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Gauhati University

MA in Education

Semester I

Paper 103

EDUCATIONAL TECHNOLOGY

Contents:

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Syllabus

103: Educational Technology

Unit 1 : Educational Technology: Meaning, Nature and Scope, Role of Educational Technology in Distance Education.

Unit 2 : Approaches to Educational Technology: Hardware approach and Software approach.

Unit 3 : System Approach: Instructional Design.

Unit 4 : Programme Instruction: Meaning, Scope, Importance of Programmed Instruction, Basic Principles of Programme Instruction.

Unit 5 : Educational Technology for Teachers: Flanders Interaction Analysis, Computer Assisted Instruction (CAI), Computer Managed Learning (CML) Computer Aided Evaluation (CAE), Internet-Meaning, Historical Background, Importance, Utility, Role of Internet in Education, Teleconferencing, E-learning tools, OER (Open Educational Resources).

Unit I
Educational Technology

Contents:

1.1 Introducation

The modern era is characterized by fast changes and development. These changes are brought to man by science and technology. We often make use of the term 'technology'. From morning to night, we are making use of a number of technologies. Indeed, it has become one of the integral organs of our lives. Uses of technology have made human lives so comfortable that in the present day context, life without technology cannot be imagined. To get our maximum work done, we have to rely on technologies. Thus, it has influenced each and every aspect of human life. The social, economic, health and other aspects of human life are significantly influenced by technology. Education is one of most prominent part of human lives. This part is also being influenced by technology. In this unit, we are going to discuss the role of technology in education under the heading of Educational technology. Let's discuss-

1.2 Objectives

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

- Know about the meaning of educational technology

- Comprehend the importance of technology in education
- Know about the area of studies under educational technology
- Know the role of technology in distance education.

1.3. Meaning of Educational Technology

Before going deep into the meaning of Educational technology, we should get a basic idea about technology. You all are habitual to technology and as such you know about technology. The word technology is associated with machinery, but it does not merely imply machinery. Technology refers to any practical art through the use of scientific knowledge. Etymologically, the word technology has been derived from a Greek word-'technikos' which means 'an art'. Again, some are of the opinion that Technology has been derived from a Latin word-'Texere', which means 'to weave or construct'. On the basis of these derivations, technology has been perceived as a pattern of interrelated part. It can be said that any system of interrelated parts that are organized scientifically to achieve its goal is technology. It is a means component. It is the application of science to art. Educational technology is that means which optimizes the human learning.

STOP TO CONSIDER

- Etymologically, the word technology has been derived from a Greek word-'technikos' which means 'an art'.
- Any system of interrelated parts that are organized scientifically to achieve its goal is termed as technology. It is a means component.
- It is the application of science to art.

The above brief meaning of technology will help you to assume the concept of educational technology. Many of you may assume application of technology in the field of education implies educational technology. But the meaning and scope of educational technology is very wide. Educational technology implies the application of system analysis to teaching and learning. It is the application of technology of modeling to education. To comprehend the meaning of educational technology simply, it can be termed as a science of techniques and methods by which educational goals can be realized. But, it is not primarily concerned with the task of prescribing the goals of

education; it also helps in specifying the goals and translating them into behavioral terms. Educational technology is the science on the basis of which various strategies and tactics are being designed for the realization of specific goals of education.

One of the crucial functions of educational technology is to structure the environment for learning. Technology provides a structure for the learning environment through the application of various resources and facilities. Thus, educational technology stands for the sum total of all educational facilities-media, method and technique for optimizing learning. It refers to the facilitation of teaching and learning through resource mobilization and utilization of learning principles. On the basis of this the concept of educational technology is being used in two senses-

- First, sense-Educational technology means the use of mass media and audio-visual aids in education or **technology in education**. It projects the picture of educational hardware like the teaching machines, film-projectors, slide projectors, language laboratories, tape recorder, cassettes, satellite, television, video tape recorder, computer etc.
- Second, sense-Educational technology is the utilization of all available resources in a system in order to optimize teaching learning process or **technology of education**. It implies the software-used by the teachers in the classroom for making teaching and learning effective and successful. It is characterized by task-analysis, writing objectives in behavioral terms, selection of appropriate strategies, reinforcement for correct responses and constant evaluation.

Definitions of Educational Technology

In the words of B. C Mathis, "Educational Technology refers to the development of a set of systematic method, practical knowledge for designing, operating and testing in school".

According to G.O.M. Leith, " Educational technology is the application of scientific process to man's learning conditions to what has come recently to be called educational or instrumental technology".

According to Robert A Cox, "Educational technology is the application of scientific process to man's learning conditions to what has come recently to be called educational or instructional technology".

According to Takshi Sakamato, "Educational Technology is an applied or practical study which aims at maximizing educational effect by 'controlling' such relevant facts as educational purposes, educational content, teaching material, methods, educational environment, conduct of students, behavior of instructors and interrelations between students and instructors".

In the words of S.S Kulkarni, "Educational technology may be defined as the application of the laws as well as recent discoveries of science and technology to the process of education".

STOP TO CONSIDER :

Two senses of Educational Technology

- First sense-Educational technology means the use of mass media and audio-visual aids in education or **technology in education**. It projects the picture of educational hardware like the teaching machines, film-projectors, slide projectors, language laboratories, tape recorder, cassettes, satellite, television, video tape recorder, computer etc.
- Second sense-Educational technology is the utilization of all available resources in a system in order to optimize teaching learning process or **technology of education**. It implies the software-used by the teachers in the classroom for making teaching and learning effective and successful. It is characterized by task-analysis, writing objectives in behavioral terms, selection of appropriate strategies, reinforcement for correct responses and constant evaluation.

1.3.1: Objectives of Educational technology—

The major objectives of Educational technology are-

- To determine the goal of education and formulate the objectives in behavioral terms
- To analyze the characteristics of the learner and the learning process.
- To organize the learning content in psychological sequence
- To mediate between content and resources of presentation.
- To make wise utilization of the learning resources.

- To evaluate the learners' performances in terms of achieving educational objectives
- To provide for modification of the learners.

1.4.2: Approaches to Educational Technology

Development of educational technology has taken place through the three chronicle stages. These stages are also considered as the approaches of educational technology. These are-

1. Hardware Approach
2. Software Approach
3. System Approach

1. **Hardware Approach**: The origin of hardware approach is based on the principles of physics and engineering science. This approach or educational technology in terms of this approach is the result of impact of scientific and technological development during the 19th century. Hardware approach is the mechanization of the teaching and learning process. Hardware technology is the systematic application of hard material as teaching and learning materials for realization of the predetermined objectives of education. Main function of hardware approach is to transmit, preserve and enhance the knowledge. Radios, Television, Tape recorder, Gramophone, language laboratory are some of the examples of Hardware technology
2. **Software Approach**: The origin of software technology lies in the application of principles of behavioural sciences to the problems of teaching and learning. This approach is characterized by task analysis, formulating objectives, selecting adequate strategies reinforcement and evaluation. This technology is related to the coursework aspects of teaching and learning. It is based on the learning mechanism for modifying behavioural potentials to a desired extent.
3. **System Approach**: The third approach or third technology is relatively a new approach to education. It was originated in the form of management technology during the world war-II. It is the application of theories and practices, and principles of management

in complex problem solving in education, industry, army and administration. This approach is based on the system analysis which suggests the solution of the problem encountered in the management and administration in different institutions and organization. In the system approach systematic and scientific investigation is done in relation to the educational problems and scientific solution is provided and suggested on the basis of the data analysis.

The details of the approaches of educational technology will be discussed on the further chapter.

STOP TO CONSIDER :

The three major approaches of Educational technology are-

1. **Hardware approach** – Hardware approach is the mechanization of the teaching and learning process. Hardware technology is the systematic application of hard material as teaching and learning materials for realization of the predetermined objectives of education.
2. **Software Approach** – This approach is characterized by task analysis, formulating objectives, selecting adequate strategies reinforcement and evaluation. This technology is related to the coursework aspects of teaching and learning.
3. **System Analysis** – It is the application of theories and practices, and principles of management in complex problem solving in education, industry, army and administration.

1.4 Nature and Scope of Educational Technology

Till now, we have discussed the meaning and basic concept of educational technology. The discussion helps us to derive the characteristic features of Educational Technology to get a more clear meaning of it. Let's know its features—

- Educational technology is the science of techniques and methods. The application of these methods help in the realization of the educational objectives.
- It emphasizes on the development of new strategies and techniques for an effective and result oriented learning.

- Educational technology defines the objectives of education in behavioral terms. Through this, it creates suitable teaching learning environment to realize these goals.
- It makes optimum utilization of the available learning resources for the sake of realizing the objectives of education.
- Educational technology is a combination of learning theories, art and science of teaching. Art and science of teaching go hand in hand.
- Educational technology is the mechanization of educational process. The mechanization is being done in the three phases of human knowledge-a. Preservation of Knowledge, b. Transmission of knowledge and c. advancement of knowledge.
- The primary function of educational technology is to make functional analysis of the teaching-learning process to identify the various components of education and observation of the effect of manipulating the various components.
- Educational technology borrows different ideas from the field of engineering, physical science and behavioral science for developing the teaching and training process of education.
- Educational technology makes the educational process systematic and scientific. It makes teaching and learning scientific, objective, simple and interesting.
- Educational technology answers how to plan, organize, lead and control educational administration.
- Educational technology is concerned with the overall effectiveness and efficient functioning of the educational system.

On the basis of the above characteristics, educational technology can be perceived as the development of a set of systematic technique, and accompanying practical knowledge for designing, testing and operating schools as educational system.

CHECK YOUR PROGRESS:

Q.1. Discuss the importance of technology in Education.

Scope of Educational Technology

The scope of educational technology depends upon the perception of its concept. The scope of educational technology in the context of hardware approaches like-audio-visual aids, mechanical and electric gadgets is limited. But, the scope of educational technology is not limited to the Medias. Its scope is very wide. Before going to discuss the scope of educational technology, let's know about its three major aspects -

A. **Input**

B. **Process**

C. **Output.**

A. Input:

This aspect of educational technology involves the entering behavior of the learner. It includes the previous knowledge or achievement and abilities of the students as well as their motivational level. This aspect of educational technology is concerned with the comprehension level of the learner. The skill and teaching methods used by the teacher are also covered by this aspect of educational technology.

B. Process:

The process here indicates the teaching and learning process of education. It involves the means and devices of learning experiences to generate situation for effective and meaningful content presentation, for selection of appropriate teaching and communication strategies and tactics. It also helps in establishing good rapport between teacher and the taught.

C. Output:

The output aspect of educational technology refers to the terminal behaviour of the students. It involves the process of analyzing the stimuli in the teaching–learning process. It refers to the determination of the context to which the determined educational objectives have been achieved.

These aspects define the process of educational technology. Besides this, the scope of educational technology can be discussed under the following headings-

1. Teaching Technology

One of the major areas of study by educational technology is teaching technology. It studies about the process of application of philosophical, sociological and scientific knowledge to teaching for realizing the specific learning objectives. Teaching is both arts and science. It is heartening to mention here that education has three types of objective cognitive, affective and psycho-motor. All these types of objectives of education can only be achieved by technology. The teaching processes are made effective and meaningful through the application of technology. Moreover, the teaching theories can be formulated by the use of teaching technology. The teaching technology implies all the three aspects – input, process and output. Thus, teaching technology is covered under the wide area of educational technology.

2. Instructional technology

One another area of study by educational technology is instructional technology. The instruction plays a significant role in human learning as most of the human learning is carried and accomplished through instruction. Generally, the orderly and systematic action inducing learning is termed as Instruction. Thus, instructional technology implies the application of psychological and scientific principles and knowledge to instruction for realizing the specific objectives of education. The origin of instructional technology is from psychological laboratory experiments. The most important example of Instructional technology is "programmed Instruction". Instructional technology is very much helpful in case of shortage of teachers. It provides a deep insight into the content structure and sequence of its elements.

STOP TO CONSIDER :

- The origin of instructional technology is from psychological laboratory experiments.
- The most important example of Instructional technology is "programmed Instruction".

3. Behavioural Technology

Behavioural technology is the application of teaching and learning principles into teaching so that behavior of students as well as the teachers may be modified in accordance with the objectives of teaching. This technology is also known as training technology. This technology puts more emphasis on the behaviour of the teachers than that of students and whatever changes they want to bring about in the behaviour of the learner can be brought through the behaviour of the teachers only. Being students of education, you all know that psychology is the science of organism. Behavioural technology is a wider area of educational technology as it covers the area of industry, defence, commerce, communication, administration, heath, motivation, training, education, teaching and instruction. From this perspective, teaching and instructional technology are two forms of behavioural technology. Behavioural technology doesn't confine itself only to the study of the classroom teacher behaviour but also the mechanism of feedback devices for modification of teacher behaviour are employed for developing teaching skills.

4. Instructional Design technology/ system analysis

One another significant area of study under educational technology is instructional design technology or system analysis. This approach of instructional design is related to management technology. It is concerned with the application of modern skills and techniques for the requirements of education and training. This includes facilitation of learning by manipulation of media, methods and the control of learning environment. It is the application of scientific and mathematical techniques into various elements of organizational activities. There are three important technical designs that are developed and applied to educational problems. These are-**Training psychology**, concerned with the problems of teaching, learning and training by breaking down the task or problem into number of components, arranging into sequence for ensuring adequate transfer from one component to another; **Cybernetic System,** indicating the connectiveness

and regulation of the system, and **System approach** indicating the deliberately designed synthetic organisms comprising of interrelated and interacting components employed to function in an integrated fashion to attain pre-determined goals

Besides these, there are some other areas of study under educational technology

Educational technology in Management and Administration

Educational technology can bring efficiency in school management and administration. The school may adopt various computerized programme, ICT (Information and communication technology) managed school processes, automated school administration programme for school administration.

Educational technology in Evaluation and Examination

Educational technology has wide scope in evaluation and examination. It can provide objective, effective and fast method of evaluation of the capabilities of the learners.

Educational Technology in Teacher Education

Educational technology has also covered the area of teacher education. Capacity building of teacher is the key to the widespread infusion of educational technology enabled practices in the school system. Teacher capacities will be developed in instructional design, selection and critical evaluation of digital and strategies for effective use of digital content to enhance students learning.

Educational Technology in Guidance and Counselling

Educational technologies have significant influence in providing guidance in education. Latest developments and discoveries are applied to help the learner in making wise choices for their better future.

Educational Technology and Research

Information is collected and stored for research purposes. Educational technology can be of great help in the storage and

treatment of the data. Researchers can make use of technology with the facilities of internet, websites to find out all that is happening elsewhere .

STOP TO CONSIDER :

The three major aspects of Educational Technology are -

1. **Input**: This aspect of educational technology involves the entering behavior of the learner.
2. **Process**: The process here indicates the teaching and learning process of education**.**
3. **Output**: The output aspect of educational technology refers to the terminal behaviour of the students.

CHECK YOUR PROGRESS:

Q.2. Discuss the Scope of Educational Technology.

1.5: Role of Technology in Distance Education

The discussion held so far helps us to comprehend the meaning, characteristics as well as the area of study of educational technology. From the discussion, it has come to light that one of the prime objectives of educational technology is realization of educational objectives through application and development of different strategies. It is sum total of all the educational facilities employed for realization of the educational objectives. Thus, technology has innumerable impact on education. Indeed, it is one of the integral means of education. Technology without education cannot be imagined today as everything is fast changing. Technology enables both teacher and learner to keep pace with the fast changing teaching–learning situation of modern technology oriented era. The role of technology in education is thus no doubt a significant one.

Distance education has become much popular now-a -days. Being a distant learner, you must have adequate comprehension of Distance education. The distance education is a form of non-formal education. It is a mode of delivering education and instruction often on an individual basis to the students who are not physically present in the traditional classroom

setting. One of the prime objectives of distance education is to provide access to learning when the source of information and the learners are separated by time and distance, or both. The system of distance education emancipates education from the boundaries of educational institutions and carries the benefits of education to each and every one who desires to be educated.

Distance education is characterized by physical isolation of student from the teacher or vice-versa. Therefore, in its quest to reach education to the masses without the traditional classrooms, distance education must take help of an appropriate delivery system for providing the learning contents to the distance learners. Technology has occupied a very significant place in the distance education system. It is playing the role of the delivery system for making the program successful and fruitful for the distance learners. The different mass Medias have gained much relevance for distance education from their capacity to disseminate educational information to a great number of people. In a well designed instructional strategy, mass media can either be an indispensable component of learning environment or it can play the role of supplementary teachers.

Educational technology with its innovative practices can educate the learners who can not attend the classroom set up for their education. Educational technology in an open learning system permits the students to continue to train themselves. A wide range of media such as radio, television, audio cassettes, video cassettes, audio tape recorder, video tape recorder, film strips, word processors, computer etc have become more popular and accessible for the distance learner. The modern technologies used in distance education are —telephone tutoring, teleconferencing, audio graphics, video conferencing, computer conferencing drill and practice, teletext, and videotext, multimedia and hypermedia, e-books, the "Internet", the World Wide Web (WWW), or the "Information Super Highway" on-line database, on line discussion, call-in course- on demand, satellite, talk-back TV etc**.** Some of the important among those are elaborated below-

Radio

Radio is one of the older but significant forms of technology widely used for the sake of distance education. It is a medium that consists of transmission through broadcasting of audio signal to listeners. The educational broadcast of the radio among the several stations serves the purposes of spreading

education to its listeners. The radio broadcast is for listening at the time it is broadcast, but with the availability of storing devices the message can be stored by the concerned distance institutions for future purposes. There are various programme formats for radio education broadcast like lecture or radio talk by experts, interviews which help the learners.

Television

Television broadcasting is one of the important components of distance education in almost all the countries of the world. This form of technology can provide distance learners with unique resource materials. Demonstration of complex or expensive experiments, field visit, microscopic observation, advanced technical equipments, industrial processes, social and interpersonal interaction and interviews with outstanding persons or experts in the specific fields are some of the experiences that can be offered to the distance learner by television broadcast. These broadcasting help the learner to get live experiences as they provide interpretation by synthesis, demonstrating continuous processes, raising awareness and developing skill of evaluation.

Audio and video cassettes/discs

The study material presented on cassettes offers considerable freedom to the learners. They can use these technologies when it appears most relevant to the individual need of the students and at a time and place convenient to them. This hardware provides the distance learner with a scope to stop, pause and replay the text or recording according to their personal preferences.

Computer

One of the key contributions of technology is the computer. In the field of education, role of computer cannot be compared to other kinds of technologies. It not only helps the learner but also the teachers to prepare, restore and transmit the developed material to the students. In that sense, it serves as the word-processor. In the field of distance education too, computer plays the most crucial role. The various computer-aided instructions help the distance learner in the process of learning. The knowledge can be best presented, stored and transferred with the help of the computer. Moreover, the use of internet network enables the learner to access any information at hand. This has emerged the idea about e-learning for the learners.

1.5.1: Significance of Using Technology in distance education

There are numbers of advantages of using technologies in distance education. These are briefly presented below. Let's know-

- Students can access quality education resulting from the mass production of course materials,
- A lot of students can be helped to learn and be taught simultaneously.
- Students can find lot of educational resources for self-study..
- It enables the distance learners to communicate with many other students at one time.
- It makes distance teaching and learning flexibility and convenient.
- Use of technology enables the participants respond quickly to the learning stimuli.
- It makes the class more interesting.
- It helps the learner to learn from the top-level experts in the field in the form of audio or video tutoring.
- It helps the distance teachers in recording, saving and reformatting the resources for future study purposes.
- It enables the learners to easy and wider access to all kinds of information resources
- It helps both teacher and students to increase efficiency and effectiveness of teaching and learning.
- It improves the cost effectiveness of distance education.
- It provides remote access to the learners.
- It provides improved opportunities for individualized learning.
- It offers possibilities of greater control for students over their learning,

STOP TO CONSIDER :

- A wide range of media such as radio, television, audio cassettes, video cassettes, audio tape recorder, video tape recorder, film strips, word processors, computer etc have become more popular and accessible for the distance learner.
- The modern technologies used in distance education are — telephone tutoring, teleconferencing, audio graphics, video

conferencing, computer conferencing drill and practice, teletext, and videotext, multimedia and hypermedia, e-books, the "Internet", the World Wide Web (WWW), or the "Information Super Highway" on-line database, on line discussion, call-in course- on demand, satellite, talk-back TV etc.

CHECK YOUR PROGRESS:

Q.3. What do you mean by Distance education? Why do you think technology to be an important instrument of distance education?

1.6 Summing Up:

- Coming to the last part of this unit, it can be said that this unit tries to give you idea about the process of technology and its forms. The unit has also thrown light on the role of technology on distance education. Thus we can summarize the unit as-
- Technology refers to any practical art through the use of scientific knowledge.
- Educational technology implies the application of system analysis to teaching and learning.
- It is the application of technology of modeling to education.
- In the words of B. C Mathis, "Educational Technology refers to the development of a set of systematic methods, practical knowledge for designing, operating and testing in school".
- To determine the goal of education and formulate the objectives in behavioral terms is the major objectives of educational technology.
- The three types of Educational technology are- Hardware technology, Software technology and System analysis.
- The three major aspects of educational technology are-**Input, Process and Output.**
- The major area of study under educational technology are teaching technology, instructional technology, behavioural technology and instructional design technology.
- The distance education is a form of non-formal education.

- It is a mode of delivering education and instruction often on an individual basis to the students who are not physically present in the traditional classroom setting.
- The different mass Medias have gained much relevance for distance education from their capacity to disseminate educational information to a great number of people.
- A wide range of media such as radio, television, audio cassettes, video cassettes, audio tape recorder, video tape recorder, film strips, word processors, computer etc have become more popular and accessible for the distance learner.
- The modern technologies used in distance education are —telephone tutoring, teleconferencing, audio graphics, video conferencing, computer conferencing drill and practice, teletext, and videotext, multimedia and hypermedia, e-books, the "Internet", the World Wide Web (WWW), or the "Information Super Highway" on-line database, on line discussion, call-in course- on demand, satellite, talk-back TV etc**.**
- Technology has made distance education cost-effective, successful and goal specific.

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Unit II

Approaches to Educational Technology: Hardware Approach and Software Approach

Contents:

2.0 Introduction

Everywhere in our society today we can see the influence of Technology in our lives. Mobile phones, Television, Radio, Desktop, Laptop, Palmtop, Audio-Visual Aids in teaching-learning process, devices used in our household activities to save our time and effort like freeze, refrigerator, washing machines, electric cooker etc. are some of the ideas of technology that assist in our day-to-day activities. Even Technology has multiple ways to entertain people. The younger generations are fully taking the advantages of technological assets to keep them busy by playing games, listening to music, composing creative videos and sharing it in the social media. The older people are also showing great interest to have technological knowledge and avail the services. The revolutionized scenario of today's world has its base in Technology. Technology has been rapidly updating itself with creative innovations, evolving and implementing new theories beneficial to the world. In fact it has presented the world into a global village connecting people whenever and where ever. Without Technology it is impossible to think of

the progress and development of a country. Technological assets have become part and parcel of our lives. In almost every field such as education, economics, medical science, research and politics, technology is a must to make a work successful. Technology has made it possible to communicate among people living in distant and remote places immediately and share information, feelings, knowledge etc. Technology provides enough scope for the upliftment, progress and development of any society. Technology that is used for Educational purpose is called Educational Technology in simple sense.

Earlier Educational Technology included within its meaning only the use of simple audio-visual aids and these were used for direct teaching-learning process. But later on, with the rapid development of science and technology, sophisticated scientific instruments, mass media and educational materials were being used. In other words Hardware and Software like Radio, Television, Tape Recorder, Films, Transparency etc. were used in the field of education.

In broader sense, Educational Technology is that technology which applies the theories and principles of Technology in the field of education. It makes the teaching-learning process smooth, active, effective, interesting, motivational and influential. This type of technology has greatly assisted both the teachers and learners in achieving the desired instructional objectives. It facilitates the learners to learn according to their own rate of speed and time. Educational Technology can create a controlled learning environment with controlled media and methods.

According to Dieuziede, Director General of UNESCO's Division of Methods, Materials and Techniques, "Educational Technology implies all the intellectual and operational efforts made during recent years to re-group, re-arrange and systematize the application of scientific methods to the organization of new sets of equipment and materials to optimize the learning process."

Acording to 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 exploitation of media and the current knowledge of communication techniques in education, both formal and informal."

Educational Technology thus can be considered to be the valid and reliable use of applied education sciences, like equipment or devices and procedures and strategies derived from scientific research. It helps the learners and teachers to interact positively promoting a more diverse learning environment. Modern Electronic Educational Technology includes within itself E-learning, Virtual-learning, Instructional Technology, Information and Communication Technology (ICT), Multimedia learning, Technology Enhanced Learning (TEL), Computer-based Learning or Computer-aided Instruction (CAI), Internet-based Training (IBT), Flexible learning, Web-based Learning (WBT), Online Education, Digital Education Collaboration, Distributed Learning, Computer-Mediated Communication, Cyber-Learning, Multi-Modal Instruction, Video-Conferencing. Educational Technology is such a great technology that has led the countries of our world to communicate with each other for a better tomorrow towards the learning environment. It has facilitated the teachers and learners to bring about positive goals of education with advanced techniques and devices easily accessible to all in all ranges.

STOP TO CONSIDER :

Technology provides enough scope for the **upliftment, progress and development** of any society. Technology that is used for Educational purpose is called Educational Technology in simple sense.Educational Technology can create a **controlled learning environment** with controlled media and methods. This makes the teaching-learning process very easy, effective, interesting and motivating.

CHECK YOUR PROGRESS:

Q.1. What is Educational Technology?

Q.2. Define Educational Technology.

2.2 Objectives:

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

- Discuss the meaning of Educational Technology.
- Identify the approaches of Educational Technology.

- Discuss the approaches of Educational Technology.
- Describe the differences between Hardware and Software Approaches.
- Identify the importance of Hardware and Software Approaches.
- Describe the uses of Educational Technology in India.

2.3 Types of Approaches:

The urgent demand of the time is knowledge acquisition and being up-to-date with the current technological world. To make the learners more active and knowledgeable, Educational Technology is inseparable. Educational Technology has reduced physical labour among the teachers and students as they can communicate with each other through various ways of social media within a few seconds. It has provided enough scope to modify and improve the educational field making the learners competitive with the modern world. Communication among the teachers and learners have become very interesting and easy now-a-days as technology has gifted us with many devices, strategies and ideas as far as possible. Educational Technology has emerged as a great source assisting the teachers and learners in the teaching-learning process. This technology emphasizes the application of systems approach to the study of multi-dimensional problems of education like Educational planning, psychology of learning, curriculum development, course design, production of teaching-learning material, audio-visual aids, management of human and non-human resources, innovations and evaluation. It has three approaches namely-Hardware Approach, Software Approach and Systems Approach. They are discussed in the following points.

2.3.1 Hardware Approach:

Hardware is any physical device that is used with a machine. For example the hardware of a computer includes Monitor, Keyboard, Mouse, CPU, DVD or CD-ROM, Modem, Drive, Video Card, RAM, Sound Card, Speakers, Printer, Motherboard, Display, Memory, Power Supply etc. Now coming to Hardware Approach in Educational Technology, it refers to the application of the electro-mechanical equipments like motion pictures, tape recorders, teaching machines, computers, desktop, laptop, mobile tablets, model, charts, slides, projectors, video-tapes, Closed Circuit Television, radio, television, Epidiascope etc. in the teaching-learning

process. Such mechanization in the teaching-learning process has helped the teachers to deal with a larger number of students with less expenditure of time, money and energy. Hardware Approach has further improved the classroom condition by facilitating the teachers with innumerable new or innovative methods to teach the learners. It is very suitable for the learners as it meets the present needs of the students to achieve their learning objectives according to their own pace of learning. The utility of hardware approach can be explained with an example like-In a classroom of overcrowded students, the teacher can use sound proof micro phones so that all the students in the entire classroom can hear the lecture and it would not disturb the other classrooms too. It reduces the extra force of a teacher to speak out loud by making him energetic till the end of the lecture and it improves the teaching-learning process. This Approach is also named as "Borrowed Technology" because the hardware materials and equipments used in education are borrowed from the physical science and applied engineering.

2.3.2 Software Approach:

Software is often referred to as the brain of a computer. A computer must have an operating system that allows the user and computer to interact with the computer hardware. Software allows the user to do numerous tasks in the computer like typing, drawing, calculating, playing games, listening to music, watching videos and films, creating and saving important documents, connecting with the internet and search for any information that he/she wants. For example-If we visit any page on the Internet Browser, the operating system that the browser is running on is called the Software. Now coming to the Software Approach in Educational Technology, it refers to the application of psychological principles for behavior modification purpose. This Approach uses the knowledge of psychology of learning to create teaching-learning strategies and materials. It is an indirect way which helps the learners in the hardware appliances. Teaching strategies, learning material, evaluation tools, teaching models, Programmed Instruction etc. are under the software approach that assist the learners to gain knowledge according to their speed and modify the learning behaviour. Software Approach helps a teacher to plan his teaching in a very effective and interesting way because he can use films, ***flash-cards***, tapes etc. in the

classroom. Software Approach creates a congenial classroom environment where the students can learn with a great interest and joy as it removes the dullness of the traditional classroom. Software Approach emphasizes on task analysis, writing objectives in behavioural terms, selection of the appropriate teaching strategies, reinforcement for correct responses and continuous evaluation. The other names of Software Approach are Teaching Technology, Instructional Technology or Behavioural Technology.

2.3.3 Systems Approach:

This is also an important approach of Educational Technology. According to Systems Approach education is a system which has to be analyzed systematically. This process includes Input, Process, Output and Analysis and Feedback. Systems Approach is designed to understand and manage the education system technically and scientifically. It acts as the mediator between hardware and software approach. It has assisted largely in the administration and organization of education and achieving the learning objectives. It manages the education system including Instructor, learners and goals of Instruction very economically and effectively. In other words it manages the sub-system of an institution i.e. classroom, faculty, student groups, informal groups etc. Systems Approach makes it clear how teaching-learning process takes place in the classroom systematically with the help of devices and psychological principles to bring out positive learning outcomes among the learners. There are three major steps in systems approach. They are

a) **System Analysis:** This is the first step of a systems approach. Here analysis is done in the system in the form of identifying its elements, the organization of elements, the function or performance of these elements individually or as a whole. This step helps to sort out the problems that hampers in the proper functioning of a system.

b) **Systems design and development:** Second step is concerned with synthesis. It has tasks like the determination of the objectives of a system, selection of appropriate devices, methods, strategies and approaches, formulation of a comprehensive programme for better working of a system.

c) **Systems operation and evaluation:** This step is related with the study of practical operation of a system and its evaluation in terms

of the pre-determined objectives for bringing necessary feedback to lead to modification in the proper functioning of the system.

Application of Systems Approach in education can effectively improve the instructional system, planning, administration and management of school, examination and evaluation, organisation of co-curricular activities, guidance services of schools. It helps in maximum utilization of man, machine and resources associated with educational process.

STOP TO CONSIDER :

Flash-card is a card bearing pictures, information of numbers, vocabulary, historical dates, formulae or any subject matter that can be learned via a question and answer format. **System Analysis, Systems design and development, and Systems operation and evaluation** are three major steps in systems approach.

CHECK YOUR PROGRESS:

Q.3. Why is Hardware Approach called "Borrowed Technology"?

Q.4. What are the other names of Software Approach?

Q.5. What is Systems Approach?

1.4 Differences Between Hardware and Software Approaches:

Educational Technology having the three important aspects or types- Hardware Approach, Software Approach and Systems Approach have played a pivotal role in promoting and developing the educational field. The system of education would not have developed to this extent today without the help of these three approaches. In fact these approaches are always in a search to introduce new, creative and constructive devices and strategies to suit the present educational needs of the learners. Hardware and Software Approaches have numerous useful activities to be performed in the teaching-learning process. They are supportive or complementary to each other. One cannot work without the other. They are two sides of the same coin. Hardware Approach provides the devices practically whereas Software Approach provides the ethical and theoretical principles to be applied in the teaching-learning process. Hardware provides the platform to express

the psychological ideas useful for the students. Although these two approaches-Hardware and Software are interrelated with each other yet they are not free from differences. Some of the differences are described below:

RDWARE APPROACH	SOFTWARE APPROACH
Hardware Approach is based on Physical Science and hence it is physical in nature. It refers to the use of machines and devices or equipments in teaching-learning process. The materials of hardware are rigid in form. Hardware Approach is expensive. Its relation is with the teaching aids. It includes Input, Storage, Processing, control and Output Devices.	a) Software Approach is based on psychology of learning and hence it is logical in nature. b) It refers to the use of principles, theories and strategies of technology in teaching-learning process. c) The principles, theories, strategies and activities of Software Approach are flexible in nature because they can be changed according to the needs of the learners. d) Software Approach is less expensive. e) It is a link between the teacher and learners. f) It includes System Software, Programming Software and Application Software.

2.5 Importance of Hardware and Software Approaches:

To break the barriers of the age old traditional classroom teaching-learning process, Hardware and Software Approaches have played a pivotal role. These approaches assist in solving the various educational problems or the problems related with the administrative and organizational aspect of the education system. They attempt to help larger and larger groups of learners as far as possible with cost effective technology. The learners and teachers are facilitated with a platform where they can get easy access to the educational world. It takes no time nowadays to interact with one another. Within a second a teacher can communicate with the students or vice versa through the use of multiple ways of mobile devices and share information related to their learning objectives. Mass media of Technology have helped greatly to provide mass education. The importance of Hardware and Software Approach can be described below:

1) Hardware approach provides the devices and software approach provides the strategies to make the teaching-learning process easy, interesting and cost effective. Software cannot perform any activity without Hardware.

2) Both these approaches have made it possible for the learners to learn easily at their own pace of learning. They have facilitated the learners with a great mode of learning environment.

3) Hardware and Software Approaches emphasize on the individual differences of the students and meet with their educational needs. The slow learners now do not have to worry about feeling ashamed before the average and talented students. Because they can learn at their own place and speed suitable to their learning objectives.

4) In this current modern world of knowledge explosion, sharing of knowledge and information can be done within a few seconds that saves the time, money and energy of both the teacher and learner with the help of Hardware and Software Approaches.

5) Hardware and Software Approaches motivate the learners continuosly to learn as they remove the dullness of conventional classroom teaching-learning process. Students get encouragement to learn with more enthusiasm as there are innumerable interesting ways to learn with these two approaches.

6) Even in the Distance mode of learning, correspondence and open learning both these approaches have proved to be useful and successful. The learners can learn from their home without any loss of money and physical effort.

7) Hardware and Software Approaches have opened up new hopes for those learners who are unable to receive formal education due to various socio-economic problems. The learners who engaged in jobs are happy as they can learn and earn at the same time.

8) Many new Software Programmes and Audio-Visual Aids have been created in the recent years that have proved to be beneficial in the teaching-learning process.

9) E-learning, E-library, Virtual Classrooms, Online teaching-learning etc. are results of the Hardware and Software Approaches where the students can access for any information related to their educational objectives.

10) Schooltube and Youtube are channels that provide the facilitators and learners to upload some informational ideas, videos concerning their learning goals. These are creations of Hardware and Software Approaches.

STOP TO CONSIDER :

E-learning, E-library, Virtual Classrooms, Online teaching-learning, Schooltube and Youtube etc are some of the important and useful creations of Hardware and Software Approaches to provide a congenial teaching-learning process.

CHECK YOUR PROGRESS:

Q.6. Mention three uses of Hardware and Software Approach.

2.6. USES OF EDUCATIONAL TECHNOLOGY IN INDIA:

Educational Technology has been a part and parcel of educational system in India since recent years. The traditional and conventional mode of learning has been overpowered by the modern technologies in the field of education. Its use has wide spread in our country as it is concerned with improvement in all the levels and stages of education with its effective design and products of Hardware and Theories or Software Programmes. India although being a developing country has advanced in the technological field to a great extent. The mechanical devices and the software programmes have brought about a drastic change in the educational field in India. Proper use of Educational Technology obviously brings positive changes in the learning outcomes of the learners. The uses of Educational Technology can be pointed out as follows:

1) Educational Technology with its innovative techniques in education has played a pivotal role. The utilization of Radio in educational purpose is a good way to approach students in every corner of the country. The well planned educational programmes are broadcasted in the Radio which benefit the learners.

2) The use of Television in educational purpose is a step more than the radio as here it is possible for the learners to both watch and listen the telecasted programmes. Creative and constructive programmes telecasted in the Television helps in awakening the need of national development among the students, specially in the rural and remote areas.

3) The introduction of many new dimensions for training the teachers for effective teaching like Micro-teaching, Team teaching, Simulated teaching, Teaching Models etc. have greatly assisted in the modification of teaching-learning process.

4) Mass media has proved to be very useful for the students of open, correspondence and distance institutes. They can avail the educational services at any time and place they are comfortable with. They are benefitted with new ways to achieve their desired learning outcomes.

5) Besides providing Mass Education, Educational Technology in India has even facilitated the learners to learn some languages of other countries like English, German, Russian, French.

6) The Software Programme now-a-days has even facilitated the students with the availability of some regional languages that can be used in media to share information in mother tongue. This greatly benefits the students who are more interested to learn through their own language.

7) It is not that in India the technological devices and theories regarding education have been used roughly without planning. It is based on proper analysis and feedback whether or not the used devices and strategies are suitable for the students' educational needs.

8) In modern India the introduction of computer application is a must in the educational institutes. Therefore it is seen that in many Indian schools the computer application course is opened up so that students can learn computer from their early education.

9) The NCERT and SCERT are making numerous efforts to develop the education system in our country. For this they provide pre-service and in-service training to the teachers with the help of technology along with human resources. This step greatly helps in the improved and effective teaching-learning process.

10) Even in the field of educational seminar, conferences, workshops etc. Educational Technology has proved to be beneficial in promoting the learning outcomes according to necessity.

STOP TO CONSIDER :

NCERT and **SCERT** are making numerous efforts to develop the education system in our country. For this they provide **pre-service** and **in-service training** to the teachers with the help of technology along with human resources.

CHECK YOUR PROGRESS:

Q.7. Mention some uses of Educational Technology in India.

2.7 Summing Up:

1. Educational Technology is that technology which applies the theories and principles of Technology in the field of education.
2. It is the ethical practice of facilitating the learners and teachers to improve the learning environment with the appropriate use of resources.
3. Educational Technology has three approaches namely-Hardware Approach, Software Approach and Systems Approach.
4. Hardware Approach in Educational Technology refers to the application of the electro-mechanical equipments like motion pictures, tape recorders, teaching machines, computers, desktop, laptop, mobile tablets, model, charts, slides, projectors, video-tapes, Closed Circuit Television, radio, television, Epidiascope etc. in the teaching-learning process.
5. Software Approach emphasizes on task analysis, writing objectives in behavioural terms, selection of the appropriate teaching strategies, reinforcement for correct responses and continuous evaluation. The other names of Software Approach are Teaching Technology, Instructional Technology or Behavioural Technology.
6. According to Systems Approach education is a system which has to be analyzed systematically. This process includes Input, Process, Output and Analysis and Feedback. System Analysis, Systems design and development, and Systems operation and evaluation are three major steps in systems approach.

7. The Hardware and Software approaches assist in solving the various educational problems or the problems related with the administrative and organizational aspect of the education system. They attempt to help larger and larger groups of learners as far as possible with cost effective technology.
8. E-learning, Virtual-learning, Instructional Technology, Information and Communication Technology (ICT), Multimedia learning, Technology Enhanced Learning (TEL), Computer-based Learning or Computer or Computer-aided Instruction (CAI), Internet-based Training (IBT), Flexible learning, Web-based Learning (WBT), Online Education, Digital Education Collaboration, Distributed Learning, Computer-Mediated Communication, Cyber-Learning, Multi-Modal Instruction, Video-Conferencing have improved the teaching-learning process to a great extent by opening up diversified learning environment.
9. Hardware and Software Approach although are interrelated yet they differ from each other.
10. In this current modern world of knowledge explosion, sharing of knowledge and information can be done within a few seconds that saves the time, money and energy of both the teacher and learner by the help of Educational Technology.
11. The introduction of many new dimensions of training the teachers for effective teaching like Micro-teaching, Team teaching, Simulated teaching, Teaching Models etc. have greatly assisted in the modification of teaching-learning process.
12. It is advisable to use High-Tech Education in near future as far as possible because the world is rapidly moving or sweeping towards highly advanced technologies. This would help the learners to quickly acquire the learning objectives in a modern systematic way. For this it is mandatory that the instructors be trained with technological experts from all over the world.

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2.9 Answers to Check Your Progress

Answer no.1- Educational Technology can be considered to be the valid and reliable use of applied education sciences, like equipment or devices and procedures and strategies derived from scientific research. It helps the learners and teachers to interact positively promoting a more diverse learning environment.

Answer no.2- According to Dieuziede, Director General of UNESCO's Division of Methods, Materials and Techniques, "Educational Technology implies all the intellectual and operational efforts made during recent years to re-group, re-arrange and systematize the application of scientific methods to the organization of new sets of equipment and materials to optimize the learning process."

Answer no.3- Hardware Approach is called as "Borrowed Technology" because the hardware materials and equipments used in education are borrowed from the physical science and applied engineering.

Answer no.4- The other names of Software Approach are Teaching Technology, Instructional Technology or Behavioural Technology.

Answer no.5- Systems Approach is an important approach of Educational Technology. According to Systems Approach education is a system which has to be analysed systematically. This process includes Input, Process, Output and Analysis and Feedback. The Systems Approach is designed to understand and manage the education system technically and scientifically.

Answer no.6- Three uses of Hardware and Software Approach can be described below:

1) Hardware provides the devices and software provides the strategies to make the teaching-learning process easy, interesting and cost effective.
2) Hardware and Software Approaches emphasize on the individual differences of the students and meet with their educational needs.
3) In this current modern world of knowledge explosion, sharing of knowledge and information can be done within a few seconds that saves the time, money and energy of both the teacher and learner with the help of Hardware and Software Approach.

Answer no.7- The uses of Educational Technology can be pointed out as follows:

1) Educational Technology with its innovative techniques in education has played a pivotal role. The utilization of Radio in educational purpose is a good way to approach students in every corner of the country. The well planned educational programmes are broadcasted in the Radio which benefit the learners.
2) The use of Television in educational purpose is a step more than the radio as here it is possible for the learners to both watch and listen the telecasted programmes. Creative and constructive programmes telecasted in the Television helps in awakening the need of national development among the students, specially in the rural and remote areas.
3) The introduction of many new dimensions of training the teachers for effective teaching like Micro-teaching, Team teaching, Simulated teaching, Teaching Models etc. have greatly assisted in the modification of teaching-learning process.

2.10 MODEL QUESTIONS

Q.1. Explain the meaning of Educational Technology with examples.

Q.2. Discuss the approaches of Educational Technology.

Q.3. Differentiate between Hardware and Software Approach.

Q.4. Mention the significance of Hardware and Software Approach.

Q.5. Describe about the uses of Educational Technology in India.

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Unit III

System Apporach

Contents:

3.1 Introduction

Educational technology makes accessible a wide range of instructional media at the curriculum planning level. The instructional process has become so multifarious these days because of the shift in technological focus from the classroom to curriculum planning. The number of objectives to be reached because of the instructional programme has increased. The amount of material to be taught and the media to be utilised has also increased. The number of students and teachers involved in the total instructional system

has also increased rapidly. In such a circumstances, there is great need for ample and thorough planning. The curriculum should not identify any student behavioural objectives but should also put forward the strategies for helping the students to reach the objectives and evaluation instruments to measure their success. Thus system approach is an operational planning concept, hired from the engineering sciences and cybernetics, which deals with self-regulating and self-sustaining systems.

3.2 Objectives

After going through this unit you will be able to :

- identify the meaning, definition, nature and types of system and system approach
- discuss the System approach in Education
- elaborate the components of Instructional System

3.3 Meaning and Definition of System

In the context of history of ideas, the idea of a system is as old as European philosophy. The great Greek philosopher Aristotles' statement, *'The whole is more than the sum of its parts,'* is a definition of the system which is still suitable.

Systems perhaps natural, such as those found in nature – solar and environmental, or they may be manmade, such as those found in society – political and educational. Engineers are concerned with systems as practically related collectives of technological devices. Physiologists single out functionally related part of living organisms (circulatory, digestive and nervous systems). Social scientists speak of economic and political systems and philosophers about the system of thought. Educationists are mainly concerned with the educational system or the instructional system. Let us try to understand this term in the light of some definitions.

Angyal (1941) opines system as a holistic organisation. The parts that comprise a system are arranged (planned and interconnected) in some way that differentiates them from a single collection of objects.

According to R.L.Ackoff (1971), "A system is the set of interrelated and interdependent elements."

Crawford Roob (1973) states that, "System is a systematic organisation of the elements that operates in a unique way."

According to A.K. Jalaluddin (1981), "A system may be defined as a dynamic, complex, integrated whole consisting of self-regulating pattern of interrelated and interdependent elements organised to achieve the pre-determined and specified objectives."

3.4 Characteristics of a System

1. A system is a general term appropriate to many fields including instruction and education.
2. A system is a vibrant and integrated whole. It is not merely sum of its components or elements.
3. A system represents a multifarious but efficient organisation of inter-related and co-dependent parts or elements.
4. In a system, all the components or elements have their relevant roles which have to be specified in relation to each other and in relation to the purposes to be reached by the system.
5. System, altogether, functions better and achieves better results than any sub-system/part or combination of the effects of individual parts.
6. System is a self-governing, self-maintaining and self-regulated composition.
7. The performance of the system is aimed to attain the specific purposes or stipulated objectives.

In this way, the term system perhaps understood as a self-maintaining and self-regulating tool consisting of inter-related and interacting elements or self-systems operating as a whole to achieve the pre-determined aims or goals with maximum efficiency, economy and productivity.

3.5 Types of Systems

The systems may be divided into two broad categories – Natural systems and Man-made systems.

Natural Systems like solar system, human body system etc. are the creation of nature or biological system. Mostly, their functioning is beyond

the control of man and therefore, their behaviour cannot be foreseen or determined accurately.

Man-made systems or man-machine systems like telegraph system, refreezing system, education system etc. are deliberately designed or created systems. The elements as well as the implementation of these systems are quite controllable and therefore, their behaviour can be predicted and determined precisely.

3.6 Parameter of System

Any system may be explained in terms of the four basic parameters. These are:

(a) Input (b) Process

(c) Output and (d) Environmental context.

Example: Atlas cycle factory at Sonepat in Haryana is a man-machine system. Its aim is the reproduction of cycles. All the workers, technical and management personnel, machines and materials are its components or elements. Here the men and material employed in the production of cycles may be referred to as inputs. What is going inside the factory for converting material into the product may be referred to as process and the production of cycle and its accessories etc as outputs. The factory operates in a definite social and physical environment and definitely controlled by these environmental restraints.

CHECK YOUR PROGRESS:

Q.1. Define a system?

Q.2. Write two characteristics of a system.

Q.3. Systems are mainly classified into _____ types.

Q.4. Write the four parameters of a system

3.7 SYSTEM APPROACHES:

System approach is a systematic attempt to synchronize all characteristics of a problem towards precise objectives. ***Webster's*** dictionary defines a system as *"a regularly interacting or independent group of*

items forming a unified whole." The characteristics of a system may be described with the help of an example – various parts of the digestive system may be called as mechanisms of digestive system. Every part of the digestive system supports in functioning of the digestive system as a whole.

In the context of education, system is a unit incorporating all its aspects and parts, namely, pupils, teachers, curriculum, content and evaluation of instructional objectives. The teaching-learning process is viewed as communication and manage taking place between the components of a system. In this case, the system is composed of a teacher, a student and a programme of instruction, all in a particular pattern of interaction.

The System Approach focuses primarily upon the learner and then course content, learning experiences, efficient media, and instructional strategies. Such a system incorporates within itself the ability of providing continuous self-correction and improvement. It is concerned with all essentials of instruction including media, including hardware and software. Its purpose is to ensure that the components of the organic whole will be obtainable with the proper characteristics at a proper time to contribute to the total system fulfilling the objectives.

In the system approach to instruction, the teacher has to plan completely the utilization of selected resource material and the classroom performance. The teacher should have a good overall outlook of the subject, know his/her limitations, know all his/her pupils and the individual differences in their learning capacities and plan accordingly. The system approach involves continuous evaluation of learning outcomes and utilization of knowledge gained by analysis of results of evaluation to suitably change the plan of approach to get the stated objectives.

3.8 Steps in System Approaches:

There are three major steps involved in a systems approach, namely

(i) System analysis

(ii) Systems design and development

(iii) Systems operation and evaluation.

(i) System Analysis: This step is concerned with the task of analysing a system in the form of identifying its elements, the organisation of these elements, the purpose or performance of these elements

individually or as a whole in order to decide the need to make changes to ensure the achievement of system, namely, inputs, process, outputs and environmental constraints.

System analysis helps the designer of the system to recognize the constraints which interfere in the attainment of system objectives. Through this analysis, the appropriateness of the system objectives in views of the structure and functioning of the system may also be evaluated well.

(ii) System design and development: The first step is concerned with analysis, whereas the second step is related with the task of synthesizing. Here efforts are made to design and develop the system on the finding of the first step i.e. system analysis.

The main activities undertaken in this step may be outlined as below:

(i) Determination of the objectives of a system.

(ii) Selection of appropriate devices, methods, strategies and approaches.

(iii) Formulating a scheme of comprehensive programme for the working of the system in relation to its parameters and stipulated objectives.

(iii) System operation and evaluation: This step is concerned with the definite operation of a system and evaluation in terms of the stipulated objectives for providing necessary feedback to bring desirable improvement and change in the structure and functioning of the system. In case the outputs of a system meet the expectations or needs of the stipulated objectives or norms, the system can be allowed to carry on. If there is a discrepancy between the two, the need for bringing necessary modification or improvement in the system is felt. It can be done in some of the following ways:

(i) By manipulating the elements or inputs of the system.

(ii) By manipulating the purposes of elements or inputs.

(iii) By manipulating the procedure and interface among the elements of the system.

(iv) By manipulating environmental restrains of the system.

In this way, the system may be restructured, reorganised and its functioning may be replanned, and reoperated inorder of achieving better results. This process of operation, evaluation, feedback, modification,

restarting and reopertaion is continued till the aim of getting best results in terms of the stipulated objectives with greater economy, exactness and precision is not achieved.

3.9 Advantages of System Approach:

i. System approach helps to recognize the suitability of the resource material to attain the specific goal.

ii. Technological advance could be used to make available integration of machines, media and people for attaining the defined goal.

iii. It helps to measure the resource needs, their sources and facilities in relation to quantities, time and other factors.

iv. It allows a systematic introduction of components demonstrated to be required for systems success in terms of student learning.

v. It stays away from rigidity in plan of action as continuous evaluation affords desired favourable changes to be made.

3.10 Limitations of System Approach:

i. Resistance to modification: Old conduct are not easy to remove. There is always resistance to any new technique or approach.

ii. Engages hard work: Systems approach requires hard and constant work on the part of school human resources. Some are not equipped for the extra load.

iii. Lack of understanding: Teachers and administrators are still not well-known with systems approach. Though it has been successfully executed in industry, it has still to make development in education.

CHECK YOUR PROGRESS:

Q.5. What is a system approach?

Q.6. Mention the steps of system approach.

Q.7. Write three advantages of system approach.

Q.8. Write three limitations of system approach

3.11 Education System

Education system is a man-made system. It may either be taken as a sub-system of the society as a system or an entire system of the society in itself. It may be diagrammatically represented as below:

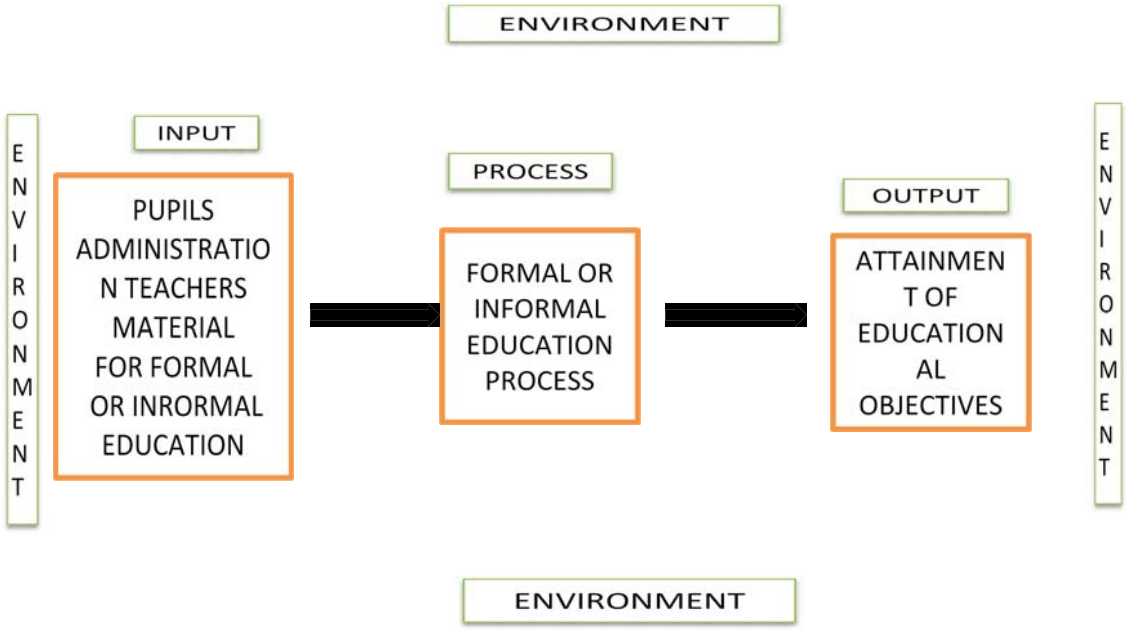


Fig:3.1: Education System

On the same lines, the school system (a system of formal education through an educational institution) may be treated as a sub-system of the education system or a system complete in itself. It may have instructional (related with the cognitive development of pupils) and co-instructional systems as its sub-systems. However, both these systems, instructional and co-instructional may exist and function quite independently as a complete system in themselves.

3.11 (a). System Approach to Education:

System approach refers to a well thought of system or rational approach for designing, controlling and using a system for realising the system objectives in the best possible ways. Its application in the field of education will surely make the system of education, self-maintaining with its essential parameters functioning systematically on the principles of feedback and

equilibrium. As a result the system approach in education is likely to solve various educational problems related with the organisation and management of the process and products of education. In brief, the underlying principle served by systems approach in education may be summarised as ahead:

1. It can efficiently develop the instructional system.
2. It can help in controlling and improving the school affairs by bringing effectiveness in the school administration and management.
3. It may facilitate in seeking utmost effective utilization of the man, and material resources connected with the process of education.
4. It may facilitate in having organized educational planning (institutional, regional or national) in terms of long-range goals and specific short-range objectives.
5. It may assist in bringing enhancement in the examination and evaluation system.
6. It may facilitate in bringing up gradation in the organisation of co-curricular activities and other educational aspects of bringing conative and affective development of the pupils.
7. It may assist in maintaining controlling and improving the guidance services of the schools.
8. It may facilitate in improving training and development programmes. For example, Teacher Training (pre-service or in-service) may be efficiently improved with the help of system approach.
9. It may provide evidence an invaluable means for designing, controlling and improving the systems of non-formal and adult education.
10. In addition to it may provide valuable services in improving the quality of education in all its areas and dimensions.

3.12 Components of an Instructional System :

Systems approach is a systematic effort to coordinate all aspects of a problem towards specific objectives. In education, this means planned and organised use of all obtainable learning resources, including audio-visual media, to achieve the desirable learning objectives by the most efficient means possible. The system approach focuses first upon the learner and

the performances required of him. Only then, it makes decisions regarding course content, learning experiences and the most helpful media and instructional strategies. Such a system incorporates within itself the ability of providing nonstop self-correction and improvement. It is concerned with all elements of instruction including media. Its purpose is to ensure that the components of the organic whole will be accessible with the proper characteristics at the proper time to contribute to the total system fulfilling the objectives.

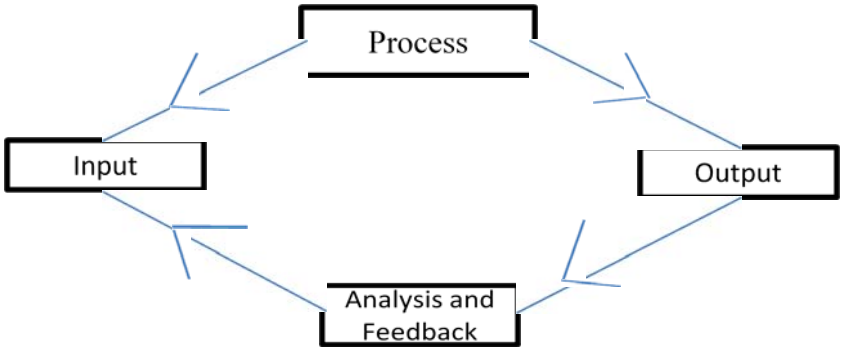
The procedure steps of system approach in education are as follows:

1. Defining instructional goals, behavioural objectives and stating them in operational, calculable terms.
2. Determining roles related to the achievements of these goals by proper aids like films, recordings, videotapes etc.
3. Defining learner characteristics and requirements.
4. Choosing suitable methods suitable for effective learning of the topic.
5. Selecting suitable learning experiences from many alternatives available.
6. Selecting appropriate materials, facilities, equipment, resources, team teaching members – supporting personnel – students.
7. Defining and assigning appropriate personal roles – teachers – team teaching members – supporting personnel – students.
8. Executing the programme – test with a few pupils in typical and appropriate condition.
9. Testing and evaluating the result in terms of original objectives measured in student performance.
10. Refining and revising if necessary to get better production and efficiency of the system to improve student learning.

In an instructional system, the teacher or instructor and the resources made use of by him are included as components of the system. There is provision for constant evaluation and self correction, for realising the stated objectives. In the systems approach to instruction, the teacher has to plan completely the utilisation of selected resource material and the classroom activities (each pupil working alone; small groups of pupils, 4 to 6, working alone or with teacher guidance; large groups working alone; very large

groups requiring the use of mass communication media). The teacher should have a good overall view of the subject, know his/her limitations, know all about his/her pupils and the individual differences in their learning abilities and plan accordingly. The system approach involves constant evaluation of learning outcomes and utilisation of knowledge gained by analysis of results of evaluation to suitably change the plan of approach to achieve the stated objectives.

In brief the systems approach applied to educational situations involves the following interlinked and interdependent stages: (a) Explicitly stated principles of output performances, including sequenced behavioural objectives and post- test; (b) Planned input and processes involving structural learning materials and methods suitably geared to the needs of a particular group of learners; (c) Monitored output which is used to revise, improve and evaluate the instructional system, providing feedback to the learner and teacher, and (d) A degree of in built flexibility to adjust to individual situations.



The parts of the instructional system noted above can be analysed into their possible components as follows:

Institutional planning – Application of systems approach – an example.

I. INPUT:

Pupils: (a) age

(b) Minimum prescribed entry qualification, attainments (entry behaviour) decided by (i) curriculum content (objectives) (ii) duration of the course.

(c) Desirable to consider (i) attitude

(ii) aptitude of pupils

Cost factor which in a constraint on input should also be considered in terms of its benefits.

(a) Job opportunities after passing out.

(b) Location of the institute – Rural
Urban

(c) Hostel facilities –cost-finance involved.

II. PROCESS:

1. Curriculum : - need-based
   - Well-defined objectives – anticipated behavioural changes in pupils
   - Suggested strategy and lines of approach (media, methods)
   - Evaluation procedures laid out
2. Institute (a) Physical environment

III. FEEDBACK

(a) Evaluation by public — Internal
Organisation, boards — External
Universities — Part internal and part external performance

(b) Employees – Initiative- adequacy- of knowledge skill – adaptability and ability to apply knowledge to practical situation.

For maximum effectiveness, it is necessary to consider the system as a whole remembering the interaction and inter-dependence of the components of the systems. Full details and specifications about the interacting factors should be clearly defined. System approach in education may be applied to institutional planning and development in its varied aspects (Macro Level) or it may be used at the classroom level with its concern of a specified topic during a brief period (Micro Level).

Curriculum objectives in terms of anticipated change in student behaviour should be well-defined. Teacher and pupils should know what is expected upon completion of an instructional unit. The evaluation should aim to reflect pupils' skills, knowledge, concepts developed through available

teaching material and the teacher. Based on evaluation results, more appropriate instructional materials and teaching strategies could be selected to ensure achievement of stated objectives. It may be necessary also to change the prescribed entry behaviour of input based on the results of evaluation. The curriculum should be modified if end-product is not suitable to fill in the need.

CHECK YOUR PROGRESS:

Q.9. Education system is a _____system. (Fill in the blanks)

Q.10. Write three underlying principles of system approach in education.?

Q.11. What are the components of a system in an instructional system?

Q.12. Write three procedure steps of system approach in education.

Summary

Systems perhaps natural, such as those found in nature – solar and environmental, or they may be manmade, such as those found in society – political and educational. Engineers are concerned with systems as practically related collectives of technological devices.

The systems may be divided into two broad categories – Natural systems and Man-made systems.

Any system may be explained in terms of the four basic parameters. These are (a)Input, (b).Process, (c). Output and (d). Environmental context.

System approach is a systematic attempt to synchronize all characteristics of a problem towards precise objectives. ***Webster's*** dictionary defines a system as *"a regularly interacting or independent group of items forming a unified whole."*

There are three major steps involved in a systems approach, namely: (i). System analysis, (ii). Systems design and development (iii). Systems operation and evaluation.

System approach refers to a well thought system or rational approach for designing, controlling and using a system for realising the system objectives in the best possible ways. Its application in the field of education will surely make the system of education, self-maintaining with its essential

parameters functioning systematically on the principles of feedback and equilibrium.

Systems approach is a systematic effort to coordinate all aspects of a problem toward specific objectives. In education, this means planned and organised use of all obtainable learning resources, including audio-visual media, to achieve the desirable learning objectives by the most efficient means possible. The system approach focuses first upon the learner and the performances required of him.

3.13 Key Terms:

System Approach: Look at a problem precisely

Instructional Design: Learning Material

3.14. Answer to Check Your Progress

Answer to Q.No. 1: According to R.L.Ackoff (1971), "A system is the set of interrelated and interdependent elements."

Answer to Q.No.2: (1). A system is a general term appropriate to many fields including instruction and education.

(2). A system is a vibrant and integrated whole. It is not merely sum of its components or elements.

Answer to Q.No.3: Two

Answer to Q.No.4: The four parameters of a system are as follows:

(a) Input (b) Process

(c). Output (d). Environmental context.

Answer to Q.No.5.: System approach is a systematic attempt to synchronize all characteristics of a problem towards precise objectives. ***Webster's*** dictionary defines a system as *"a regularly interacting or independent group of items forming a unified whole."*

Answer to Q.No.6: There are three major steps involved in a systems approach, namely

(i). System analysis

(ii). Systems design and development

(iii). Systems operation and evaluation.

Answer to Q.No.7: Three advantages of system approach are as follows:

i. System approach helps to recognize the suitability of the resource material to attain the specific goal.

ii. Technological advance could be used to make available integration of machines, media and people for attaining the defined goal.

iii. It helps to measure the resource needs, their sources and facilities in relation to quantities, time and other factors.

Answer to Q.No.8: Three limitations of system approach are as follows:

i. *Resistance to modification:* Old conduct are not easy to remove. There is always resistance to any new technique or approach.

ii. *Engages hard work:* Systems approach requires hard and constant work on the part of school human resources. Some are not equipped for the extra load.

iii. *Lack of understanding*: Teachers and administrators are still not well-known with systems approach. Though it has been successfully executed in industry, it has still to make development in education.

Answer to Q.No.9.: Man-made

Answer to Q.No.10.: The three underlying principle served by systems approach in education may be summarised as ahead:

1. It can efficiently develop the instructional system.
2. It can help in controlling and improving the school affairs by bringing effectiveness in the school administration and management.
3. It may facilitate in seeking utmost effective utilization of the man, and material resources connected with the process of education.

Answer to Q.No.11.: In an instructional system, the teacher or instructor and the resources made use of by him are included as components of the system.

Answer to Q.No.12.: The three procedure steps of system approach in education are as follows:

1. Defining instructional goals, behavioural objectives and stating them in operational, calculable terms.
2. Determining roles related to the achievements of these goals by proper aids like films, recordings, videotapes etc.
3. Defining learner characteristics and requirements.

3.15 Essay Type Questions

Q.1. What do you understand by the term system? Discuss its characteristics.

Q.2. Briefly describe the major steps involved in system approach.

Q.3. How can the system approach be applied to education? Discuss in the light of the major steps involved.

Q.4. Write short notes on:

(a) Parameter of a system.

(b) System analysis.

(c) System operation

(d) System design

(e) System approach to education.

3.16 Further Reading

1. N. Venkataiah "*Educational Technology"* published by APH publishing corporation, New Delhi
2. S.S. Kulkarni, "*Introduction to Educational Technology: A System Approach to Micro Level Education"* published by Oxford &IBH, New Delhi
3. C.P. Singh, "*Introduction to Educational Technology"* published by Lotus Press, New Delhi

3.17 References

Sampath, K & Others., "*Introduction to educational Technology"* sterling publishers Pvt. Ltd., New Delhi: 2001

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Unit IV

Programmed Instruction

Contents:

4.1 Introduction

Programmed instruction or programmed learning stand for one of the efficient improvement in teaching learning process. As a highly individualized and organized instructional approach, classroom instruction as well as self-learning or auto-instruction has been found quite useful. In a country like India, an attempts has been made for the use of programmed instructions particularly in providing material to the students of distance courses. Suitable self-instructional programmed materials for different subjects and grades have been prepared and it is being used for instructional or self-instructional purposes. Besides its use for instructional purpose, programmed instruction has full potentiality for being used as mechanism of feedback device for the modification of teacher behaviour and improving teaching efficiency.

4.2 Objectives

After going through this unit you will be able to :

- Identify the origin, meaning, definition, nature and types of programmed instruction.
- Discuss the different types of programmed learning.

4.3 Meaning and Definition of Programmed Instruction:

In general, the instructions given by a teaching machine or programmed text book is referred to a s programmed instruction or programmed learning. Let us take into consideration the definitions put forward by the various academicians in understanding the meaning of the term programmed learning or programmed instruction.

According to **Smith and Moore (1962),** "Programmed instruction is the process of arranging the material to be learned into a series of sequential steps, usually it moves the students from a familiar background into a complex and new set of concepts, principles and understanding."

Programmed instruction is a technique of self-instruction in which all of the instructional load is carried by teaching machines or programmed texts.

According to **Jacobs and others (Jacobs, et. al, 1966),** "Self instructional programmes are educational materials from which the students learn. These programmes can be used with many types of students and subject matter, either by themselves, hence, the name "self-instruction" or in combination with other instructional techniques."

According to **Espich and Williams (1967),** "Programmed instruction is a planned sequence of experiences, leading to proficiency, in terms of stimulus responses relationship that have proven to be effective."

According to **Leith (1966),** "Programme is a sequence of small steps of instructional material (called frames), most of which requires a response to be made by completing a blank space in a sentence. To ensure that expected responses are given, a system of cueing is applied, and each response is verified by the provision of immediate knowledge of results. Such a sequence is intended to be worked at the learners' own pace as individualized self instruction."

Susam Markle, (1969) opines that "It is a method of designing a reproducible sequence of instructional events to produce a measurable and consistent effect on the behaviours of each and every acceptable students."

Programmed instruction is a technique of self-instruction in which all of the instructional load is carried by teaching machines or programmed texts.

Gulati and Gulati, (1976) is of the view that "Programmed learning as popularly understood is a method of giving individualized instruction, in which the student is active and proceeds at his own place and is provided with immediate knowledge of results. The teacher is not physically present. The programmer, while developing programmed material has to follow the laws of behaviour and validate his strategy in terms of students learning."

According to **N.S. Mavi, (1984),** "Programmed instruction is a technique of converting the live instructional process into self learning or auto-instructional readable material in the form of micro-sequences (the segments of subject matter) which the learners are required to read, make

some right or wrong response, correct wrong responses or confirm the right response and attain the complete mastery of the concepts explained in the micro sequences."

To conclude the above definitions may reveal the things given ahead regarding the meaning, nature and characteristics or programmed learning.

4.4 History of Programmed 'Instruction'

Some educators are of the view that the 'Gita' is the first example of programmed learning. They also maintained that the text of the 'Gita' has several ingredients of programming: initial behaviour, small steps, active participation, terminal behaviour, immediate feedback and self-evaluation by the learner.

Several academicians viewed that Socrates as one of the earliest programmers, saying he developed a programme in geometry. This was recorded by Plato in the dialogue MENU. Socrates used to direct his followers to knowledge by conducting them informally along a pathway from fact to fact and insight to insight.

Programmed Learning as 'Technological Revolution' in Education:

Programmed instruction owes its source to the psychology of learning. First psychologist whose findings bear direct significance to programming is E.L. Thorndike (1874-1949). Thorndike gave some laws of learning. According to one of his laws, the law of effect, a learner likes to replicate his performance or takes more values in further learning if the present learning gives him pleasure or satisfaction. In other words, reward, pleasure or contentment contributes in strengthening the behaviour i.e. providing instant reinforcement. In this way, the law of effect has a close link with the concept of reinforcement, which is regarded as the backbone of programmed instruction.

The name of Sydney L. Pressey (1926), inventor of a teaching machine like devices, is also linked with the source of programmed instruction. His tool contained the format of multiple-choice items having provision for instant feedback. In such a tool out of the several choice provided for answering a question only one is correct and if a student select his correct answer the tool present the next item, if not, he is required to keep on with his selection process till he selects the correct one. Although

suffering from some weakness the tool or machine developed by Pressey certainly had the components of programming.

Another leading move in the way of the development of programmed instruction came in middle fifties through the idea of operant conditioning put forward by B.F. Skinner of Hardware University. In operant conditioning, response of the individual is voluntary and natural and the chance of the occurrence of these responses is increased if there is a provision of instant reinforcement. While doing experiments on pigeons, Skinner tried to develop the fundamental principle of human learning and through these principles developed a teaching learning model which is popularly known as ***Skinnarian or Linear model of programmed instruction.***

Inspired with the work of Pressey and Skinner, Norman A, Crowder in 1955, tried to build up another model of programmed instruction widely known as branching.

The sixties witness a great deal of development in the field of programmed instruction. The mentionable are the following:-

Edward L Thorndike (1912) described the fundamental idea of programmed self-instructional materials in these words," If, by some miracle of mechanical ingenuity, a book can be so arranged that only to him who had done what was directed in page one would page two become visible and so on, much that now requires personal instruction could be managed by print." This 'miracle' later on become a reality.

1. Near the beginning of sixties, Robert Mager and others developed a method of programmed instruction, theoretically, known as ***"Learner Controlled Instruction".*** In this method, learner and not the programmer or instructor plays the main role. The instructor remains silent while the learner motivates him to respond or help.
2. In 1962, T.F. Gilbert developed a new method of programmed instruction known as Mathetics.
3. In 1965, E.Z. Rothkopt used a new expression '***Mathemagenics'*** for clearing up the progress of learning and put forward suggestion for useful mathemagenic programming.
4. Again in 1965, Lawrence Stolurow tried to reform the field of programmed instruction by bringing the idea of ***Computer Assisted Instruction(CAI).*** CAI tries to use the computer as an all knowing teaching brain in such a way that students can interrelate directly with it without the help of a teacher.

Thus, the idea of individualized self instruction prompted by programmed instruction approach has reached its height by the introduction of computer assisted instruction.

In this manner, the method of programmed instruction is becoming more and more scientific and practical by using the methodical and objective principles of Mathematics, Applied Sciences and Engineering. Originating from the psychology of learning and instruction it has now been developed as one of the important aspects of instructional technology.

4.5. Features or Characteristics of Programmed Instruction:

1. Programmed instruction is a system or technique of giving or receiving individualised instruction from a variety of sources like programmed text book, teaching machine, computers etc. with or without the assistance of a teacher.
2. In this system the instructional material is rationally sequenced and broken into appropriate small steps or segments of the subject matter called frames.
3. For sequencing a particular unit of the instructional material, the programmer has to pay consideration for the first or entry behaviour of the learner with which it begins and the terminal or end behaviour or the capability which student is required to attain.
4. In factual operation the starting is made by presenting a frame (a small but meaningful segment of subject matter). The learner is required to read or listen and then respond actively.
5. Programmed instruction system has an adequate provision for immediate feedback which is based on the theory of reinforcement. For example while responding to the first frame of the programmed material the learner is informed about the correctness of his response. In case he is correct, his response is reinforced and if he is wrong, he may correct himself by receiving the correct answer.
6. It is the communication between the learner and learning material or programme which is stressed in the programmed instruction. Here the student is actively encouraged to learn and take action.
7. Programmed instruction provides self pacing and thus learning may occur at individual rate rather than general, depending upon character of the learner, learning material and learning situations.

8. It calls for the overt responses of the learner which can readily be observed, measured and effectively controlled.
9. It has the provision for continuous evaluation which may help in improving the student's act and the quality of programmed material.

The terms Progarmmed Learning and Programmed Instruction have been used interchangeably in educational literature. The English educators prefer the use of programmed learning (PL). On the other hand, the American writers use the term programmed instruction(PI)

On the basis of above features we may define programmed instruction in the following ways:

Programmed instruction is a systematically planned, empirically established and effectively controlled self-instructional technique for providing individualised instruction to the learner through logically sequenced small segments of the subject matter by using the principles of operant conditioning and schedules of reinforcement.

4.6 Diference between Programmed Instruction and Traditional Method

Sl No.	PROGRAMMED INSTRUCTION	Sl. No	TRADITIONAL METHOD
1.	It is an individualised method of instruction	1.	It is group method
2.	It is based on teaching principles that have been known for years.	2.	It becomes difficult to apply teaching principles in crowded classrooms.
3.	It presents the instructional matter step by step in logical order	3.	It presents the instructional matter as a whole.
4.	The size of the unit of information presented to the pupil is small.	4.	The unit is a lengthy one. There is no provision for response from the pupil in the type of answers to questions.
5.	Instant feedback is given to the pupil.	5.	The pupil does not get instant feedback.
6.	Objectives are defined very clearly in effective terms.	6.	Objectives are not well-defined and are usually unclear.
7.	The programmer prepares his programme with care and precision.	7.	Little preparation is made.
8.	The programme is prepared in such a way that the student automatically participates actively by making reactions continuously.	8.	The pupil usually remains a passive listener and the teacher himself does the summarizing and reviewing.
9.	A programme is developed practically through a series of tryouts and is refined gradually. Efficient sequences of frames are retained and ineffective one discarded.	9.	It is usually found to be very difficult to modify traditional instruction on the basis of pupil's reaction.

4.7 Fundamental Principles of Programming :

1. **Principle of small steps:** This principle is based on the fundamental assumption that one learns better if the content theme is presented to him in suitable small steps. Therefore, according to this principle, a programmer while preparing a programme should try to organize the subject matter into a properly sequenced meaningful sections of information called frames. These sections should be presented one at a time before the learner for responding.
2. **Principle of vigorous responding:** This principle rests on the postulation that a learner learns better by being vigor. In programmed instruction the learner may remain active if he responds actively to every frame presented to him. Therefore, a good programme should actively involve the learner in the learning process. It should be so formed that the learner may not feel much difficulty in moving from one frame to another and to remain meaningfully, busy and active by responding to the frames and thus acquiring the knowledge step by step in a properly sequenced way.
3. **Principle of instant reinforcement:** The psychological phenomenon of reinforcement is the basis of this principle. One learns better when one is motivated to learn by receiving information of the result immediately after responding. Therefore, in a good programme, proper consideration is always made for the provision of instant reinforcement by informing him immediately about the correctness of his response.
4. **Principle of self-pacing:** The programmed instruction is a method of individualised instruction. It is based on the basic supposition that learning can take place better if a person is allowed to learn at his own pace. Therefore, a good programme should always take care of the principle of self-pacing. The programming of the material should be done in view of the principle of individual difference and the learner should be able to respond and move from one frame to another according to his own pace of learning.
5. **Principle of student-testing:** For better learning it is always better to seek continuous assessment of the learning process. The present principle meets this requirement. In the programmed instruction,

the learner has to leave the evidence of his reply because he is required to write a reply for each frame on a response sheet. This detailed record help in revising the programme. It may also prove a good source for studying and improving the complex phenomenon of human stage.

CHECK YOUR PROGRESS:

Q.1. Who is the inventor of Teaching Machines?

Q.2. Programmed Instruction owes its origin to the psychology of _____. (Fill in the blanks)

Q.3. Name the first psychologist whose findings bear direct relevance to programming.

Q.4. Programmed Learning/Instruction is an audio-visual device. (Write True or False)

Q.5. Which law of learning is regarded as the backbone of Programmed Instruction?

Q.6. Define educational psychology.

Q.7. Write three characteristics of programmed instruction.

Q.8. Programmed learning is based on operant conditioning.(Write True/False)

4.8 Steps of Programmed Instruction :

The program process is highly vibrant, demanding and time-consuming exercise. The programmer must be expert person to write the programs. It has three major steps.

Namely:

I. PREPARATION: This step involves the following sub-heads.

(a) Selection of theme or units, to be programmed

(b) Preparing a content outline.

(c) Defining objectives in behavioural terms

(d) Constructing a test of entering behaviour.

(e) Constructing a test of terminal behaviour.

II. WRITING THE PROGRAMME: This step involves the following sub-headings:

(a) Presenting the material in frames.

(b) Provide for dynamic student response.

(c) Provide for verification or correctness of student response or reinforcement.

(d) Use prompts to direct student response.

(e) Provide careful sequencing of frames.

III. TRYOUT AND REVISION: After editing the draft, the program must be read by subject matter for expert to check in accuracy's in the content. Then it is tested validity by administering the program to group of pupils. Based on its evaluation, the revision of program density is calculated as given below.

(1) ERROR RATE: This is calculated on the basis of response given by the learners for each frame in the program. The formula to calculate the error rate is -

$$\text{Error Rate} = \frac{\text{Total Number of errors}}{\text{Total Number of frames} \times \text{Number of learners taking the program}} \times 100$$

(2) PROGRAMME DENSITY: It is measured in terms of type taken ratio (TTR), which is calculated using the formulae –

$$\text{TTR} = \frac{\text{Number of different response required in a section of the program}}{\text{Total Number of response required in a section of the program}}$$

4.9 Outcomes of Programmed Learning on the Teaching Process:

(i) Tutorial experiences are provided for individual learners on a large scale, wherein the learner may proceed at his own rate.

(ii) Programmed instruction can exercise control on assignments and individual study.

(iii) Programmed instruction can facilitate the learner to catch up if he fallen behind in his learning programme due to absence from school.

(iv) Programmed instruction provides a technological explanation to the problem of individual differences. The lack of programmed instructional materials would force the teacher to design his presentation to provide to what he senses is the student of average capability, but such a presentation is bound to be too slow for the bright students and too fast for the slow ones.

(v) The ease of use of instructional material of a programme and its influential tools allow the teacher to be much more professional in his approach to teaching than he now is.

(vi) By interpreting the feedback obtained through verbal questions and discussions in the class, the teacher can intelligently change the flow of information or further instruction.

(vii) A essential quality of teaching machines is 'immediate knowledge of results' followed by immediate correction of errors and instant rewards for correct answers. It has been established by investigate that more frequent the rewards, the better the learner understand the material.

(viii) It eradicate deception because the learner has nothing to gain by it.

(ix) The learners prefer the use of machines over studying from a textbook.

(x) It eradicate the influence of teacher variables, as shown by research.

4.10 Merits of Programmed Learning :

Programmed learning is well thought-out to be more well-organized method of teaching-learning. Its advantage is well-established over the conventional methods of teaching-learning. It is increasingly being used in highly developed countries. It is realised that programmed instruction has the possibility to transformed the theory and practice of teaching.

Following are the principal merits of programmed learning:

(i) A well-programmed learning is a great force in the way of individualised instruction, as it is modified to the needs of the individual learner in the class.

(ii) It allows an individual learner to improvement at his own speed. An intelligent learner no longer needs to be bored or allowed to lose interest on account of slow development of other learners of the class. He can make progress at his own pace, even if it is faster than the rest of the class.

(iii) Since a programme requires constant response from the learner, it overcomes inactivity and passivity on the part of the learner.

(iv) The teacher can give description in the classroom if the error is common, or he may arrange individual conferences on definite points.

(v) Well-programmed instruction is a chief thrust in the way of individualised instruction as it is tailored to cater to the needs of individual students.

(vi) Learning material by way of programmed instruction is presented in such a way that learning look like an interesting game, motivating the learner to meet the challenges as per his own capacities.

(vii) It is the experts who developed the Program. They are experimentally tested and modified till they are standardised. Some learners can use a single good programme and thus save on textbooks.

(viii) In programmed instruction, the learner is instantly reinforced to spot on his response. This reinforcement sustains the motivation of the learner.

(ix) The self-instructional method presents material whose difficulty is simplified through the analysis of the subject matter, into small and more easily assimilated parts of information.

(x) The introduction of programmed instruction is of a great importance for developing countries which need to instruct millions of learners and are short of teachers.

4.11 Demerits of Programmed Materials :

Programmed materials have been severely criticised as threatening to replace the teacher.

It is argued that there is too much importance in learning facts and very little importance on the mastery of principles and concepts.

Some critics of programmed instruction maintain that the user of a programme does not know where he is moving.

Again they opined that the learners are not aware of the organisation and programmed instruction is unrelated to other features of instruction.

Another demerit of programmed instruction material is that it is very costly and only rich nations can afford it.

It is also stated that the progress and use of programmed instructional material requires expert knowledge and training. An average teacher finds it very hard to make use of this machine.

CHECK YOUR PROGRESS:

Q.9. Write three advantages of learning.

Q.10. Write three limitation of programmed instruction.

Q.11. What are the Objectives of Programmed Learning/Instruction?

4.12 Styles of Programming :

In programmed instruction the presentation of the learning material or subject matter to the learner in a suitable form is termed as programming. Various types of programming have emerged because of researches and experimental studies in the field of programmed instruction. Some of the mentionable are listed below:

(1) Linear or extrinsic Programming.

(2) Branching or intrinsic Programming.

(3) Mathetics Programming.

(4) Rule system of programming

(5) Computer Assisted Instruction (CAI)

(6) Learner Controlled Instruction (LCI)

The first three types – linear Branching and Mathetics – represents the actual basic formats. The rule system represents inductive and deductive approach. The CAI and LCI are actually the ways and means of providing instructions.

4.12.1. Linear or Extrinsic Programming :

B.F. Skinner of Harvard University developed linear programming model. Psychologists have defined it as *"A programmed material sequence in which each student proceeds in a straight line through a fixed set of items."* This type of programme is also called Skinnerian type of programming because for the first time he used this type of sequence to form the behaviour of animals and prepared ground for human learning.

The instructional material in Linear programming is sequenced into a number of significant small steps called frames. These frames arranged in sequence are presented one at a time to the learner. The learner is required to act in response actively at each step. Immediately learner gets the feedback regarding the exactness of the response. This reinforces the learner and inspires the learner to process to the next frame at his own pace of learning. By passing through all the frames of the program, the learner acquires the desired learning experiences and changes his behaviour.

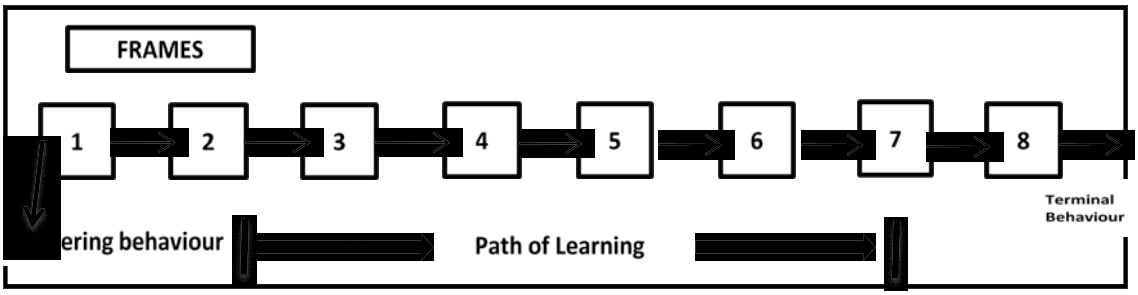

Fig: 4.1: Linear Programming

4.12.1(a) Charateristics of Linear Programming:

1. Linear means scheduled in a straight line. Generally, in linear programme, information is broken down into small steps of 40 to 50 words in length which is called a frame. The learner must respond to each frame in series by filling in word or phrase in a blank.
2. *Linear arrangement:* In such type of programme, the learner proceed in a single series of short steps which are designed to make sure a high rate of correct responding to the questions (frames). Each learner follows same path. The learner starts from his first behaviour to the terminal behaviour following straight-line sequence. All learners pass through the same path.
3. *Responses are controlled:* In linear programme, the programmer controls responses. The responses and their order are fixed. The learner has no option to respond in his own way.
4. *Response is emphasised:* In linear programme, the importance is laid on response. The learner must respond to each frame in order the learning to occur.

5. *Feed-back is quick:* As soon as the learner responds the frame he can immediately compare his response with the response of the programme.
6. *Provision for prompt:* In the beginning, prompts or cues are supplied to helps learning to occur.
7. *Cheating* is dejected by not revealing the answer to the learner.
8. S.D. *is important* and is emphasised in linear model.
9. It may be used from first position.
10. Learner can leave out certain frames.
11. Reaction are self-constructed.

4.12.1(b) Demerits of Linear Programming :

1. N*eed of motivation:* It is assumed that learning becomes boring and learners experience dullness and tediousness. It take too a large amount time to teach very few points.
2. *No place for freedom of choice:* The learner has no alternative of his own to respond, thus, it is alleged that inventive imagination of learner is inhibited.
3. *Expensive:* The researcher found that the preparation of programmed material consumes too much paper and time.
4. Rothkopf that opines that in many programmes, the learners find out the hint as to what is to be filled in blanks and important terms are guessed.
5. It can be used in limited areas where the behaviour is calculable and noticeable such as maths and science.
6. S.L. Pressey and his associates have enquired the value of linear programming format on the following grounds:
   (a) Serial Order: The frames are presented in sequential order.
   (b) Penetrating of material is not allowed as in a textbook. Judgemental learning is not adepted.
   (c) Linear programming does not allow discrimination among responses.
7. Students do not contribute for innovation of answers except to follow a rigid line set by the programme.

8. Programmes are generally designed with a view that learner has no previous background of the subject matter. It is very difficult to find out exactly the background of each learner.
9. In case of book form presentation, learners are likely to be sincere but from all learners we cannot expect sincerity. They can see the right response without reading the frames.

CHECK YOUR PROGRESS:

Q.12. _____ developed the Linear Programming mode.(Fill in the blanks)

Q.13. According to linear programming Recall is more important than recognition in the learning process. (Write True/False)

Q.14. What are the three major types of programmes for programmed learning.

Q.15. What are the structure of the frames of linear programme?

Q.16. The Linear programme is based on the learning theory of _____. (Fill in the blanks).

Q.17. In linear programme every learner follows the _____ path. (Fill in the blanks)

4.12.2. Branching or Intrinsic Programming :

Norman A. Crowder originated the branching or intrinsic programming. He has given its definition as: "It is a programme which adapts to the needs of the students without the medium of extrinsic device as a computer." It is called intrinsic because the learner within himself makes the choice, to become accustomed with the instruction to his needs.

The underlying principle of intrinsic programming postulates that the basic learning takes place during the student's exposure to the new material on each page.

4.12.2(a).Characteristics of Branching Model :

1. Material in a frame is larger; a lot information is presented at each step. A step may consist of two to three paragraphs and occasionally a full page.

2. The method of student response is different from the linear model, student has to make choice out of a number of choices. Multiple-choice questions are asked. Each response to the question is keyed to diverse pages. If the learner selects right response, his response is confirmed and in case he selects wrong response, then he is routed to material which clarify as to why he is wrong.
3. Crowder holds that teaching is communication and so he focuses his attention upon the enhancement of communication.
4. Learner has freedom to decide his own path of action according to the background of subject matter. The learner controls the correct sequence that he will follow.
5. The programme has plenty of chance to utilize the literacy style.
6. Students are more aware and deliberate on the subject matter more carefully.
7. Revealing and correction of errors is essential. Crowder holds that making error is necessary to learning. He permits 20 per cent errors in his model. In such a model first the errors are revealed and then corrected. Learner can make out why he is wrong. Crowder says that it is unrealistic to remove errors in the process of learning.
8. The vital and categorizing attribute of branching model is the fact that the material presented to each student is constantly and directly controlled by the learner's performance in answering questions.
9. Intrinsic programmed material when presented in a book form, the book is called scrambled book because the pages do not follow in regular sequence.
10. It is very helpful to concept learning or where the material is given in larger steps.
11. The role of active response is not central in intrinsic theory. Intrinsic programmes offer less direction to learner as to what material in the frame is important.

4.12.2(b) Assumption of Branching :

i. Learning takes place better if the subject matter is presented in its whole form.

ii. Learning takes place better if the subject matter is presented in the form of significant components or units.

iii. Wrong answers do not essentially hamper the learning of a correct answer.

iv. Multiple-choice items assist more in the learning process.

v. It is based on the possibility of revealing and correcting errors.

vi. Vital learning takes place during the learner's disclosure to the new material.

vii. Learning takes place better if the learner is allowed enough freedom to take choices for adopting the instruction to his needs.

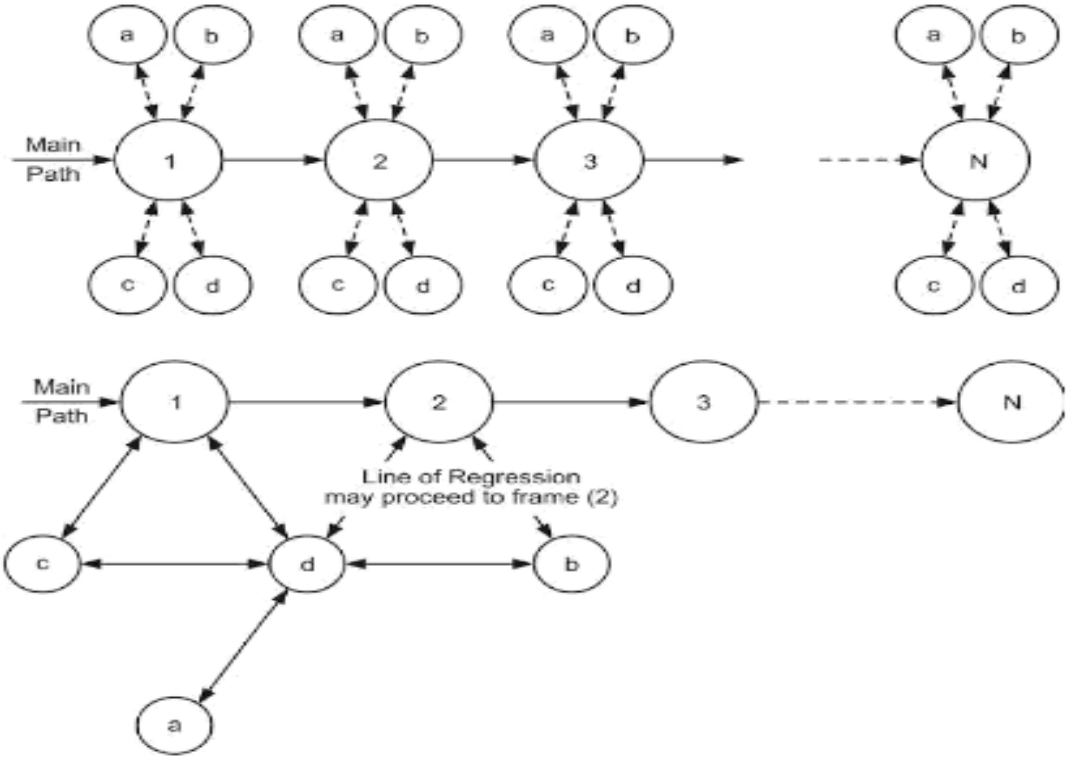

Fig. 4.2.: Main path and branching in branching programme.

4.12.2(c) Merits of a Branching Programme :

i. Big size of a frame as well as the branching reduces unnecessary repetitions and responding, thus reducing the amount of learning time and fatigue.

ii. The drawback and consequences of incorrect logic are usually explained in the remedial frames so that the learner not only gets the correct response but also understands why some other response is not correct.

iii. Instead of simple response, it provides choices in the form of multiple choices.

iv. Through its broad frames, branching programme presents for more freedom to respond and scope of choosing one's own path of learning according to one's need. Thus, it helps in maintaining the interest and initiative of the learner.

v. Branching programme is helpful in the progress of the power of discrimination of the learner.

vi. Branching programme helps in the development of originality and problem-solving capability.

vii. Branching is most useful in the areas beyond facts, definitions and fundamental skills.

viii. The frames, being of larger size, contain a good deal of information and this may enable the programmer to enrich his method and develop his ideas.

4.12. 2 (c) Demerits of Branching :

1. The learner may guess the right response devoid of understanding the subject matter of the frame.
2. Endless branching cannot be provided. It can not make available to the needs of all individuals. It is very complicated to find out the total number of branches for every individual.
3. Preparation method is very expensive, audio-visual equipments is costly.
4. The programme needs review after every two years which is a very costly affair.
5. Programmes are the product of programmer's imagination and it is who decides analytical questions and level of content.
6. Branching model can be used after VI grade because small children do not understand its mechanism.

7. It is very hard to ask questions on the whole matter of frames because frames are too large and sometimes essential subject matter is left.

CHECK YOUR PROGRESS:

Q.18. Who developed Branching Programming?

Q.19. Branching programme is _____ centred.

Q.20. What is the basic structure of Branching/Branched programme?

Q.21. What are the major forms of Branching Programme?

Q.22. Branching programme is also called _____.

4.12.3 Mathetics Programming :

Thomas P Gilbert (1962) is the originator of the idea of mathetics. According to him, *"Mathetics is the systematic application of reinforcement theory to the analysis and construction of complex behaviour repertories usually Known as subject matter mastery, knowledge and skills. Mathetics, if applied diligently, produces materials that exceed the efficiency of lessons produced by any known method."*

The word 'mathetics' is derived from the Greek word 'mathein' which means 'to learn'.

There are two unique types of programming techniques: one stressing the subject matter and its action and the other stressing the behaviour. Mathetics falls under the second category.

Mathetics is eclectic in nature but it is exceptional in application. It analyses the deficiencies and tries to make up for them. The success of task analysis depends to a great extent on the capability and dependability of data. The term 'task analysis' suggests the breaking down of the task into its basic parts and involves detailed listing of component behavioural elements of a job or task. A task analysis is really an inventory to which knowledge, skills and attitudes are identified and isolated with a view to ultimately synthesising them into a hierarchical organisation relevant to the writing of learning prescription.

Task analysis is of three types:

(i) Analysis of topic, (ii) Analysis of job, and (iii) Analysis of skills.

4.12.3(a) Main Characteristics of Mathetics Programming:

(i) Like any other well-thought out instructional plan, a mathetics programme begins with a thorough analysis of what is to be taught.

(ii) In mathetics, an exercise is the mechanical unit of learning instead of a frame as in linear or branching programming.

(iii) No constraint is put on the size of an exercise.

(iv) The size of the exercise is determined by how big a step a learner can practically take at a time.

(v) Each exercise assumes the reinforcement value of completion. In a mathetics style, a different strategy of reinforcement is employed, i.e., other than the 'knowledge' of results, which is the chief source of reinforcement in the linear programming.

(vi) Programme makes use of the techniques of retrogressive or backward chaining.

(vii) Learning instruction involves three principles: (a) Principle of discrimination, (b) Principle of chaining, and (c) Principle of generalisation.

The underlying principle of a mathetics programme is that the closer the learner is to reinforcement when he is taught, the more effectual the reinforcement becomes. The reinforcement, in the case, is the completion of the ask.

4.12.3(b) Different areas most suited fo shaping the behavior through Mathetics Programming

(i) Behaviour needs chain.

(ii) Skills and multifaceted behaviour repertories.

(iii) Behaviour which shows dependence of one on the other.

4.12.3(c) Merits of Mathetics:

(i) It is a job and task-oriented programme.

(ii) Results can be linked to actual goals which we intend to achieve through a mathetics programme.

(iii) Its stress on learner-success at 90/90 criterion level of mastery to motivates the learner.

(iv) It make use of the principle of backward chaining.

(v) It is relevant, significant, significant and suitable in the eyes of the learner and the programmer.

(vi) It can be applied to a wide range of subject matter but it particularly suits the teaching of skills where the main objective is transfer of training of skills from one condition to another.

4.12.3(d) Demerits of Mathetics Programming :

(i) It is very mechanical in nature and as such demands a lot of expertise, training and labour on the part of the programmer.

(ii) It is not fit for learning the material of all subjects. Only concrete material and subject material involving psycho-motors skills can be gainfully programmed by means of Mathetics.

(iii) This programme makes insufficient provision for individual differences. All learners have to learn the same way.

(iv) It provides very little choice to the learners, as constructed responses are usually required.

(v) The learner encounters complexity in constructing the last response or mastery response in the beginning.

(vi) Mathetics cannot be used for factual content.

(vii) Mathetics cannot be used for higher cognitive and affective learning objectives.

(viii) Mathetics does not provide any curative help for the weaknesses and difficulties of learners.

(ix) Mathetics is not based on any sound learning theory.

CHECK YOUR PROGRESS:

Q.23. Who is the originator of mathetics?

Q.24. The term Mathetics is derived from the Greek word -_____.

Q.25. What are the areas of behaviour most suited for shaping through mathetics programming?

4.13 Application of Programmed Instruction in India :

Programmed instruction is still in its formative years in India. Programmed instruction as an optional or elective paper has been included at the B.Ed/M.Ed. level in a few universities in India. It also forms a part of the paper of Educational Technology/Educational Innovation. However, its actual classroom use is almost nil.

As far back as 1996, the Kothari Commission had suggested to develop programmed material in different subjects to test the appropriateness of the method in Indian conditions. An Association of Programmed Instruction was formed to organize the research being done at different centres in the country. The association also distributes the information on new studies through its journal issued from time to time. The *National Council of Educational Research and Technology* has also done some work in the field. Inspite of all these efforts, it may be stated that the application of programmed instruction has yet to make any appreciable impact on our classroom teaching. Our methods of teaching remain traditional, largely.

Following are the important factors, which stand in the way of introducing programmed instruction in Indian schools:

(i) Resistance to adjust.

(ii) Lack of good programmes and programmers

(iii) Lack of facilities.

4.14 Summary :

- Programmed instruction is a systematically planned, empirically established and effectively controlled self-instructional technique for providing individualised instruction to the learner through logically sequenced small segments of the subject matter by using the principles of operant conditioning and schedules of reinforcement.
- Steps of Programming- (i). Preparation, (ii). Writing the Programme, (iii). Tryout and Revision.
- Types of Programmed Instruction: (i) Linear Programming, (ii) Branching Programming and (iii) Mathetics

- Linear programming model was developed by B.F. Skinner of Harvard University. It has been defined by psychologists as "A programmed material sequence in which each student proceeds in a straight line through a fixed set of items." This types of programme is also called Skinnerian type of programming because for the first time he used this type of sequence to shape the behaviour of animals and prepared ground for human learning.
- The branching or intrinsic programming was originated by Norman A. Crowder. He has given its definition as: " It is a programme which adapts to the needs of the students without the medium of extrinsic device as a computer." It is called intrinsic because the learner within himself makes the decision, to adapt the instruction to his needs. The rationale of intrinsic programming postulates that the basic learning takes place during the student's exposure to the new material on each page.
- Thomas P Gilbert (1962) is the originator of the concept of mathetics. According to him, "Mathetics is the systematic application of reinforcement theory to the analysis and construction of complex behaviour repertories usually Known as subject matter mastery, knowledge and skills. Mathetics, if applied diligently, produces materials that exceed the efficiency of lessons produced by any known method."
- The word 'mathetics' is derived from the Greek word 'mathein' which means 'to learn'.
- Basic Steps in Mathetical Programmes-
  (i) Data collection and task analysis
  (ii) Prescription for mastery-characteristics of the trainees are assessed.
  (iii) Characterisation and lesson plan – deficiency is removed and plan is prepared to overcome the deficiency.

4.15. Key Terms :

Programme or Programming: Arrangement of the stimulus material in an order of presentation

Frame: It is a digital data transmission unit in computer networking and telecommunication.

Self-pacing: Self-paced instruction is any kind of instruction that proceeds based on learner response

4.16. Answer to Check Your Progress :

Answer to Q.No.1.: Sydney L. Pressey (1926)

Answer to Q.No.2.: Learning.

Answer to Q.No.3.: E.L.Thorndike (1874-1949)

Answer to Q.No.4.: False (Strategy)

Answer to Q.No.5.: The Law of Effect

Answer to Q.No.6.: Smith and Moore (1962). "Programmed instruction is the process of arranging the material to be learned into a series of sequential steps, usually it moves the students from a familiar background into a complex and new set of concepts, principles and understanding."

Answer to Q.No.7.: i. Programmed instruction is a method or technique of giving or receiving individualised instruction from a variety of sources like programmed text book, teaching machine, computers etc. with or without the help of a teacher.

ii. In this technique the instructional material is logically sequenced and broken into suitable small steps or segments of the subject matter called frames.

iii. For sequencing a particular unit of the instructional material, the programmer has to pay consideration for the initial or entry behaviour of the learner with which it begins and the terminal behaviour or the competence which student is required to achieve.

Answer to Q.No.8.: True

Answer to Q.No.9.: (i). A well-programmed learning is a great thrust in the direction of individualised instruction, as it is tailored to the needs of the individual learner in the class.

(ii). It permits an individual learner to progress at his own speed. An intelligent learner no longer needs to be bored or allowed to lose interest on account of slow progress of other learners of the class. He can make progress at his own pace, even if it is faster than the rest of the class.

(iii). Since a programme requires continuous response from the learner, it overcomes inertia and passivity on the part of the learner.

Answer to Q.No.10.: (i). It is also argued that there is too much emphasis in learning facts and very little emphasis on the mastery of principles and concepts.

(ii). Some critics of programmed instruction maintain that the user of a programme does not know where he is headed.

(iii). They also point out that the learners are not aware of the organisation and programmed instruction is unrelated to other aspects of instruction.

Answer to Q.No.11.:

(i) Help students to learn by doing.

(ii). Provide the situation where learning is at learner's own pace.

(iii). Help students to learn without the presence of a teacher.

(iv). Present the content in a controlled manner and in logically related steps

Answer to Q.No. 12: B.F. Skinner

Answer to Q.No. 13: True

Answer to Q.No.14: (i). Linear, (ii). Branching, and (iii). Mathetics

Answer to Q.No.15.: (i). Stimulus-Contextual Form, (ii) Response-Desired Behaviour Form and (iii) Reinforcement-Confirmation Form.

Answer to Q.No. 16: B.F. Skinner

Answer to Q.No. 17. Same path

Answer to Q.No. 18.: Norman Crowder

Answer to Q.No. 19: Stimulus

Answer to Q.No. 20.: The basic structure of Branching/Branched programme is:

(i). Home Page and

(ii) Wrong Page

Answer to Q.No. 21.: (i) Constructed-Response Question, (ii). Constructed-choice Questions. (iii). Block Questions and (iv) Linear Sequence.

Answer to Q.No. 22.: Intrinsic programme

Answer to Q.No. 23.: Thomas P Gilbert

Answer to Q.No. 24.: Mathein

Answer to Q.No. 25: (i). Behaviour requiring chain.

(ii). Skills and complex behaviour repertories.

(iii). Behaviour which shows dependence of one on the other

4.17. Essay Type Questions :

Q.1. Define programmed instruction. What are its principles?

Q.2. What is linear programme? Describe its assumptions according to Skinner.

Q.3. What are the characteristics of a good linear programme? How can this programme be used at secondary level?

Q.4. What is branching programme? Discuss its assumptions.

Q.5. Briefly discuss the limitations of branching programme.

4.18. FURTHER READING:

- Sampath.K and others *"Introduction to Educational Technology"*
- Chauhan, S.S. "*Advanced educational Psychology"*
- Mangal, S.K. *"Foundations of Educational Technology"*

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Unit: 5
Educational Technology for Teachers

Contents:

5.1 Introduction:

Educational Technology is the scientific application of psychology of learning to practical teaching problems. It is a dynamic, continuous, active and progressive mechanism in the field of education. According to Takashi Sakamato, "Educational Technology is an applied or practical study which aims at maximizing education effect by 'Controlling' such relevant facts as educational purposes, educational environment, conduct of student, behavior of instructors and interrelations between students and instructors."

This means that Educational Technology is a great technique which provides a better learning environment for students and making teacher's behavior more effective along with bringing maximum educational output with desirable educational methods, contents, ideas, objectives, better teacher-student relationship etc. and in keeping with the dynamic environment of today's

world of technology. Educational Technology includes Instructional Technology, Teaching Technology, Programmed Learning, Micro-Teaching and System Analysis etc. It does not only mean including electronic media and hardware materials, machines in education but most importantly also including psychology, science, technology, system, art, audio-visual aids to the educational field. It enables to bring newer dimensions in the field of education as the education system is also changing along with time. It emphasizes on providing valuable benefits in the teaching-learning process to bring forth best results in an economic and interesting way. Educational Technology modifies the behavior of both teachers and learners according to the need of the hour. Educational Technology has innumerable functions in the field of education like selecting teaching-learning materials, finding out clearly the goals and objectives of education, development of curriculum, production and development of the teaching-learning material, teacher-training, development and selection of teaching-learning strategies and tactics, use of appropriate devices and control through evaluation, audio-visual aids, effective utilization of Hardware and Software and mass media, effective utilization of sub-system of education, providing essential feedback. Computer Assisted Instruction (CAI), Computer Managed Learning (CML) and Computer Aided Evaluation (CAE), Open Educational Resources, Teleconferencing are the innovations of educational technology.

Stop to Consider

Educational Technology is the scientific application of psychology of learning to practical teaching problems.Educational Technology modifies the behavior of both the teachers and learners according to the need of the hour.

Check Your Progress

Q.1. Define Educational Technology.

Q.2. What are the innovations of Educational Technology regarding teaching-learning process?

5.2 Objectives

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

- understand the meaning of Educational Technology.
- analyse Flanders Interaction Analysis
- describe about the Computer Assisted Instruction (CAI), Computer Managed Learning (CML) and Computer Aided Evaluation (CAE)
- understand the Meaning of Internet and its Historical Background, Importance and Utility.
- know role of Internet in Education.
- discuss Teleconferencing, E-learning Tools and Open Educational Resources.

5.3 Flanders Interaction Analysis

Flanders Interaction Analysis is an effective way of reflecting the classroom teaching-learning environment. The classroom situation will only be useful when there is proper interaction between the teacher and students. This interaction can be assessed step by step to make the teaching-learning process a successful one with adequate feedback. The teaching effectiveness of a teacher can be judged or analysed in a systematic way. The study analysis of the interaction between teacher and students during classroom

situation is called Interaction Analysis. This system was developed by Ned Flanders and as such it is called Flanders Interaction Analysis. According to Dr. S.K. Thakur, classroom interaction analysis may be defined as "an instrument which is designed to record categories of verbal interaction during, or from, recorded teaching learning sessions. It is a technique for capturing qualitative and quantitative dimensions of teacher's verbal behavior in the class-room."

The investigators or observers who observe and analyse the classroom interaction focus on the following tasks:-

a) Teacher-pupil Interaction.

b) Pupil-pupil Interaction.

c) Interaction with various materials and the focus is given to the Affective elements, Cognitive elements, Psychomotor elements, Activity, Content, Physical environment and sociological structure.

Flanders Interaction Analysis is a scientific and systematic recording of the classroom behavior and activities. This analysis depicts the classroom teaching-learning interaction. It helps to evaluate and provide feedback on the aspect of the interaction done between teacher and students. The observers must have some rules to analyse the classroom interaction like knowledge of studying the classroom situation, place of sitting, recording the category number, instant recording, no partiality, recording after every three seconds till the observation is over. Only trained and expert persons can be engaged in this analysis of classroom interaction. The demerits of this system are that they are time consuming, not useful for non-verbal behavior and it is not possible to record each and every reaction of the teacher and students during the class.

Stop to Consider

Flanders Interaction Analysis is a scientific and systematic recording of the classroom behavior and activities. Classroom interaction focusses on (a) Teacher-pupil Interaction, (b) Pupil-pupil Interaction, and (c) Interaction with various materials

Check Your Progress

Q.3. What is Flanders Interaction Analysis?

Q.4. On which tasks do the observer focuses in Flanders Interaction Analysis?

5.4 Computer Assisted Instruction (CAI)

The word 'Computer' is derived from the Latin word 'Computer'. It means to compute which means to determine by calculation. A computer consists of five basic parts. They include Input equipment, Output equipment, a Memory store, a Processing unit and a Control unit. A complete Computer includes Monitor, Keyboard, System Unit, Mouse, Printer. The demand of computer is increasing day by day as it enables an individual to perform special tasks. As such, computers are inevitable in the field of education too. The benefits of computer in general include its accuracy to get correct input, its working capacity in the same manner all the time and its speed. It carries informations and instructions in less than a millionth of a second. The computer technology has undergone various changes along with the changing times. This has resulted in the coming of different generations of computers like First Generation, Second Generation, Third Generation, Fourth Generation and Fifth Generation. A computer can be classified into three types- Analog, Digital and Hybrid computers. Again, on the basis of size

computers are divided into Micro Computers, Mini Computers, Mainframe Computers and Super Computers.

Computer Aided Instruction or CAI is a process of imparting instruction to the students with the help of computer as a machine. Computer Assisted Instruction uses the programmed textbooks and makes the teaching-learning process an individualized and self-directed instructional process. In fact, Computer Assisted Instruction is an advanced form of teaching machine. This type of instruction can be defined as the method of instruction in which there is a purposeful interaction between a learner and computer device for helping the individual learner to achieve the desired instructional objectives with his own pace and abilities at his command. There are various instructional modes of CAI. They are described below-

- **Tutorial mode-** In this mode the learners are given a question to which they have to give a response. This is followed by a feedback as to whether the response was correct or incorrect.
- **Drill and practice mode-** In this mode the learners are assumed to have a clear understanding of the concept that he has already learnt. A number of graded questions have to be solved by the learners. The correct responses give positive feedback and the incorrect responses are corrected. The learner can repeat this mode until he achieves mastery on learning the particular task.
- **Discovery mode-** In this mode the learners are given a number of problems and are also given the freedom to solve them by following trial and error method. Through this mode the learners keep on trying again and again until he reaches the correct response. This helps the learners to discover the actual technique of solving a problem.

- **Simulation mode-** In this mode the learners have to learn in a simulated situation which can be used in a real situation.
- **Gaming mode-** This mode is very interesting specially for small children. In this mode the learners learn spelling, name of places, general knowledge, problem-solving skills etc. through playing various games opposite to the computer.

Computer Assisted Instruction thus is a process of instruction which promotes an interaction between teacher and students to achieve the set and pre-determined goals of education through various modes of instructions.

5.5 Computer Managed Learning (CML)

In this type of instruction the computer manages the instructional process by gathering information, storing information to provide self-learning. It guides the learners to learn from different modes and sources. The computer forms some learning objectives of some topics and asks the learners to identify them. The computer instructs the learners to study some pages from some books to achieve the objectives. After this the computer puts some questions to the learners and evaluates their learning. Following this, the next step includes some practical tasks that the learners are to perform. They have to perform a laboratory experiment to make learning permanent. According to Hofmeister, "Computer Managed Learning is the systematic control of instruction by the computer, prescriptions, and thorough record-keeping. CML is an electronic learning management system that allows data from tests to be analysed, providing information which can be the basis of educational decisions." CML helps both the teacher and students to follow suitable learning services by assuming every user as an individual. CML is an accessible software and relevant to the learning needs. It provides feedback to the users and helps the teachers to refine and improve the

teaching method. CML assists in sharing valuable resources developed by teachers from time to time. The teaching environment can be controlled to achieve the goals of learning. However, the users must be careful while using CML as many unknown problems related to informatory materials may arise and make the users confused. CML further helps the Principals, management bodies of schools and also the Government to formulate some educational policies by collecting necessary data.

5.6 Computer Aided Evaluation (CAE)

Computer Aided evaluation is a process of evaluation of students' learning with the help of computers. It is extensively used by teaching staff and students. It is a programme which is designed to provide proper guidance to the learners, as to which task has been learnt properly by the students and which tasks are learnt incorrectly. Different grades of questions are asked to the students according to the programmed textbooks and tasks related to their subject of study. The responses of the students to those questions are evaluated through the computers already processed in the programmed learning. CAI is a software that helps to create more suitable learning strategies at different levels and it tracks the progress of the students. The easy access of CAI makes it significant and special for the users. The computers never get tired and hence the learners can repeat the question answer process of the programmed task and get appropriate feedback and achieve mastery on a particular subject or topic. The teachers get more free time if the CAI is used for students' learning evaluation. Perhaps, this evaluation may also include the evaluation of the OMR answer sheets of any competitive examination.

Stop to Consider

Computer Assisted Instruction uses the programmed textbooks and makes the teaching-learning process an individualized and self-directed instructional process.In Computer Managed Learning the computer manages the instructional process by gathering informations and storing information to provide self-learning.CAI is a software that helps to create more suitable learning strategies at different levels and it tracks the progress of the students.

Check Your Progress

Q. 5. Name the modes of Computer Assisted Instruction (CAI).

Q.6. What is the full form of CMI?

Q.7. Why is the CAE designed?

5.7 Meaning of Internet

Internet has a tremendous role in connecting people from one place to the other within a few seconds through various modes. Internet is a network of networks including numerous computers all over the world. These computers are connected through cables and satellites and they communicate through protocol. A computer, communication software and a telephone line is necessary to connect to the internet. Local Area Network or LAN is a network that connects more than two computers within a small or local geographical area. And Wide Area Network or WAN is a network connecting computers all over the world. Internet is a network that makes people stay in contact or connect from every corner of the world. Internet has brought changes to the life style of the people of the world. Physical

effort to contact with one another has been reduced as they can contact through the virtual world using Internet.

5.7.1 Historical Background

The history of Internet can be traced back to the 1950s with the development of electronic computers. Initially, Wide Area Networking or WAN emerged in several computer science laboratories in the United States, United Kingdom and France. Internet was started as ARPANET by the department of Defence in 1969. The Advanced Research Projects Agency Network (ARPANET) began as a military computer network. Later in 1984, the National Science Foundation (NSF) began a chain of connections where institutions were connected to their nearest computing centers which again connected to central supercomputing centers. The first message was sent over the ARPANET in 1969 from computer science Professor Laeonard Kleinrock's laboratory at University of California, Los Angeles. The ARPANET project led to the development of protocols for the internetworking, where multiple separate networks could be joined into a network of networks. By 1980s, there were many networks around the world but all could not communicate with each other. Then, it was decided to standardize the system and in 1989 the Internet was formally created. The Internet is not a private property and is not administered or owned by any official body. But there are some organizations that always work to make the internet more accessible and useful.

5.7.2 Importance of Internet

Internet is an essential requirement of the current world as the world has transformed into a global village with the sharing of knowledge and information at a rapid rate. People are able to communicate with each other within a

minute. The importance of Internet lies in the fact that it generally helps the common people and specifically helps teachers and students to develop the education system. Students and teachers can collect innumerable informations and knowledge on any field or subject they want to know through the various websites available. It helps them to remain updated as the newest and latest information can be availed through the internet at any time. The students and teachers can avail any information by sitting at any corner of the world. Not only do they avail services but also they themselves can create some websites and share, post or upload self-made educational videos for the classroom.

5.7.3 Utility of Internet

Internet has proved to be of use in a multi-purpose way. It has many websites through which people get the opportunity to avail various services. Internet has been useful for entertainment and online shopping purpose, e-commerce etc. E-commerce means electronic commerce which is used in the field of business, trade, giving product advertisements etc. Internet is a must in the bank at present because transaction is mostly done through ATM (Automated Teller Machine) and ATP (Automatic Transaction Process). Swipe card is a recent service that needs Internet connection for successful transaction of money. On-line shopping of cosmetic products, dresses, gadgets are done through internet services by sitting at their own places. Cash on delivery of purchased products, or immediate payment of money is possible through e-banking. With the help of the Internet we can connect to the ongoing programmes broadcasted on radio and telecasted on television. Tremendously, Internet extends its facilities to the users, specially teachers and students who can avail maximum facilities with minimum cost and effort.

5.7.4 Role of Internet in Education

Education system keeps on changing with the change of time and on the basis of needs of the students. In the educational field Internet plays a vital role to help both teachers and students. The role of Internet in Education can be described below-

- **E-mail-** Electronic Mail or E-mail is designed to allow teachers and students to communicate with the help of text messages, voice, videos, graphic. The sender and receiver of e-mail must have e-mail address of their own allotted by IPS (Internal Server Provider).
- **Information Infrastructure-** Internet provides many informations and services to both the teachers and students by the help of different softwares.
- **Videotex-** The Videotex system is composed of a keyboard, a TV display unit, a decoder, a telecommunication link and a central computer containing a data base. Videotex transmits text information and graphics from a remote data base computer through telephone network for display on television screen. Videotex is very useful in Distance Education for a two-way interaction.
- **Teletext-** Teletext is an electronic communication system in which printed information is transmitted by television signal to sets equipped with decoders. This can be applied by teachers to communicate with students.
- **Fax-** Fax is an exact copy or duplicate of anything. In education, fax is mostly used for documents. The document to be sent by fax is done through a Fax Machine. Here the

documents exactly appear like the original document. The sender still has the original document and the receiver has the copy or fax. Both teachers and students can share necessary information.

- **Teleconferencing-** Tele-conferencing is a way of communication which enables one person to connect with the other specially in the remote areas. Teleconferencing is of three types- Audio Conferencing, Video Conferencing and Audio-Video or computer Conferencing. Teachers and students can avail this service to interact and discuss subject matter of their curriculum in a virtual world through internet connection.

- **Radio Programmes-** If teachers and students want to connect directly with the important educational programmes broadcasted in radio, they can take help of the internet facility.

- **Digital Library-** Digital Library is a large store house of knowledge and information that can be accessed through digital internet services. We can search for many useful education related articles, journals, research publications etc.

- **On-line Education**- On-line education is an innovation of technology helping learners of distance education. This type of education provides scope to learn by using various modes and it includes satellite courses, computer-based program, video-instructions, educational television, correspondence or home study courses.

- **Electronic Bulletin Board Service**- This service of the internet helps the teachers and learners to listen and take part in group discussion. The participants upload or share information related to their subject matter.
- **Research**- Internet tremendously helps researchers of any field to pursue their investigation properly.

Stop to Consider

Internet is a network of networks including numerous computers all over the world.The history of Internet can be traced back to the 1950s with the development of electronic computers.**E-mail, Videotex, Teletext, Fax, Teleconferencing, Radio Programmes, Digital Library, On-line Education, Electronic Bulletin Board Service and Research** are some of the important facilities that can be availed through Internet services.

Check Your progress

Q.8. State the utility of Internet?

5.8 Teleconferencing

Tele-conferencing is a great innovation of electronic age and it has changed the techniques of teaching, specially in the field of Distance Education. In this communication, one to one or one to groups of persons, can communicate among each other. Discussion on study related topics and exchange of views among teachers and students is possible through Tele-conferencing. The teacher can deliver lectures on the topic related to their curriculum. The students interacting in the communication process may clear

their doubts from the teacher by raising questions. The teacher and students can communicate through Tele-conferencing with three modes- Audio-Teleconferencing, Video-Teleconferencing and Computer-Teleconferencing. Tele-conferencing is a way of communication which enables one person to connect with the other specially in the remote areas. The types of Tele-conferencing can be described below-

- **Audio Teleconferencing-** In audio-teleconferencing, the teachers and students can only hear or listen to the topics of discussion. This conferencing requires a multiple phone line electric switch for the transmission of data.

- **Video Teleconferencing-** In this conferencing type there are greater facilities than the audio-teleconferencing as students and teachers can not only listen to one another but also have face to face interaction scattered over wide areas. It makes teaching-learning process very interesting and effective. It is a two-way movement of audio and video signals.

- **Computer Teleconferencing-** Computer Tele-conferencing is again more advanced than the two above mentioned types of conferencing. This type has the facility to communicate among teachers and students according to their convenience of time. This conferencing has the capacity to store the conference dialogue in the computer. Communication here is possible through text and graphics. The sender can send them and the receiver can open and receive them whenever it is convenient for the sender.

Tele-conferencing has the advantages of allowing the users to communicate with each other through electronic devices according to their convenience of time. It is a better mode of education that removes the dullness of traditional education. It provides the users with greater flexibility, motivation and immediate feedback.

5.9 E-Learning Tools

Most of the teachers want to create a sparking and joyful learning environment for students. But this is not an easy task. There are greater demands in a classroom. In fulfilling such demands, the teachers often get frustrated. To make the classroom student centred and more interesting, E-learning is instrumental. E-learning tools help the students to be more responsive to the teaching stimuli. It is very essential to meet the challenge and potential of the students in the classroom environment. Co-operative learning is possible through the use of e-learning. Teachers who are able to integrate e-learning technology in classroom may reorganize their roles in keeping with the changing demands of time. E-learning means the use of Information and Communication Technology (ICT) that helps in enhancing education. E-learning is basically education via the Internet, network or standalone computer. E-learning process includes Web-based learning, computer-based learning, virtual classrooms and digital collaborations. The mediums used to learn any topic through such learning aspects are called E-learning tools. These tools are mainly divided into three types-Curriculum tools, Digital Library tools and Knowledge representation tools. They are described below-

- **Curriculum Tools-** Curriculum tools include instructional tools, administration tools and student tools. These tools are widely used by teachers and students for browsing class materials, assignments, readings, projects and other necessary resources. Sharing and collaboration of discussion forums, self-testing and evaluation facilities can be accessed through curriculum tools. WebCT and Blackboard are largely used curriculum tools.
- **Digital Library Tools-** These tools consist of numerous correct knowledge or informations regarding any subject matter. The users can search, browse and discover the collections on any specific

topic they want to know. These tools are store houses of books or treasure of information largely useful for students.

- **Knowledge representation tools-** Knowledge representation tools assist the users specially teachers and students, to visually review, capture and develop knowledge. These tools provide an active learning environment for learners.

E-learning is thus a very important and updated way of learning beneficial to all kinds of learners be it formal, informal or non-formal. This learning process can reach learners of almost every corner of the world. E-learning, directly or indirectly, helps to achieve the objectives of education in an innovative way.

Stop to Consider

Tele-conferencing has three modes of communication among the users- Audio-Teleconferencing, Video-Teleconferencing and Computer-Teleconferencing.Tele-conferencing is a way of communication which enables one person to connect with the other specially in the remote areas.E-learning means the use of Information and Communication Technology (ICT) that helps in enhancing education.

Check Your Progress

Q.9. What are the types of Tele-conferencing?

Q.10. What are E-learning Tools?

5.10 Open Educational Resources (OER)

Generally speaking, Open Educational Resources (OER) are teaching, learning and research materials in either digital form or otherwise. These resources are open and free to be used by public. These are openly licensed

educational materials. They are helpful for educators, teachers, students, self-learners etc. The available educational resources in OER are lesson plans, power point presentations, full courses, course materials, textbooks, videos related to education, tests, software, quizzes, syllabi, instructional modules, simulations etc. These can be used, re-used, shared, posted and adapted. Some of the important resources helpful for teachers and students are described below-

- **Lesson Cast:-** It is a website where many important informations and ideas related to teaching are submitted by experienced teachers and personnel. They submit ideas on lesson planning, classroom management strategies in 2 minutes 30 seconds or less. The documents are in the form of Power Point, Document, Pictures or Web Cam etc. The submitted documents are further reviewed by experts and accomplished teachers and then shared online. This website assists the teachers greatly to learn and apply the classroom management techniques practically in a classroom situation.

- **Glogster EDU:-** This webpage or poster is created to make possible an interactive visual platform consisting audio, video, text, images, graphics, drawing, data etc. This webpage can be used for lesson planning or preparation, presentations, distance teaching and much more. The benefit of Glogster is that it provides diversified ways to teach and also helps in saving papers.

- **Teacher Tube:-** In this website teachers create and upload self ideas and videos useful for classroom. It is a safe mode to upload and share their ideas online without any risk of inappropriate content.

- **Story Birds:-** In this webpage there are short art inspired stories with the help of which teachers can make their classroom teaching interesting and full of life.

- **Flashcard Machines:-** Flashcard is a card-bearing information as words or numbers, on either only one side or both sides. Teachers can create flashcards for students and make the classroom interesting.
- **Edmodo:-** Edmodo is a networking site which helps a teacher to communicate with students online. Teachers can share or post assignments, test notifications, create polls, award grades etc. Students can check important notifications and become updated.
- **Bitstrips for Schools:-** Here, teachers can design their own cartoon characters, write dialogues and create online comic strips to teach the students any number of subjects and topics.
- **Kidblog:-** It is a very useful platform with advanced primary features specially for elementary and middle school students. Teachers have administrative control on the posts that are uploaded.

These resources have proved to be useful and effective in the teaching-learning process. They have benefitted both teachers and students to build a modern technological and educational environment.

Stop to Consider

Lesson Cast, Glogster EDU, Teacher Tube, Story Birds, Flashcard Machines, Edmodo, Bitstrips, Kidblog are some of the very useful resources which teachers and students can avail.

Check Your Progress

Q.11. What is Edmodo?

5.11 Summing Up

- Educational Technology includes Instructional Technology, Teaching Technology, Programmed Learning, Micro-Teaching and System Analysis etc.
- Computer Assisted Instruction (CAI), Computer Managed Learning (CML) and Computer Aided Evaluation (CAE), Open Educational Resources, Teleconferencing are the innovations of educational technology.
- Flanders Interaction Analysis is an effective way of reflecting the classroom teaching-learning environment.
- Computer Assisted Instruction uses the programmed textbooks and makes teaching-learning process an individualized and self-directed instructional process.
- Computer Managed Learning guides the learners to learn from different modes and sources.
- Computer Aided Evaluation is a programme which is designed to provide proper guidance to the learners, as to which task has been learnt properly by the students and which tasks are learnt incorrectly.
- Internet is a network of networks including numerous computers all over the world. These computers are connected through cables and satellites and they communicate through protocol.
- In the educational field Internet plays a vital role to help both teachers and students.
- Tele-conferencing is a great innovation of electronic age and it has changed the techniques of teaching, specially in the field of Distance Education.

- E-learning process includes Web-based learning, computer-based learning, virtual classrooms and digital collaborations. The mediums used to learn any topic through such learning aspects are called E-learning tools.
- E-learning tools are mainly divided into three types-Curriculum tools, Digital Library tools and Knowledge representation tools.
- Open Educational Resources (OER) are teaching, learning and research materials in either digital form or otherwise.

5.12 References and Suggested Readings

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