as well as, from the social sciences particularly from psychology and sociology, in order to solve a problem. Here, it is important to understand that technology of education emphasizes on the techniques of teaching and learning derived from the principles, ideas, and practices drawn from various fields of knowledge such as; psychology, sociology, philosophy, management, cybernetics, etc. in order to optimize the teaching-learning

process. It refers to the application of teaching-learning principles towards directing and shaping of behaviour. It is closely associated with the modern principles and theories of teaching, instruction, teacher behaviour and principles of programmed learning. It is characterized by task analysis, stating objectives in clear terms, selection of appropriate teaching strategies, reinforcement for correct responses, and continuous evaluation. Silverman (1968), called this ‘constructive educational technology’. It concentrates on the analysis, selection and construction of whatever is necessary to meet the educational needs of the learners.

Having talked about both the hardware and software approaches, we shall now examine the interdependence of these two approaches on each other. One without the other is incomplete. It is the software approach that makes the hardware function and without the use of software, hardware alone would have little or no value; for example; a CD burner is not useful without the burning software. A scanned text document can only be manipulated with the use of optical character recognition (OCR) software in order to convert it and to turn into an editable text. Similarly, some software are redundant without appropriate hardware. Communications software (e.g. FTP, phone dialler) are of no use without matching internet or phone connections. A file manager is of no use without some sort of storage medium to manage. Some games will not run properly without specified graphics or a sound card.

iii) Systems Approach to Educational Technology

The systems approach is an effective approach of educational technology. You know that teaching-learning is a complex process and systematic planning is necessary to achieve pre-fixed objectives. To streamline the teaching-learning process we use the systems approach which is concerned with systematic planning, designing, construction and evaluation of the education system. Systems approach is applied to develop, implement and evaluate the educational system, sub-system, and curriculum or, for designing an individual lesson. If hardware can be said to form the body of a computer system, then software is its mind. Software refers to computer programs, procedures and documentation that perform certain tasks on a computer system. The four elements of the systems approach are; input, process, output, and analysis & feedback. Let us discuss, how these elements function together to make the education system more productive. See figure 1.2

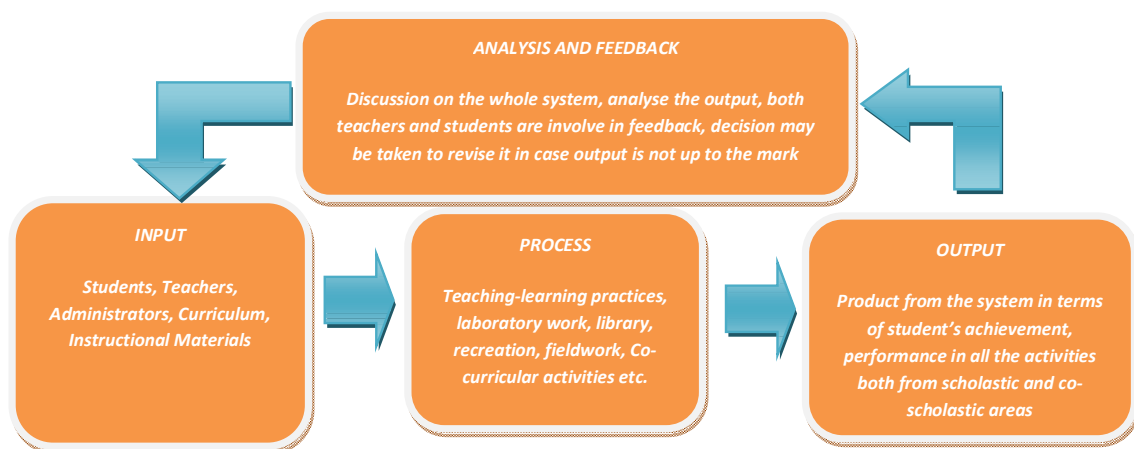


Figure 1.2: Parameters of a System

Input, process, and output components are part of educational technology which has been discussed under aspects of educational technology.

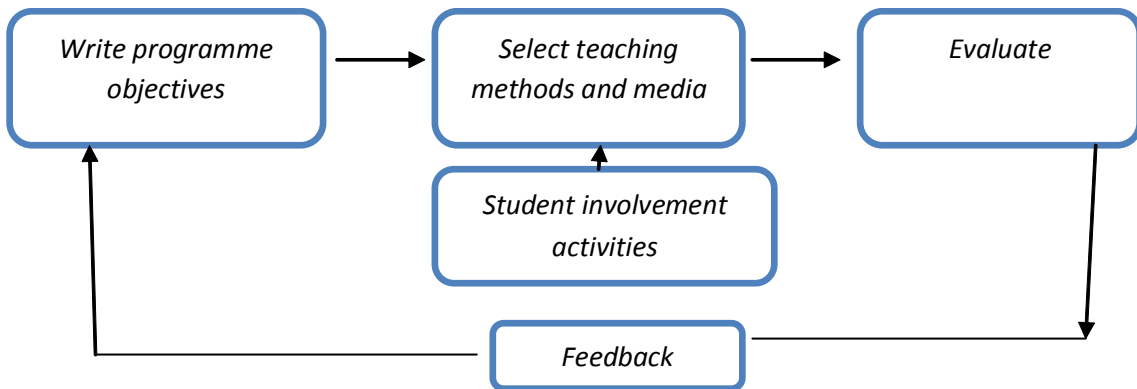


Figure 1.3: System Approach to Teaching Model (SAT)

[Source: Smith, 1991]

In the light of the above figures 1.2 and 1.3 and discussion it can be concluded that the systems approach is concerned with the systematic planning, designing, construction and evaluation of the education system. It is applied to develop, implement, and evaluate various aspects of the education system, and sub-system. It is a problem solving method, analyzing the educational process, and making it more effective. The purpose of the systems analysis is to create an enabling learning environment for both teachers and students.

Let us discuss the **key points** of the systems approach used in education:

- System is a complex whole, a set of things working together as a mechanism or interconnecting network.
- A system is an arrangement of components/elements so related or connected as to form a unity or organic whole. It is a regular, orderly way of doing things. Schools are viewed as a social system. Instruction / teaching is considered to be a sub-system within the social system of the school. Classroom, faculty, student etc. are other sub-systems of a school.
- Education is considered to be a complex organization of technical, managerial and institutional systems. It has three parts; instructor, learner, and objectives of instruction.
- The systems approach to education, thus, considers education as an input-output system.

ACTIVITY 1.6



Analyze Figure 1.2 and prepare a note to explain how input, process, output, and analysis & feedback work as effective aspects of the systems approach to educational technology.

To sum up what has been discussed so far and to arrive at an understanding of the systems approach to education, let us take a simple example: “computer which is a system has many components such as, the Central Processing Unit (CPU), monitor, printer, etc.; all these components have to work coherently to perform a task effectively. Therefore, a systems approach is the systematic effort to coordinate all the components of interacting systems to achieve the specific objectives. The systems approach in general includes the steps shown as a flow chart in figure 1.4

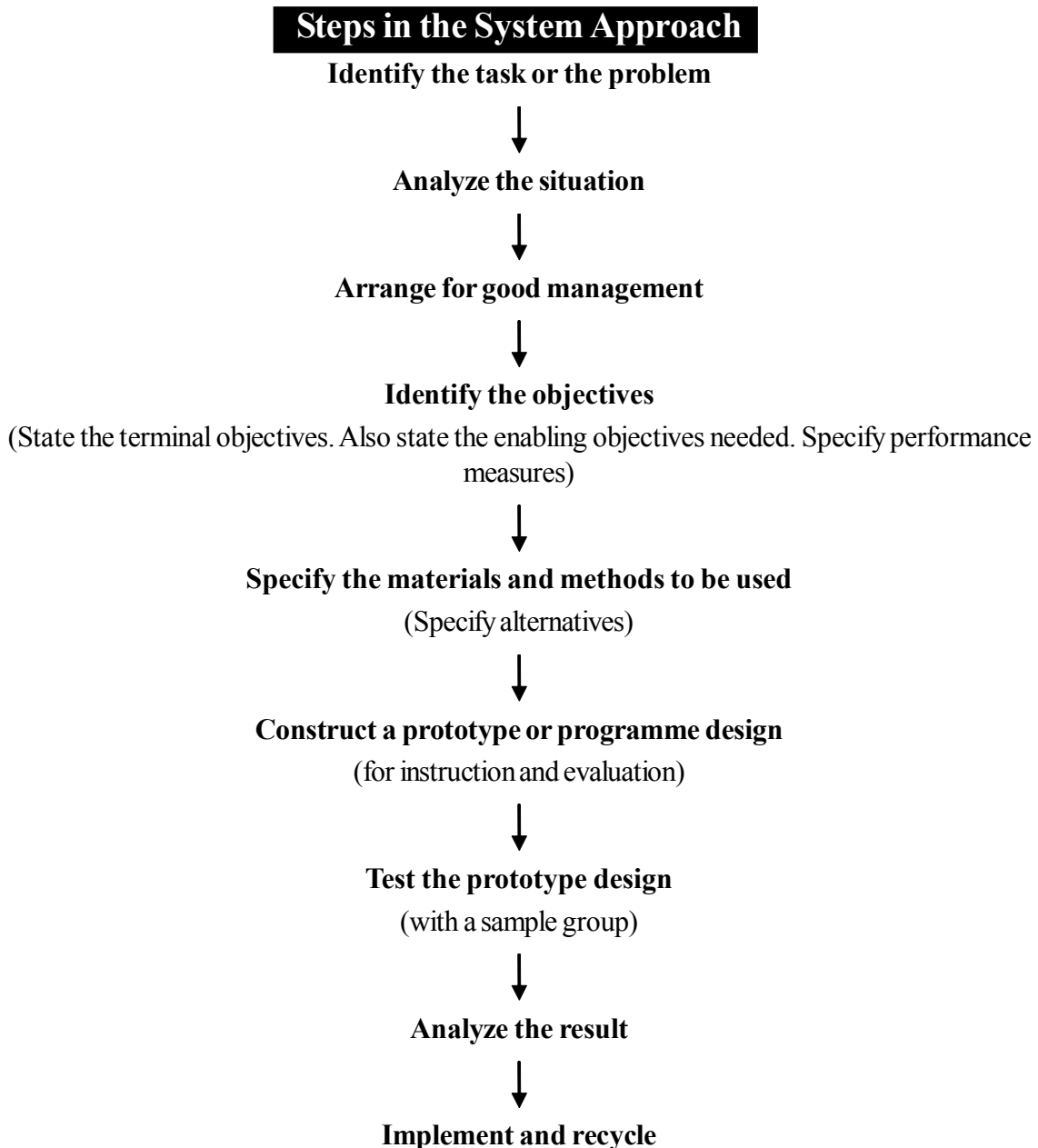


Figure 1.4: Flow Chart Showing Steps in System Approach

ACTIVITY 1.7



Identify a problem in your teaching subject and prepare and practice a suitable system approach as stated in Figure 1.4.

Management Technology

Management technology focuses on management of the teaching-learning processes. It helps in using appropriate educational resources - both human and physical, including planning, programming, budgeting, management, decision making, operational research system analysis etc., for effective implementation of the teaching-learning process. Management technology provides useful models, information systems and organization theory for man-machine systems.

Planning Technology

Planning technology helps in reducing extra expenditure, time and energy and thus, increases the cost benefit of the educational system. It is concerned with the planning of the teaching-learning process. It starts from the preparation of teaching materials by teachers and ends with the evaluation of students' performance. Planning technology plays a significant role in the transacting of teaching-learning instructions to students.

Though we discuss the management and planning technology separately, they are part of the systems approach. An effective systems approach includes both the aspects of management and planning. The systems approach tells us how to teach students so that they are able to achieve their learning objectives efficiently. Figure 1.2 and 1.3 can help you understand, how the management and planning components are effectively inbuilt into the systems approach methodology.

ACTIVITY 1.8



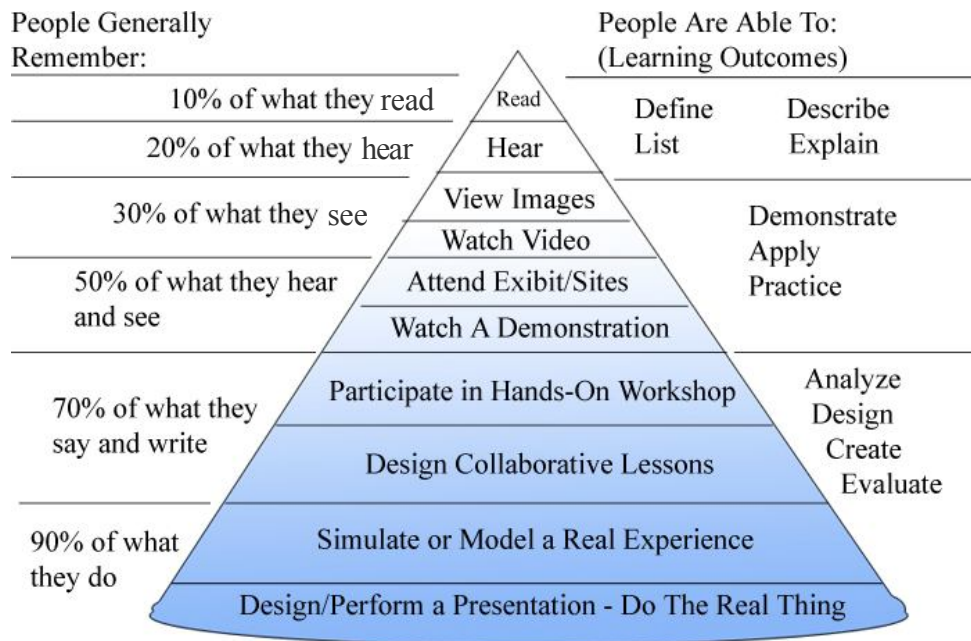
- 1. Differentiate between the significance of teaching, instructional, and behavioural technology in educational technology.*

2. Differentiate between the hardware and the software approach of educational technology?

3. How is the systems approach useful in education?

Classification of Educational Technology

In this section, you will study **Edgar Dale’s** cone of experience which is a part of both the hardware and the software approaches to educational technology and the classification on the basis of the senses that are stimulated by educational technologies. For understanding these classifications conceptual clarity on the different approaches of educational technology is essential and you have already learnt about these in the preceding sections. Let us focus on classification of teaching-learning aids given by Edgar Dale.



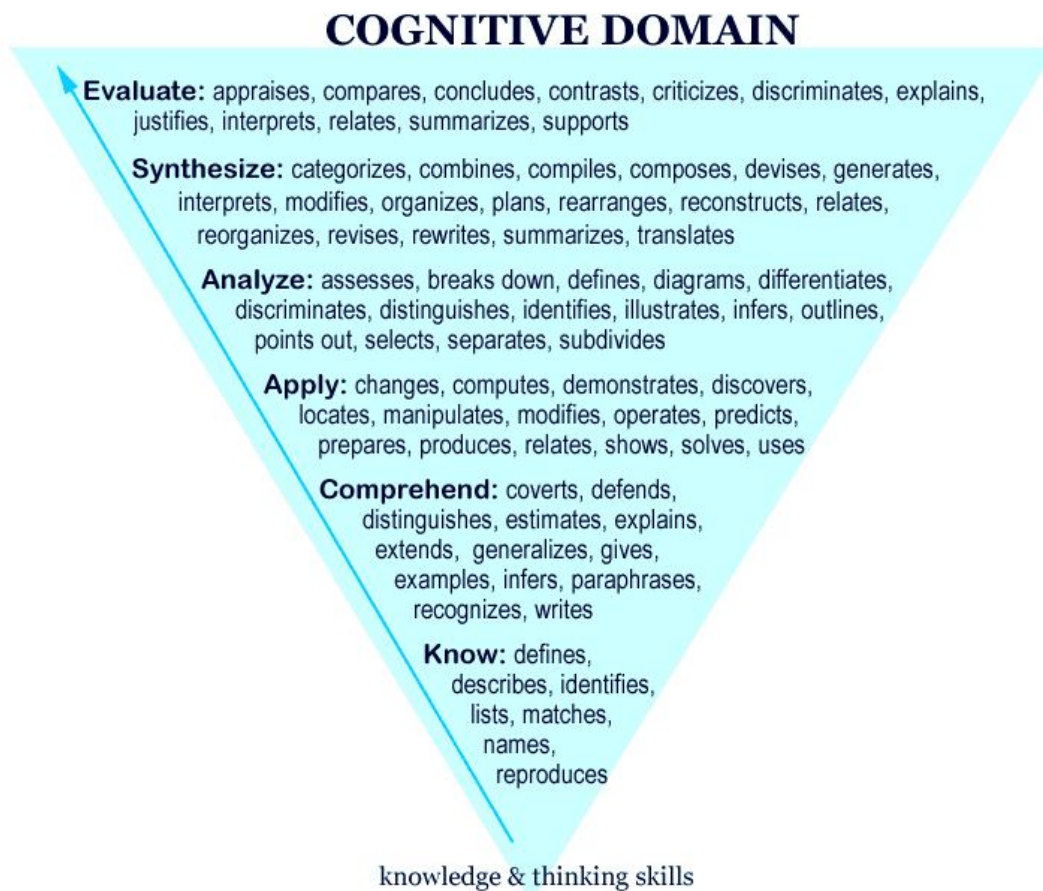
Dale’s Cone of Experience

Figure 1.5: Edgar Dale’s Cone of Experience

(Source: Principles of Teaching, Bloomsburg University, Spring 2003)

The figure 1.5 clarifies that all the taxonomies of educational objectives: cognitive, affective, and psychomotor, have been inbuilt in the hierarchy (see Figure 1.5). Towards the right it starts from reading at the top of the pyramids and ends with the do the task at the bottom. It has been arranged from the lowest to the highest experience and accordingly has covered learning outcomes from acquiring knowledge aspects to evaluation. Again, towards the left, it has maintained in hierarchy the remembering percentage of content taught from the lowest at the top to the highest at the bottom. Use of higher level teaching-learning aids results in better remembering. Both the hardware and software approaches use Edgar Dale's classification of the use of the aids to teaching and learning.

For better understanding of Dale's classification of educational experiences, let us discuss the taxonomies of educational objectives suggested by Benjamin S. Bloom.



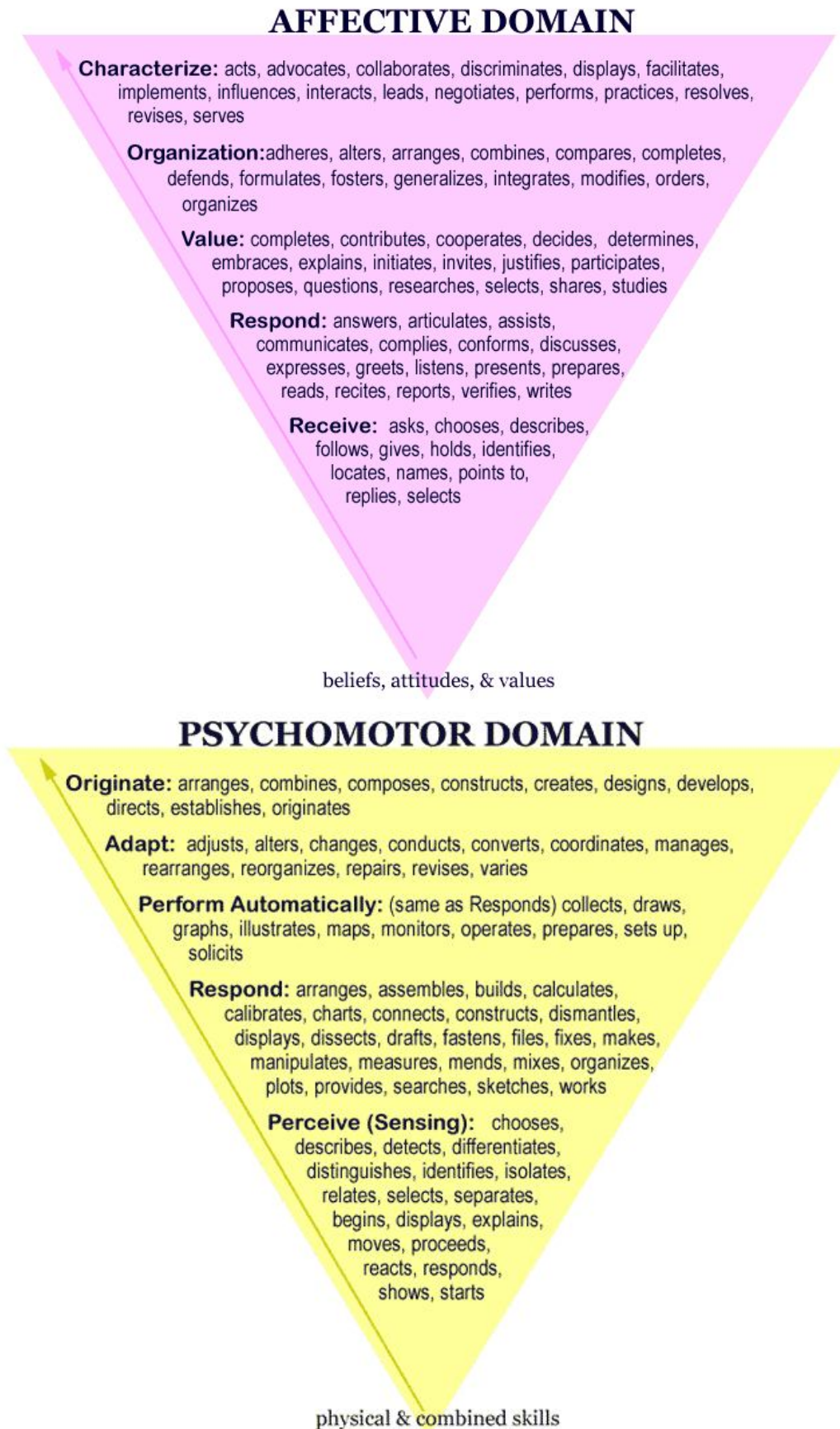


Figure 1.6: *Taxonomy of Educational Objectives*

Figure 1.6 discussed the action verbs recommended for stating specific instructional objectives in behavioural terms in Bloom’s Taxonomy of educational objectives. In Dale’s Cone of Experience, learning outcomes are arranged from lowest to highest order, that is from knowledge to evaluation objectives and more critically all the behavioural aspects of Bloom’s taxonomy, i.e. cognitive, affective, and psychomotor behavioural aspects. When we critically analyse Figure 1.6, find that the action verbs presented clearly represents Dale’s model.

ACTIVITY 1.9



Analyse the ten (10) points hierarchy of Edgar Dale’s classification of teaching-learning aids. Discuss, how Dale’s model follows Bloom’s Taxonomy of Educational Objectives.

The first classification of educational technology is purely based on the use of teaching-learning aids. Let us discuss the most widely used classification which has been prepared on the basis of senses that are stimulated by educational technologies.

Table 1.3: Classification of Educational Technology

Classification	Specification
Visual (verbal) Print or Duplicated	Textbook / Supplementary book, Reference book, Encyclopaedia, Magazine, Newspaper, Documents and Clippings, Duplicated written material , Programme learning material and self-instructional modules, Case studies (simulating reality) and Case report
Visual (Pictorial) Non-Projected Two-dimensional	Blackboard writing and drawing, Charts, Posters, Maps, Diagrams, Graphs, Photographs, Cartoons, and Comic Strips
Audio	Human voice, Gramophone records, Audio tapes/discs, Stereo records, Eadio broadcast, Telephonic conversation
Visual Non-Projected Three-Dimensional	Model, mock-up, Diorama, Globe, Relief map, Specimen, Puppet, Hologram
Visual Projected (Still)	Slide, Filmstrip, Transparency (OHP), Microfilm, Micro card, Computer
Audio-visual Projected with Motion (Multisensory)	Motion picture film, Television & close-circuit television, Video cassette/disc

Multi-Media Packages (Multisensory)	Slide + tape + workbook, Radio + slide or posters (Radio vision), Film + posters + workbook (print material), Television + workbook (print materials), Any of the above + group discussion, Any of the above + introductory and summarising talk by teacher / leader of the group
Emerging Media (Multisensory)	Teleconferencing (group discussion through telephones), Cable television (localized television where feedback is possible), Satellite television / communication satellites, Computer networking, Video discs, Mini computers / micro computers / word processors.

(Source: Kulkarni, 1986, pp. 143-144)

ACTIVITY 1.10



How can more than one sense (multisensory educational technology) be effectively used in the teaching-learning process to teach the topic “National Integration”?

Aspects of Educational Technology

By now you have studied the concept, approaches, and classification of educational technology. You have understood how educational technology facilitates the teaching-learning process. Let us now proceed to another concept - aspects of educational technology. The input-process-output (IPO) is a model which works in almost all systems, in education or as well as other sectors. The IPO in the teaching learning process means, the inputs we utilise in the teaching learning process, such as, teachers, students, technical resources, financial aspects, etc. The process encompasses what we practice in real teaching and learning, it may be methods, media, pedagogy, feedback, experimentation, expression, observation etc. The output includes the product of the teaching learning process i.e. achievement of the students, change in behaviour of the students, problem solving and other difficulties. The IPO aspects of education are shown in Figure 1.7 and are followed by discussion. You may also wish to refer to ES-361 Block-2 Unit-4 of the B.Ed. Programme.



Figure 1.7: *Aspects of Educational Technology*

According to Figure 1.7, you may consider educational technology in three different aspects: i.e. input, teaching-learning process and output.

Broadly **input** involves targeting students with human, technical, and financial resources. It includes the following points:

- Entry behaviour of the students;
- Previous knowledge and abilities of the students and level of motivation;
- Comprehension level of the learners; and
- Availability of and skills for use of information and communication technologies.

Output consists of the change in behaviour or performance of the target groups. It includes the following points:

- implies primarily the terminal behaviour of the learners;
- identifies the characteristics of content;
- clarifies the objectives achieved through content;
- analyses the stimuli; and
- determines the characteristics of students' desired activities.

The middle aspect of educational technology is the **process**. Organisation of the teaching-learning process is the major work in the system of educational technology. It provides unique experiences to the learners. Let us highlight the important aspects in the stage of the teaching-learning process.

The process aspects:

- involves the means and devices of learning experiences;
- creates situation for presenting the subject matter systematically;
- selects and uses appropriate teaching strategies, methods, and techniques for desired learning structures (for this you may refer to B.Ed. Content Based Methodology courses: ES-341, 342, 343, 344 and 345);
- employs appropriate teaching aids for desired behavioural change;
- identifies and uses suitable communication techniques for the comprehension of the subject matter;
- involves the skills of teaching and awareness of teaching and training methods;
- uses suitable schedules of reinforcement for effective learning;

- establishes rapport with students for effective teaching; and
- creates appropriate learning environment.

ACTIVITY 1.11



Select a topic of your interest and prepare a structure of input, teaching-learning process, and output of that topic.

Scope of Educational Technology

As you know, the scope of any subject depends upon its understanding in a broader connotation. In the preceding section you have learnt that educational technology is concerned with bringing improvement in the teaching-learning process. You have also studied that educational technology is an applied or practical study which aims at maximising educational effects by controlling various factors such as educational purposes, content, learning environment, teaching materials, behaviour of students and teachers and interrelation between students and teachers. We have discussed as to how the hardware and the software approaches can be used to make the educational process more effective and productive. The scope of educational technology encompasses educational objectives, the selection and use of media and methods, the management of resources and evaluation. Let us now evaluate the scope of educational technology.

Table 1.4: *Scope of Educational Technology*

Scope	Functional Specification and Key Points
Analysis of Teaching and Learning	<i>Concept of teaching, variables of teaching, levels of teaching, phases of teaching, theories of teaching, concept of learning, relevance of theories of learning, relationship between teaching and learning, making teaching-learning more effective</i>
Identification of Educational Objectives	<i>Educational objectives in terms of behavioural specification, fulfilling broad educational objectives in terms of specific classroom teaching objectives</i>
Development of the Curriculum	<i>Helps to design / construct a suitable curriculum for achieving educational objectives</i>
Development of Teaching-Learning Materials	<i>Development of programme learning material, computer assisted learning material, mass media instruction material, individualised system of instruction and other instructional strategies</i>

Preparation of Teacher	<i>Prepares models of teaching, team teaching, simulated teaching, micro-teaching, classroom interaction analysis for developing teacher effectiveness</i>
Teaching-Learning Strategies	<i>Selection of strategies according to content, use of available teaching resources in that strategy,</i>
Audio-Visual Aids	<i>Use of projected and non-projected teaching aids in the teaching-learning situation. Please follow classification of educational technology by Edgar Dale and multi-sensory use of teaching-learning aids (discussed earlier).</i>
Utilisation of Hardware and Mass Media	<i>Educational technology utilises and studies the resources suitably use in teaching-learning process. Development of equipments, instruments, communication devices, and gadgets with their application in teaching-learning situation, handling and maintenance, preparation, selection and cost effectiveness are included in it.</i>
Utilisation of the Sub-System of Education	<i>Effectively utilises the sub-system of education as input, process aspect, and output. Organisation and management of the system, and specifies the role of man, machine, and media.</i>
Providing Feedback and Control through Evaluation	<i>Develops suitable tools and devices for continuous and improved evaluation of the process and product of teaching-learning activities. Provides feedback both for the teachers and learners.</i>

The ten points given in Table 1.4 make it clear the areas of educational technology. You may have observed the wide scope of ET? It covers all the models, variables, phases, levels and dimensions or aspects of the teaching-learning process. It directs the teacher on the science of teaching, the students on the science of learning, the academic administrators on the skill of managing and monitoring teaching-learning tasks, and the educational planners on better construction and transaction of curriculum effectively. Moreover, it particularly advocates for individualised instruction, group instruction, and mass education through mass media and other means. For this purpose, we use the radio, television, Films, OHP, slides, LCD projectors, tele-text, computer-controlled devices, personal computer, and other modern information and communication technologies.

Besides that, educational technology has also fulfilled many other educational utilities and engages in far more needs assessment, product evaluation, and research in the areas of educational development.

The scope of educational technology till the fourth generation of distance education was to some extent limited. It worked till the early 1990s and was confined to the use of multimedia, telecoms, audio-video conferencing, PC, NICT, and asynchronous use of recorded materials. The scope of educational technology became wider in the first and second generations of Open and Distance Learning (ODL) started from the early 90's to till date. Sophisticated educational technologies entered the educational scenario and could provide solution many of the issues in teaching-learning process. During this time autonomous and self-directed learning, asynchronous and

synchronous online learning, mobile, e-learning, blended learning, on-campus and web experience have been highly used. To go into detail about the scope and evolution of educational technology you may study Figure 2.6 in Unit-2 of this same Block.

Let us discuss the educational technology syllabus of D.Ed. /B.Ed. /M.Ed. proposed by CIET, NCERT, New Delhi in 2012.

Table 1.5: *Educational Technology Syllabi of D.Ed., B.Ed. and M.Ed.*

Teacher Education Courses / Programme	Contents
D.Ed.	<ul style="list-style-type: none"> ▪ Introduction of Educational Technology: Concept of ET its scope and approaches, communication, mass teaching strategies, programme, cooperative, discovery, collaborative learning, & Open and Distance Education mode. ▪ Multiple Technologies: Relevance and use: audio, audio-visual, multi-media, interactive video, internet, web 2.0 tools, teleconferencing, web conference, adaptive & assistive technologies for inclusive classroom. ▪ Evaluation and Feedback: Role of ET in CCE, preparation and maintenance of a portfolio, CRC, CRT & NRT, Rubrics for assessment. ▪ Practices and Challenges of ET: Micro teaching and teaching skills, reflective teaching, problem solving, simulated teaching, teaching strategies of multi grade classes, diversified age group learners, team teaching, action research in ET and using web 2.0 tools.
B.Ed.	<ul style="list-style-type: none"> ▪ Introduction to ET: Concept, technology in education and technology of education, learning theories, & ICT. ▪ Transactional Strategies: Communication, individualised, personalised, group, and mass educational strategies, programmed learning, types of programmed material: SIM, IEP, Text Book, e-course ware, constructivist learning design, distance and open learning systems. ▪ Evolution of Educational Media: Educational Radio, TV, Projected & non-projected aids, storage media, transmission technology, computer technology etc. ▪ Role of ET in Evaluation: Role of ET in CCE, portfolio and electronic portfolio assessment, rubrics and digital rubrics, e-assessment. ▪ Practices and Challenges of ET: Micro teaching, teaching skills, using web 2.0 tools, teaching strategies for multi-grade classes, diversified age group learners, action research in ET, technology integration practices in school.

M.Ed.	<ul style="list-style-type: none"> ▪ Educational Technology for a Knowledge Society: Concept, scope, ET, IT, and ICT, historical development of ET, learning theories as base for development of ET, interdisciplinary perspectives, web 1.0, 2.0, and 3.0 technologies, contribution of: UNESCO, CEMCA, ISTE, CIET, IGNOU, NIOS, EMMRC, AVRC, CEC, SIET, etc. ▪ Transactional Strategies: Communication, interaction analysis, phases and levels of teaching, learning strategies for multiple intelligence, programme learning, models of teaching, SIM, IEP, e-learning, e-content, RLO, OER, distance and open learning: student support service, counselling method, evaluation strategies, IGNOU as an Open Learning System. ▪ Multiple Technologies, Relevance and uses: Instructional design, behaviouristic, cognitive, and constructivist approaches, Smart and virtual classroom, teleconference: EDUSAT, mass media, interactive video, WBI, CAI, CMI, use of web 2.0 technology for learning, e-content development, adaptive and assistive technologies for inclusive classroom. ▪ Technology for Management, Research, and Development: ICT for professional development, ICT and security, programme evaluation, action research in ET, current trends and future scenario of ET.
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(Source: CIET, NCERT, 2012)

Table 1.5 reveals that, in the teacher education curriculum both the conceptual approach of educational technology and its practices are included. Teacher education curriculum needs to be technology oriented and in order to fulfil the needs of the learners, the demands of time need to be kept in mind. The evolution of new technologies such as, the electronically based information system has created ample possibilities and has also increased productivity in education. The possibilities and productivity in education has been made possible by the use of lower cost educational technologies. As a result of all these innovations, three different functions in the educational scenario have been developed for accommodating individualisation of educational practices, integration of technologies in educational practice, and for providing innovation in education.

ACTIVITY 1.12



1. *How does educational technology help in preparing effective teachers?*

2. Differentiate between synchronous and asynchronous learning strategies? How does it help the learners in modern time?

Summary

In this unit, you have learnt about the concept of educational technology which includes the meaning, definition and its characteristics. In the beginning of this unit, you learnt how educational technology is not merely used as a hardware device or engineering gadget in the educational process. Rather it emphasised many more aspects such as, programming, system approach, psychological and pedagogical aspects of teaching-learning process. We defined educational technology, discussed the different types of technology that is encompassed under the umbrella of educational technology, such as, hardware, software, and systems approach, which is the meeting point as well as the complementing and supplementing of the hardware and the software in an organised system to facilitate the teaching-learning process.

We then examined the classification of educational technology, looking at Edgar Dale's Cone of Experience and Kulkarni's classification of educational technology. The use of multi-sensory and multimedia technology in education was also highlighted closely. The use of input, output, and the process (IPO) aspect of technology in education was another key learning point of this unit, which we explained with suitable examples. At the end of this unit, we discussed the scope and areas of educational technology. Ten different signifying areas and scope of educational technology have been discussed in this unit, which made you aware of how educational technology plays an inseparable part in the modern teaching-learning process.

We have also looked at the development of educational technology during the first to the forth generation of 'Distance Education', and during the first - second generation of 'Open and Distance Learning' which will be useful in the understanding of units 2 & 3 of this Block.

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Questions for Critical Reflection

1. Visit a school or any Secondary Teacher Education Institute and make a report on the change in the use of educational technology over the years.
2. Discuss the objectives of educational technology at both the macro and micro levels of educational process.
3. Discuss the scope of educational technology in the Indian context relating to global educational developments and challenges.
4. Explain the role of teacher educators in sensitising trainee teachers on the use of emerging educational technology.
5. Discuss future perspectives of the use of educational technology.
6. Critically examine the curriculum of Educational Technology and ICT meant for teacher education programme in different levels at present time.

ABBREVIATIONS USED

AVRC	:	Audio-Video Research Centre
CAI	:	Computer Assisted Instruction
CBM	:	Content Based Methodology
CCE	:	Continuous and Comprehensive Evaluation
CEC	:	Consortium for Educational Communication
CEMCA	:	Commonwealth Educational Media Centre for Asia
CIET	:	Central Institute of Educational Technology
CMI	:	Computer Managed Instruction
CRC	:	Comulative Record Card
CRT	:	Criterion Referenced Test
EMMRC	:	Educational Multimedia Resource Centre
ICT	:	Information and Communication Technology
IEP	:	Individualised Educational Program
IPO	:	Input - Process - Output
ISTE	:	International Society for Educational Technology
LAN	:	Local Area Network
NIOS	:	National Institute of Open Schooling
NRT	:	Norm Referenced Test
OER	:	Open Educational Resources
RLO	:	Reusable Learning Objects
SIET	:	State Institute of Educational Technology
WBI	:	Web Based Information