Forms of Educational Technology: Teaching Technology, Instructional Technology, Behavioural Technology, Instructional Design Technology

Forms of Educational Technology: The scientific investigations of technological developments have influenced every walk of human life. there is rapid mechanization in field of industries, defence, trade, administration, etc. the educational process does not remainuntouched by these advances. it has resulted the introduction of technology in field of edcation. There are several educational technologies and there is great overlap among them. Hence, it creates among the student. The Meaning, assumptions, content and characteristics of major educational technologies have been discussed below: 1. Teaching Technology 2. Instructional Technology 3.Behavioural Technology 4. Instructional Design Technology

The major features of these technologies are as follows:

- [| Teaching_technology]
- [Instructional_Technology]
- [Behavioural Technology]
- Instructional Design Technology

Educational Technology – Meaning, Nature and Scope

CHAPTER OUTLINE

- Origin and History
- Meaning and Definitions
- The Nature of Educational Technology
- Objectives of Educational Technology
- Forms of Educational Technology
- Approaches of Educational Technology
- Scope and Significance of Educational Technology
- Use and Significance of Educational Technology (in the Indian Context)
- References and Suggested Readings

Origin and History

Educational Technology, in terms of terminology and structural composition, may carry out two basic components, namely education and technology. We are focusing here more on the evolutionary nature of the second component, i.e. technology, as a subject has its sole concern with the task identifying the most suitable, appropriate and developed technology (both hardware and software) for serving educational needs and purposes of the students and the society at a particular time and place. It is a matter of no secret that there has been a continuous shift in the nature of the use of technologies means and measures for improving the process and products of education depending upon the type of excellence attained by the members of the society and communities all over the globe in terms of scientific, philosophical, psychological and technological progress and advances. This is why, we can witness a continual shift in the modes and means of educational technology being used for serving the cause of education in different periods of human history and civilization.

• In the early period of human history, when writing was unknown, the method of verbal presentation on the part of the teachers and citation and memorization on the part of the students was a common practice in almost all the civilization of the world. Socrates' teacher-pupil oral dialogue system prevalent in the west and oral teaching tradition maintained by the ancient sages in the *Gurukuls* of our country may be cited as a testimony of the use of relevant technology on the field of teaching-learning at a particular age in the progress of human civilization.

• With the advent of writings as the means and materials of communication, like writing on the leaves and tree-trunks, engraving on metals and rocks, and then the use of the some type of paper and ink material provided the next breakthrough in the use of writing technology for teaching and learning. In the time to come, it provide a great impetuse in the field of teaching and learning which witnessed the use of the subject matter available in the form of printing materials and textbooks, a great scientific and technological advancement.

• The use of writing and printing technology then took its next leap in helping the cause of teaching and learning by utilized in the production and use of the instructional materials like chalkboard, pictures, chart, models, maps, diagrams and other graphic material.

• Later on with the industrial development and technical advancement, sophisticated scientific instrument, mass media and educational materials were used. It brought the use of sophisticated hardware and software such as radio, television, tape recorder, films, transparency, etc. in the field of education.

• The concept of programmed instruction and theories. Later on, added another dimension to the meaning and concept of educational technology. This was again broadened when the new approaches in the form of system approach, microteaching, interaction, analysis and computer assisted instruction came into existence.

Meaning and Definitions

G.O.M. Leith: "Educational Technology is the systematic application of scientific knowledge about teaching-learning and conditions of learning to improve the efficiency of teaching and training (Leith, 1967)."

Shiv K. Mitra: "Educational Technology can be conceived as a science of techniques and methods by which educational goals could be realized (Mitra, 1968:4)."

S.S. Kulkarni: "Educational Technology can be defined as the application of the laws as well as recent discoveries of science and technology to the process of education (Kulkarni, 1969)."

D. Unwin: "Educational Technology in concerned with the application of modern skill and techniques to requirements of educational training. This includes facilitation of learning by manipulation of media and methods, and the control of environment is so far as this reflects on learning (Unwin, 1969)."

W. Kenneth Richmond: "Educational Technology is concerned with providing appropriately designed learning situations which, holding the view of objectives of teaching or training, bring to bear the best means of instruction (Richmond, 1979)."

I.K. Davies: "Educational Technology is concerned with problems of education and training context and it is characterized by the disciplined and systematic approach to the organization of resources for learning (Davies, 1971)."

J.R. Gases: "Educational Technology has to be seen as a part of a persistence and complex endeavour of bringing pupils, teachers and technical means together is an effective way (Ford Foundation Team, 1971). "

US President Commission of Enquiry: "Educational Technology may be defined as a systematic way of designing, carrying out and evaluating a total process of teaching and learning in terms of specific objectives based on findings from research in human learning and communication (cited in, tucker, 1979:159). "

Scottish Council for Educational Technology: "Educational technology is a systematic approach to designing and evaluating learning and teaching methods and methodologies and to the application and exploiting of media and current knowledge of communication techniques in education, both formal and informal (cited in, Tucker, 1979:160)."

These definitions initially encompass the whole range of educational technology activities from the analytic methods of psychology of learning and teaching the audio-visual communication and mass media technology. The views propagated by these definitions may help us to conclude about the meaning and nature of educational technology as follows:

1. Educational technology is concerned with the systematic application of science and technology in the field of education and thus may be defined as the application of technology to education in order to further the case of the latter.

2. Just as science and technology help in carrying out the practical task in general, educational technology helps in providing efficiency to the task of teaching and learning.

3. Educational technology provides technical guidance and solution to the problems of education.

4. Teaching is communicating and education technology can play an effective role in the communication between teacher and student.

5. Education technology encompasses the total teaching and learning process involving the elements like the following:

- Specification of goals and behavioral objectives.
- Analysis of the characteristics of the learner.
- Selection and organization of the content or subject matter to be learned.
- Methods and strategies of the presentation of the content.
- Use of aid-materials, software and hardware, mass media and communication techniques.
- Effective arrangement of learning situations and learning environment.
- Effective classroom control and management.
- Continuous feedback and evaluation of the results.

6. Educational Technology is not limited to the use of audio-visual aids and does not symbolize merely educational hardware such as sophisticated gadgets and mechanical devices used in education. For the effective management of the total teaching-learning process it tends to utilize the results of all goods, experiments and researches in the field of human learning and the art of communication and employs a combination of all possible human and non-human resources to achieve the desired educational objectives.

In brief, educational technology should stand for a wise application of the available human and non-human resources for providing appropriate solution to the educational problems and to improve the process and products of education.

The Nature of Educational Technology

To understand the nature of educational technology, let us try to view from the following angles:
- Evolution of the concepts of educational technology.
- Existing positions and latest concepts.
- Distinction from the related concepts.

Evolution of the Concept of Educational Technology

It may be discussed in the detail as follows:

- The earliest concept of educational technology was linked with the use of audio-visual aids like chart, models, maps, specimen and concrete material. In this sense, the term educational technology was used as a synonym to audio-visual aids meant foe direct teaching and learning.

- With the advent of physical science and consequently the electronic revolutions there come an era of sophisticated hardware and software (gadgets and mechanical devices) like projectors, tape-recorders, radio and television. As a result, educational technology was taken in terms of these sophisticated instruments and equipment used for presenting instructional materials.

- Then came the age of mass media. It led to massive communication revolution for instructional purposes. Utilization of radio, television, tele-text and computer –assisted instruction for individualized learning, thus, brought more sophisticated in the use of appliances and instruments for formal education.

- With the advent of programmed learning and programmed instruction concept, a new dimensions of educational technology came into educational horizon. It tried to individualize the process of education and introduced a system of self-learning in the form of designed self-instructional material and teaching machine. As a result, educational technology was regarded as being concerned with preparation and the use of individualized instruction or self-intructional programmed material, leading to the use teaching machine to the use of audio-instruction or learning.

- The concept of programmed learning added another dimensions to the meaning of educational technology when some new devices and approaches like wide applications of the theories of learning and teaching, micro-teaching, analysis of behavior and systems approach, etc. came into existence.

The Existing Position and Latest Concept

Although the term 'educational technology' has been in vogue in several decades, yet on the account of its complex nature involving many disciplines and demanding too much specialization and understanding of the planning, process and products of education, it has been narrowly conceived by different individuals on where one works and stand within the educational spectrum. It has resulted in the information of varying concept of educational technology. For the experts of programmed learning and individualized instruction, it means -the programming of the self-instructional material and use teaching machines or computer-aided learning material.

In this way, in actual sense technology exists, to a very large extent, in a fragmented way not only in India but also globally. As a result, in many course or scheme of educational technology related to B. Ed., M. A. or M. Phil. (Education) of the universities in India and abroad, we find significant diversification in terms of objectives, topics and the coverage of content. However, serious attempts are now being made to arrive at some general consensus to end the confusion and debate regarding the concept and meaning of educational technology. This latest concept involves the concept of systems engineering or system approach originated from computer science. According to this concept, educational technology is more the sum of its parts. It is a systematic way of designing, carrying out and evaluation of the total process of learning and teaching in terms of specific objectives based on research in human learning and communication leading to combination of humans and non-humans resources recognized into an efficient and economic system for the best possible result.

This aspect of educational technology carries wide meaning and multifaceted concepts. It emphasizes the application of system approach to the study of multidimensional problem of education. Some of these problems areas are as follows:

The educational planning and organization

- The educational planning and organization.
- The psychology of learning.
- The curriculum development and course design.
- The production of teaching-learning material.
- Audio-visual method of presentation and dissemination of information, storage and retrieval.
- The allocation and management of human and non-human resources.

- The cost effectiveness of media in education.
- Innovations.
- Evaluation.

Educational Technology and other Related Concepts

The concept and meaning of educational technology may be made clear by distinguishing it from other concepts.

Educational Technology and Instructional technology

Educational technology is more comprehensive and broad-based concept. Instructional technology is a sub system of the main system of educational technology. Education is comprehensive process and imparting of instruction is one of the several means to achieve the goals of education. As a result, the technology of instruction may be regarded as a part of section of the whole phenomenon of educational technology.

In strict sense, instructional technology is concerned with determining and providing appropriate stimuli to the learner to produce a certain type of responses for making learning more effective. On the other hand, educational technology is concerned with the scientific use of the available human and non-human resources for solving various problems of education (including instruction) for optimizing the result of the whole teaching-learning process.

Educational technology and teaching technology

Like instructional technology, teaching technology is also one of the sub-types of the system of educational technology. It concerns with the systematization of the process of teaching and provides necessary theory and practice for the teachers to bring improvement to the task of teaching. The concept of educational technology is much wider than the concept of teaching technology as it also includes the means and materials concerning individualized instructions and self-learning including teaching machines and computer-assisted learning, independent of the teachers and their acts.

Teaching technology is merely a specialized branch of educational technology which is meant for the teachers and learning process. While education, as a whole, can never be limited merely to the teaching process or teacher's task, educational technology can never

be confined to teaching technology only. It is much more than mere teaching or instructional technology

Technology of education and technology in education

The term 'technology in education' refers to the use of technological advancement such as various equipment, materials and machines for educational purposes. It invokes the increasingly complex range audio-visual equipment, hardware and sophisticated electronic devices like projectors, films, radio, televisions, tape recorder, recording machines, tele-text and computer aided instructions for individualized and group learning.

The term technology in education is thus a service concept like technology in the service of farming and agriculture or science in the service of mankind. In this sense, educational technology can provide its services to the teachers of the following grounds:

1.   For explaining the purpose and functions of different forms of appliances, equipment and audio-visuals material and mass media.

2.   For providing training and acquiring the material and handling the equipment to overcome their reluctance to use new media and materials.

3.   For showing the relevance to the use of equipment and material in the context of individualized and group learning for achieving the goals of formal or non-formal education.

The term 'technology of education' or 'educational technology' cannot limit itself to the role of service as confined in the case of technology in education. The term, technology of the education, does not represent something added or helped from outside as sounded in the case of technology in education. It signifies a system of technological approach to the problems of education. Emphasizing on this point of view, T.K. Robinson (1976) writers" The strongest protagonist for educational technologies are not, however satisfied with a role limited to technology in education and the provision of audio-visual aids. They see themselves as crucially involved in the design and evaluation of systems of learning involving an understanding of the psychology of learning and communication and information theory to be used to established a rational for a good teaching practice which uses a variety of media and modes and which enables the teachers to deploy his skills more effectively and apply them more widely. This is technology of education.

In view of the discussion carried out in the above pages, the following conclusions can be drawn about the concepts of educational technology:

1.   Educational technology cannot be taken as a synonym to audio-visual aids, and technology in education emphasizes the concept of service, i.e. the use of different equipment, gadgets and mass media.

2.   Educational technology must mean technology of education presenting itself as a system for bringing improvement in the total process of teaching-learning by carefully analyzing its problems and obtaining the optimum results.

3.   Educational technology cannot be view in terms of is part or processes. Instructional technology, teaching technology, behavior technology, programmed

learning, micro-teaching, system analysis, management of teaching-learning, teacher or pupils behavior, etc. are all its constituents and resources.

Objectives of Educational Technology

Educational technology, in the capacity of technology of educational, provides valuable help in the total teaching-learning process for achieving the possible results in an economic way through the available human and non-human resources. In the respect, the major objectives of education technology can be summarized as follows:

Objectives at the Macro Level

In view of the broad educational goals, i.e. the macro level, the objectives of educational technology can be listed in the following way:

1. To identify educational needs aspiration of the community.
2. To determine the aims of education, broad strategies and structure of education.
3. To develop a sustainable curriculum with interaction with science, art and human values.
4. To identify man-material resources and strategies for achieving the stipulated aims of education.
5. To develop certain models leading to improvement of the process of teaching and learning.
6. To develop the appropriate aids and equipment to meet the educational purposes.
7. To identify the major constraints in the environment and the ways and means to tackle those.
8. To help in extending educational opportunities to the masses especially the neglected section of the community.
9. To manage the whole educational system covering planning, implementation and the evaluation phases.

Objectives at the Micro Level

In view of specific classroom teaching, i.e. the micro level, the objectives of educational technology are as follows:

1. To identify and analyze the characteristics and educational needs of the pupils.
2. To determine the specific classroom objectives and state them in behavioral terms.
3. To analyze the contents of instruction and organize it in proper sequence.

4. To identify the available teaching-learning materials and resources.

5. To identify the nature of the interaction of the sub-systems like students, teachers, teaching-learning materials, content of instruction and methodologies.

6. To plan the teaching strategies and utilize the man-material resources for achieving specific classroom objectives.

7. To plan the teaching strategies and utilize the man-material resources for achieving specific classroom objectives.

8. To plan the teaching strategies and utilize the man-material resources for achieving specific classroom objectives.

Forms of Educational Technology

Educational technology, as has already been discussed, has a wide range of scope and applicability in the field of education. In a broader sense, it stands for the application of the principles and techniques of science and technology as well as psychology and pedagogy in the activities of teaching and learning. As a result, it has been capable of providing necessary ways and means, theoretical as well as practical, for improving the process and products of teaching-learning related both formal and informal education. These forms of educational technology, in general, can be listed as follows:

1. Teaching technology
2. Instructional technology
3. Behavioral technology
4. Instructional design technology

Teaching technology

As already emphasized in this chapter, teaching technology, as a sub-system of educational technology, is concerned with the task of systematization of the process of teaching. However, teaching cannot merely be treated as a sum total of certain teaching skills. A teacher has to play the role of technician by learning the art and science of teaching. Teaching must be regarded as a technology that a teacher should try to know and practice well if she wishes to be successful in his teaching job.

A technical knowledge and skills of tasks requires that it should be completed with reasonable economy and greater efficiency. If a teacher can teach well with the least efforts resulting into maximum productivity, then he can be thought utilizing teaching as technology. The essence of the application of technology lies in getting more and better output with the least input in terms of time and labor.

If teacher is in the position to make the use of technology in teaching, he must be well equipped with the technological skills like the following, besides having a good knowledge or mastery over the subject matter:

Communication skills,
1. Communication skills,
2. Skills of interaction with his students,

3. Skill of making the students to learn and think independently, and

4. Skill of evaluating and reinforcing pupil's learning behavior, etc.

Fundamental principle and characteristics of teaching technology

Teaching technology, suggested by E.G. Vedanagayam (1988), can be distinguished because of certain characteristics and fundamental principles as follows:

1. Teaching is a scientific process and its major components are content, communication, and feedback.

2. There is a close relationship between teaching and learning.

3. It is possible to modify, improve and develop the teaching-learning activities.

4. The terminal behaviour of the learner, in terms of learning structures can be established by appropriate teaching environment.

5. Teaching skills can be developed and strengthened by means of feedback devices with or without sophisticated techniques.

6. Pre-determined learning objectives can be achieved by designing suitable teaching activities.

7. Use of achievement motivation technique enhances the output of the teacher and the learner.

Contents of teaching technology

Teaching technology process certain basic things in the shape of the philosophy and acts of teaching. A teacher has to imbibe the art and techniques of this technology. How should a teacher in practice proceed for the use of teaching technology in the process of teaching-learning? This aspect has been closely analysed by scholars like Glazer, Bruner, Gagne and Davies. Davies(1971), in his work *Management of learning,* has presented the contents of teaching, leading of teaching controlling of teaching. These four steps systematically prescribe the contents of teaching technology to be learnt and practiced by a teacher for becoming a teaching technician.

1. ***Planning of teaching:*** Through this step, teaching technology helps a teacher to plan the details of his teaching journey to be traveled along with his students. For this purpose, it tells that a teacher must first try to formulate teaching-learning objectives to be realized through the on-going teaching-learning process and then very carefully plan for the realization of these set of objectives by taking care of (i) the entry behavior of the learners (ii) selection of appropriate learning experiences, (iii) selection of proper teaching methods, strategies and aid material, and (iv) creating a conducive and helpful environment for proper teaching-learning.

2. ***Organization of teaching:*** in its second step, teaching technology supplies the necessary knowledge and skills to the concerned teacher for arranging, relating and organizing all the available teaching-learning resources, men and material, for the proper realization of the set teaching-learning objectives in the most effective, efficient and economic way possible. Specifically here, it may talk about the ways and means of seeking cooperation of the administration personnel,

parent and community; developing teacher's own competencies for better communication including use of proper teaching method, aids, strategies; organization and utilization of the available physical facilities and resources for a better teaching-learning.

3. ***Leading o teaching:*** the contents of teaching technology in this step provide necessary knowledge and skills for teacher to motivate, encourage, and guide and thus, lead his students on the path of learning for the realization of the set teaching-learning objectives.

4. ***Controlling of teaching:*** Through its last step of managing teaching, the contents of teaching may help a teaching to acquire necessary knowledge and skill for the proper measurement and assessment of the teaching-learning outcome, i.e. the output of his teaching in view of set teaching-learning objectives.

Instructional Technology

This kind of technology is meant for helping the instructor and the learner in the desired instructional task for the realization of the stipulated instructional objectives in a particular teaching-learning situation. The term instructional stands for a certain type of command meant for getting some specific information, knowledge and understanding about a thing system or a process. Instructional technology, in this way, first try to plan what type of instruction and instructional material are needed in a particular teaching-learning situation and then suggest ways and means for the utilization of this instructional material for the proper realization of the instructional objectives.

Instructional technology may be defines as a subsystem of educational technology which helps the instructor or the learner himself as a part of his self-learning or auto instruction bye determining the media, methods and material for realization of the stipulated instructional objectives in a given teaching-learning situation.

Setting of instructional objectives

Instructional objectives make a very core and heart of any instructional process. Instructional technology may help the instructor and learner to take decisions about the instructional and learning objectives in close cooperation of the following:
*   The age and grade level of the learner.
*   The physical, emotional, social and mental potential of the learner.
*   The previous experiences of the learner related to the subject and topic.
*   The men-mental resources available for imparting instruction.

Taking decisions about the instructional material

We have to select the teaching-learning experiences and then organize and integrate them properly for utilizing in the course of instruction. This instructional material then divided into properly related and sequenced units by following the principles of simple to complex, specific to general, theory to practice, etc. all such decision about the selection of the instructional material, for carrying out the task of instruction in view of the realization and stipulated instructional objectives, are always facilitated by knowledge and skills provided by the instructional technology.

Taking decision about the media and method

Instructional technology may help the teacher and also the learners to select and make use of appropriate media and methods for carrying out teaching-learning process.

There are varieties of media and method available for imparting instruction. One has to take proper decision about the selection of particular media and method or a combination of media and methods depending upon the nature of the piece of instruction and resources and environment available in a particular teaching-learning situation.

It contains the topic like the following in its prescribed syllabus of course:

- Instructional strategies like lecture strategy, demonstration strategy, etc.
- Special instructional procedures for carrying out auto-instructional or self-learning like programmed instruction, instruction carried out with the help of teaching machines, etc.
- Cooperative or group instructional strategies like working on project, living and learning in the community, etc.
- Knowledge and application of various types of audio-visual aids and instructional material such as radio, television, tape recorder, projector, charts, etc.

Taking decision about the proper instructional environment

Particular type of environment is essential for carrying out particular type of instruction, and at then helps the teacher as well as learner for organization of that type of instructional environment.

Helping in the task of evaluation

Evaluation is the real key and controlling agency of any type of instructional activity carried out by the teacher in the shape of auto-instruction. How far a teacher or learner has been successful in
realizing the stipulated instructional objectives can be made known only through a well-planned strategy of evaluation.

Behavioural Technology

Meaning
"Any manifestation of life is activity", says Woodworth (1945), behaviour is a collective name of such activities.

Behavioural technology, as one of the kind/type in its board form, may be utilized to study and bring modification in the behaviour of all living organisms.

Behavioural technology, in a broader technical sense, may also include behaviour modification strategies which are not based on learning principles. However, in school situations, the task of behavioural technology has almost become synonymous with the behavioural analysis and behaviour modification carried out through the principles of operant conditioning (shaping of the desired behaviour) and observational learning (imitation of a model behaviour)

Use and application of behavioural technology

1. *Analysis of behaviour:* behaviour technology may very well help in analysing the observed behaviour of individual in proper way. An analyst with its help may state the behaviour in specific, observable behavioural terms, e.g. he is day dreaming or wasting time in gossiping or reacting in a specific situation, etc.

2. *Setting the target behaviour for behavioural modification:* once the existing behaviour is known and analyzed into specific behavioural terms, the help of behavioural technology may be taken for setting as well as stating the target behaviour (desired modified behaviour) in specific behavioural terms. As a result of such naming, identifying and fixing of desired modified target behaviour in specific term, the actual task of behaviour modification, then become quite scientific, purposeful and goal-oriented.

3. *Proving suitable ways and means for behavioural modification:* here it can help:

•	The learners to acquire the desired learning experiences in terms of knowledge, understanding, skills, application, attitudes and values, by bring changes in their entry behaviour.

•	The teacher by suggesting ways and means for bringing changes in the learning and acquisition behaviour of their students.

•	The parents, teachers, educational administrators, guidance personnel and social workers, by suggesting suitable technology for the prevention and treatment of behavioural problems and disorder.

•	The parents and teachers to work with their children and students for the optimum growth and development of the desirable personality traits and behavioural acts.

•	The teachers in learning proper teacher behaviour and acquiring needed teaching skills through special behavioural technology techniques like interaction analysis, micro-teaching, stimulated teaching, action research. Etc.

•	The teachers to manage properly the classroom behaviour and interaction of their students aimed at creating proper conducive environment for effective teaching-learning.

For inducing the desired behaviour or for bringing the needed modification in the existing behaviour, behaviour technology, as said earlier, makes use its own technology including the appropriate learning principles based on operant conditioning and social learning.

In shaping technique (based on Skinne's operant conditioning), a slightly modified or improved behaviour is properly reinforced for attaining the desired degree of modification in one's behaviour.

In adopting modelling as a technique of behaviour modification, the appropriate target behaviour is put before the child by a model for his observation.

Instructional design technology

Instructional as a process stands for helping the individual as a learner for achieving the suitable teaching-learning situation. A good instruction is goal oriented with a specific purpose or purposes implying that the manner in which the learner is imparted instructions (assisted in his learning process) should always be a well-conceived, planned and effectively controlled phenomenon.

These instructional design, as Dr. Robert C. Branch, Syracuse University, USA emphasizes (1996:44), are meant for "*responding to the complexities associated with the instructional episode by analyzing, defining, testing and recommending strategies for implementing instructions.*"

The term instructional design, in its simple meaning, thus stands for layout or plan describing the manner in which an instruction process (involving teaching and learning and its interaction) should be carried out for attainment of the stipulated objectives.

Instructional design technology, for exercising such control and manipulation, may be seen to adopt a new distinctive approaches like systems approach, cybernetic approach and training psychology for generating effective instructional design with a clear cut motive and helping the learner and teacher in the attainment of the stipulated instructional objectives.

Approaches of Educational Technology

Educational technology I or hardware approach

This type of educational technology has its origin in physical sciences and engineering and is based on the concept of service, i.e., using technology in education (Silverman 1968). While teaching in a big hall, a teacher uses a microphone for making his voice audible, he may be said to approach such type of education technology for making his teaching effective. Such type of mechanical and teaching revolution has almost mechanized the teaching-learning process. Almost all the material and equipment of hardware approach originally belong in areas other than education and being borrowed and utilized for educational purposes.

Educational Technology II or software approach

Psychology of learning provided solid technology for bringing the desirable behavioural changes in the students and thus serves the cause of education by laying down definite instructional procedure, teaching behaviour and behaviour modification devices. The

second type of educational technology is sometimes referred to as instructional technology, teaching technology or behavioural technology.

This type of technology tries to adopt a process-oriented technique for production of suitable teaching-learning material, teaching-learning strategies, and evaluating techniques for the optimum results in the process of teaching and learning. Educational technology basically stands for the technique of developing and utilizing software and, that is why, it is referred to as the software approach. The materials, such as programmed material and teaching-learning strategies based on psychology of learning are usually known as software and the equipment and gadgets are called hardware.

Distinction between hardware and software technologies

Hardware technology	Software technology
Hardware technology has its origin in physical sciences and applied engineering.	Software technology has its origin in behavioural sciences and their applied aspects concerning psychology of learning.
It is more concerned with the production and utilization of audio-visual aid material and sophisticated instruments, and mass media learning for helping the teacher and learners in their task	It makes use of psychology of learning for the production and utilization of software techniques and materials in terms of learning materials, teaching learning strategies, and other devices for smoothening the task of teaching learning.
It tries to adopt product-oriented approach. What is produced through software technology in the shape of teaching-learning material and strategy gets utilized by the hardware instruments and gadgets for effective teaching-learning.	It tries to adopt a process-oriented technique or approach for the production of teaching-learning material. What is produced here is made available for being used by the hardware appliances.

Role of hardware and software technologies in modern educational practices

1. **Individualization of instruction:** Individualization of instruction is a major trend in the modern educational practices and is the demand of the hour. In brief, we can highlight the role of hardware and software technologies on this account by stating some of the materials and equipment as follows:

- Programmed instruction, programmed books, and programmed learning modules.
- Teaching machines, computer assisted instruction and computer managed learning.
- Video and audio recorded learning and instructional material.

- Email, internet, teleconferencing and other online educational facilities.
- Special aid material, equipment and appliances used for special education and adjustment measure of for the disabled.
- Special provisions and facilities for the creative and gifted to nature and develop their individual capacities according to their pace and interest.

2. **Use the multimedia and multi-sensory approach to teaching-learning:** Hardware and software technologies help the teacher as well as the learners for making a proper and judicious use of multimedia and multi-sensory aid material, equipment and principles of teaching-learning, derived from psychology and technology of teaching.
- All the sensory organs sense the sight, hearing, touch, smell and taste for the acquisition of the desired teaching-learning experiences.
- Multimedia, material and appliance involving hardware and software technologies for sharing desirable teaching-learning technologies.
- All the relevant and needed teaching-learning method, devices, and strategies, well-accompanied and aided by hardware and software technologies.

3. **Management of the affairs of educational practices in an efficient and productive way:** Educational and professional responsibilities
- Planning o teaching-learning.
- Organization of teaching-learning.
- Leading teaching-learning.
- Controlling teaching-learning.

4. **Providing proper input and process for the best possible outcomes (products):** in the true spirit of the system engineering, use of hardware and software technologies can help the educational and instruction system to make all possible efforts for providing adequate and the needed process organizations to arrive at the best possible outcomes.

5. **Fulfilling the expectation of distances and correspondence education:** the demands of today's education and modern education practices are putting increase emphasis on the extension of distance education and correspondence and online education facilities to the increasing number of learners.

6. **Making the task of teaching-learning interest, purposeful and productive:**
- Suggesting suitable teaching-learning methods, devices and strategies based on psychology of teaching-learning.
- Suggesting suitable maxims and principle of teaching-learning based on the theory and practice of technology of teaching-learning.
- Putting various types of audio-visual aid and materials and equipment at the disposal of teachers and learners.
- Providing a variety of instructional and self-learning material suiting the varying needs of teaching-learning situations and individuality of the teacher and learners.

Educational Technology III or Systems Approach

This type of educational technology is related to the concept of system engineering which owes its origin to computer science. It represents the latest concept in educational technology of education.

This systems approach takes education as a system having a set of inputs which are subjected to a process, design to produce certain outputs which are intended to meet the stipulated objectives of the system.

Thus, in system approach, one has to make a continuous comparison of the different roles played by man, machine and media in a system of education and develop an appropriate instructional design and strategy in relation to the stipulated objectives.

Scope and Significance of Educational Technology

Keeping an eye over such broad concepts of educational technology, one is able to map but the areas of its operation in terms of topic or aspects covered through its study or application. In brief, they may be summarized as below.

1. *Analysis of the process of teaching and learning:* Educational technology tries to discuss the concept of teaching, analysis of the teaching process, variables of the teaching, phase of teaching, levels of teaching, theories of teaching, principles and maxims of teaching, the concept of learning, relevance of the theories, the relationship between teaching and learning.

2. *Spelling out the educational goals or objectives:* Educational technology tries to discuss the topics such as identification of education needs and aspirations of the community, survey of the resources available for satisfaction of these needs.

3. *Development of curriculum:* This aspect of educational technology is concerned with the designing of a suitable curriculum for the achievement of the stipulated objectives.

4. *Development of teaching-learning material:* This area of educational technology is concerned with the production and development of the suitable teaching-learning material in view of stipulated objectives, design curriculum and available resources.

5. *Teaching preparation or teaching-training:* Teacher is a key figure in any process of teaching and learning. Educational technology, therefore, take care of the proper preparations of teachers for exercising their complex responsibilities.

6. *Development and selection of the teaching-learning strategies and topics:* This aspect deals with the central problems of teaching learning act. Here educational technology tries to describe the ways and discovering, selecting and developing suitable strategies and tactic of teaching.

7. *Development, selection and use of the appropriate audio-visual aids:* teaching-learning is greatly influenced and benefited by the use of

appropriate audio-visual aids. Educational technology covers this aspect by discussing various types of audio-visual aids used for educational purpose, their proper selecting suiting to a particular teaching-learning situation.

8.   *Effective utilization of the hardware and mass media:* various sophisticated instrument, equipment, gadget and communication devices brought through mechanization and electronics revolution playing an effective role in the attainment of educational objectives by helping the teachers and learners in their respective roles.

9.   *To work for the effective utilization of the subsystem of education:* educational technology considers education as a system operating, in a systematic and scientific way, for the achievement of educational objectives.

10.   *To provide essential feedback and control through evaluation:* educational technology I essentially concerned with the task of exercising appropriate control over the process of teaching and learning by planning and devising suitable tools and devices for the continuous evaluation of the process and products of the teaching-learning activities.

Thus, educational technology is concerned with all variables, phases, levels, and aspects of the teaching-learning process. In brief, it works for over all planning and organization of the system or subsystem of education.

In above discussion, an attempt has been made to identify the scope of the subject educational technology by mapping out its field of operation, but in true sense, it is unwise to put hedge and boundaries around such a developing and fast growing subject.

Use and Significance of Educational Technology (in the Indian context)

In India, before the 1960's the term educational technology was almost unknown to the educational system. It was used as synonym to audio-visual teaching aids. The role of educational technologist in India, today, is not merely that of an audio-visual aid master, hardware expert, media expert or programmed text writer, but of one who is concerned with the information of an overall design to carry out an evaluation of the total process of education in terms of specific objectives.

Educational technology, as we find it today, has a meaningful present and promising future in our country. Some of the significant development in this direction may be summarized as follows:

1.   There has been a wider and more effective utilization of radio for broadcasting educational programmes throughout the country. These well planned programmes are now broadcast throughout the country for both in-school and out-of-school groups.

2.   Another significant development in the use of educational technology is concerned with the development of television programmes.

3.   The third important area where educational technology has been useful is the problem of -training and re-training a large number of school teachers in an effective way.

4.   Another application of educational technology in our country is known as distance education.

5.   Another major area where educational technology is being used in our country relates to language instruction.

6.   Another field of operation of educational technology in our country is concerned with the correspondence education,

7.   Another use for which educational technology is being put in our country is concerned with preparation, development and utilization of audio-visual material, and handling as well as maintenance of the hardware appliances and sophisticated gadgets.

8.   In the latest trend, educational technology is providing its worth by utilizing the services of computers and advanced form of ICT technology in the field of education.

Thus, educational technology has been providing its worth in our country by guiding, planning, implementing and evaluating various programmes of formal as well as non-formal education.