MAEDN-501

Educational Technology

MA EDUCATION

3rd Semester

Rajiv Gandhi University

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EDUCATIONAL TECHNOLOGY

MA [EDUCATION]

Third Semester

MAEDN-501

RAJIV GANDHI UNIVERSITY

Arunachal Pradesh, INDIA - 791 112

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About the University

Rajiv Gandhi University (formerly Arunachal University) is a premier institution for higher education in the state of Arunachal Pradesh and has completed twenty-five years of its existence. Late Srnt. Indira Gandhi, the then Prime Minister of India, laid the foundation stone of the university on 4th February, 1984 at Rono Hills, where the present campus is located.

Ever since its inception, the university has been trying to achieve excellence and fulfill the objectives as envisaged in the University Act. The university received academic recognition under Section 2(f) from the University Grants Commission on 28th March, 1985 and started functioning from 1st April, 1985. It got financial recognition under section 12-B of the UGC on 25th March, 1994. Since then Rajiv Gandhi University, (then Arunachal University) has carved a niche for itself in the educational scenario of the country following its selection as a University with potential for excellence by a high-level expert committee of the University Grants Commission from among universities in India.

The University was converted into a Central University with effect from 9th April, 2007 as per notification of the Ministry of Human Resource Development, Government of India.

The University is located atop Rono Hills on a picturesque tableland of 302 acres overlooking the river Dikrong. It is 6.5 km from the National Highway 52-A and 25 km from Itanagar, the State capital. The campus is linked with the National Highway by the Dikrong bridge.

The teaching and research programmes of the University are designed with a view to play a positive role in the socio-economic and cultural development of the State. The University offers Undergraduate, Post-graduate, M.Phil and Ph.D. programmes. The Department of Education also offers the B.Ed. programme.

There are fifteen colleges affiliated to the University. The University has been extending educational facilities to students from the neighbouring states, particularly Assam. The strength of students in different departments of the University and in affiliated colleges has been steadily increasing.

The faculty members have been actively engaged in research activities with financial support from UGC and other funding agencies. Since inception, a number of proposals on research projects have been sanctioned by various funding agencies to the University. Various departments have organized numerous seminars, workshops and conferences. Many faculty members have participated in national and international conferences and seminars held within the country and abroad. Eminent scholars and distinguished personalities have visited the University and delivered lectures on various disciplines.

The academic year 2000-2001 was a year of consolidation for the University. The switch over from the annual to the semester system took off smoothly and the performance of the students registered a marked improvement. Various syllabi designed by Boards of Post-graduate Studies (BPGS) have been implemented. VSAT facility installed by the ERNET India, New Delhi under the UGC-Infonet program, provides Internet access.

In spite of infrastructural constraints, the University has been maintaining its academic excellence. The University has strictly adhered to the academic calendar, conducted the examinations and declared the results on time. The students from the University have found placements not only in State and Central Government Services, but also in various institutions, industries and organizations. Many students have emerged successful in the

National Eligibility Test (NET).

Since inception, the University has made significant progress in teaching, research, innovations in curriculum development and developing infrastructure.

About IDE

The formal system of higher education in our country is facing the problems of access, limitation of seats, lack of facilities and infrastructure. Academicians from various disciplines opine that it is learning which is more important and not the channel of education. The education through distance mode is an alternative mode of imparting instruction to overcome the problems of access, infrastructure and socio-economic barriers. This will meet the demand for qualitative higher education of millions of people who cannot get admission in the regular system and wish to pursue their education. It also helps interested employed and unemployed men and women to continue with their higher education. Distance education is a distinct approach to impart education to learners who remained away in the space and/or time from the teachers and teaching institutions on account of economic, social and other considerations. Our main aim is to provide higher education opportunities to those who are unable to join regular academic and vocational education programmes in the affiliated colleges of the University and make higher education reach to the doorsteps in rural and geographically remote areas of Arunachal Pradesh in particular and Northeastern part of India in general. In 2008, the Centre for Distance Education has been renamed as "Institute of Distance Education (IDE)."

Continuing the endeavor to expand the learning opportunities for distant learners, IDE has introduced Post Graduate Courses in 5 subjects (Education, English, Hindi, History and Political Science) from the Academic Session 2013-14.

The Institute of Distance Education is housed in the Physical Sciences Faculty Building (first floor) next to the University Library. The University campus is 6 kms from NERIST point on National Highway 52A. The University buses ply to NERIST point regularly.

Outstanding Features of Institute of Distance Education:

(i) At Par with Regular Mode

Eligibility requirements, curricular content, mode of examination and the award of degrees are on par with the colleges affiliated to the Rajiv Gandhi University and the Department(s) of the University.

(ii) Self-Instructional Study Material (SISM)

The students are provided SISM prepared by the Institute and approved by Distance Education Council (DEC), New Delhi. This will be provided at the time of admission at the IDE or its Study Centres. SISM is provided only in English except Hindi subject.

(iii) Contact and Counselling Programme (CCP)

The course curriculum of every programme involves counselling in the form of personal contact programme of duration of approximately 7-15 days. The CCP shall not be compulsory for BA. However for professional courses and MA the attendance in CCP will be mandatory.

(iv) Field Training and Project

For professional course(s) there shall be provision of field training and project writing in the concerned subject.

(v) Medium of Instruction and Examination

The medium of instruction and examination will be English for all the subjects except for those subjects where the learners will need to write in the respective languages.

(vi) Subject/Counselling Coordinators

For developing study material, the IDE appoints subject coordinators from within and outside the University. In order to run the PCCP effectively Counselling Coordinators are engaged from the Departments of the University, The Counselling-Coordinators do necessary coordination for involving resource persons in contact and counselling programme and assignment evaluation. The learners can also contact them for clarifying their difficulties in then respective subjects.

SYLLABUS

Objectives:

1. To enable the students to know about nature and scope of Educational Technology.
2. To familiarize the students with the effective teaching learning process.
3. To enable the students understand models of teaching
4. To enable the students analyse process of communication.

Course Content:

UNIT I. **Education and Technology:**

- Meaning, Nature and scope of Educational Technology, its significance
- Hardware, software approaches-Technology in Education and Technology of
- Education.
- Objectives of Educational Technology at Micro level and Macro level
- Systems Approach

UNIT II. **Teaching-learning Process:**

- Educational Objectives with special reference to Cognitive, Affective and Psychomotor Domain.
- Nature of teaching-learning process
- Teaching variables-Phrases of Teaching-Pre-active, Inter-active, Post-active
- Levels and operations of teaching learning

UNIT III. **Models of teaching:**

- Nature and elements of teaching models.
- Information processing models.

UNIT IV. **Process of Communication and Instruction:**

- Communication process; concept of communication, principles Modes and Barriers of communication, classroom communication (interaction, verbal-non- verbal)
- Modalities of Teaching-difference between Teaching and Instruction, conditioning & Training

Practicum :

1. Organizing the class teaching and teaching at the understanding level
2. Practice for preparing question paper as per various domains

Follow the teaching using any model of teaching

UNIT 1 EDUCATION AND TECHNOLOGY

Structure

1.0 INTRODUCTION

History has revealed that technology strengthens the hands of a teacher and makes his/her teaching more effective. Education has been benefited by technology in various ways and at various levels. From both, sociological and the economic points of view, technology has made an impact on education training. Education could keep pace and avoid costs and uncertainties of invention by merely following technological leads. Today, a number of institutions in developed and developing countries are offering courses through various communication technologies such as interactive TV, computer conferencing, the Internet and other modern media. Some distance education/open learning institutions in developing countries now are also offering courses electronically. As a result, a large number of learners are pursuing their studies through technology. In such conditions it becomes essential for all those in the field of education to be familiar with the nuances of the use of technology in education. Besides, it is well known that some teachers teach better by utilizing new methods and techniques, whereas others prefer old methods. Over the years, many techniques, methods and equipment have been developed by teachers and researchers to make the process of learning effective. This process of developing and using scientific methods, media and techniques for enhancing the effectiveness of teaching and learning, is essential for educational technology.

In this unit, you will learn about the meaning of educational technology, its types and scope. You will also learn about the hardware and software approaches, objectives at the micro and macro level.

1.1 UNIT OBJECTIVES

After studying this unit, you will be able to:

- Explain the meaning of educational technology
- Describe the types of educational technology
- Discuss their scope and significance
- Analyse the hardware and software approaches to educational technology
- Interpret the objectives of educational technology at the micro and macro levels

1.2 MEANING OF EDUCATIONAL TECHNOLOGY

The 21st century has been named the 'age of knowledge' and there is no way in which one can deny the role of technology in different aspects of our lives. Like other fields, education too has been deeply impacted by technological revolution. This interface of education and technology is popularly known as educational technology. Some associate the term 'educational technology' solely with technical equipment and media of education, such as overhead projectors, television, computers. There are others who believe that educational technology involves a scientific and systematic analysis of the teaching–learning process with an objective to maximize its effectiveness.

Before going further, it is essential to understand the word technology. This word is taken from the Greek word *technologia,* which means an art and is related to skill and dexterity. Generally, the term technology denotes the systematic application of the knowledge of sciences to practical tasks in industry. Technology can refer to material objects like machinery or hardware and comprise more themes, including systems, methods of organization and techniques.

In context of educational technology, Garrison (1989) opines, 'Technology will be viewed here as having both, a process (software) and a product (hardware) component, where process is the creative application of knowledge of purposeful activities. A subset of hardware is media, where media are the devices used to distribute information.' Thus, educational technology is a wider concept of the word technology. Further, it will be wrong to confuse the term teaching with the process of teaching or instructing, or educating, or provision of knowledge or engineering. This creation of education does not compromise and has very positive future prospects. For all those who are constantly engaged in the pursuit of knowledge otherwise, it will remain destructive to the welfare of free society.

Different groups and individuals have defined educational technology in many ways, over a period of time. A few of the notable definitions are as follows:

According to Finn (1962), 'Educational technology is a process, an attitude, a way of thinking about certain classes of problems.'

Lumsden (1964) arrived at two meanings of educational technology, viz., Educational Technology-I (ET-1) and Educational Technology-II(ET-II). ET-I refers to the application of engineering principles of technology to instrumentation, useful in the process of teaching. ET-II refers to the application of behavioural science to improve instruction.

The National Council for Educational Technology (1967) has defined educational technology as 'the development, application and evaluation of systems, techniques and aids to improve the process of human learning'. According to G.O.M. Leith, 'Educational technology is the application of scientific knowledge and learning and the conditions of learning, to improve the effectiveness and efficiency of teaching and training. In the absence of scientifically established principles, educational technology implements the techniques of empirical testing to improve learning situation.' According to S.K. Mitra, 'Educational technology can be conceived as a science of techniques and methods by which educational goals could be realized.'

According to 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.' D. Unwin has defined educational technology as concerned with the application of modern skills and techniques to the requirements of education and training. This includes the facilitation of learning by manipulation of media and methods and the control of environment in so far as this reflects on learning.

According to *Shiksha Paribhasha Kosh* (1978), educational technology has the following meanings:

(i) It is the use of those scientific theories and principles during the formulation and application of training systems, which emphasize result and experience based objectives, and are based upon educational principles to guide the education system.

(ii) Educational technology is the use of those audio-visual devices in training, which are based on modern technology, e.g., use of computer stimulators, television, radio, video-tape, etc.

(iii) It is self-training based on planned instructional material, through teaching machines.

For Association for Educational Communication and Technology (AECT) (1977), 'Educational technology is a complex and integrated process, involving people, procedures, ideas, devices and organization, for analysing problems and devising, implementing, evaluating and managing solutions to those problems, involved in all aspects of human learning.'

According to Mitchell (1978), there are five fundamental definitions of educational technology:

(i) Educational technology I (educational psycho technology): This meaning depends upon psycho technology to enhance a learner's capability by manipulating sensory input directly or indirectly. The various problems of educational psycho technology are: assessing the capability of students on the basis of diagnoses; clarifying the objectives of education; selecting or prescribing the instructions of communication, resources or actions and assessment. It includes all methods of management of the learning processes of others, in order to achieve certain prescribed behaviours. Controlled learning is important since student is the focal point. This meaning corresponds to the professional role of learning consultant.

(iii) Educational technology II (educational information and communications technology): This meaning stresses on the model, manufacture and assessment of training resources and communications for local or widespread distribution. Focus is on generating, selecting, processing and storage of information for the purpose of education and to retrieve information. This is to make knowledge more accessible. This meaning corresponds to the role of education materials provider.

(iii) Educational technology III (educational management technology): This definition stresses on organization of the resources of education. These resources include associated activities like planning, programming, budgeting, management, decision-making, operations research and system analysis. Organizational technology provides useful decision modes, information systems and organizational theory for man-machine systems. This concept of educational technology is supported by both practical and theoretical investigations. So, this meaning corresponds to management of learning resources.

(iv) Educational technology IV (educational system technology): This concept pertains to functions like setting up, outlining, constructing and evaluating educational systems. The education system developer is concerned with administration, operations, extra-mural and alternative educational systems. It may envision and execute a computer-aided system of training or design suitable courses.

(v) Educational technology V (educational planning technology): This meaning focuses on planning at the supra-institutional or national level. Non-educators are the prime occupants of this field. Their belief in alternative opportunities of education is overshadowed by economic factors related to the role played by the educational planner.

This five-fold meaning of educational technology represents the primary and central concept of educational technology. Each of these types can stand alone and yet be integral to others.

Mitchell (1978) arrived at the following consolidated definition of educational technology: 'Educational technology is an area of study and practice (within education) that is concerned with all aspects of the organization of educational systems and procedures, whereby resources are allocated to achieve specified and potentially replicable educational outcomes.'

According to the Scottish Council for Educational Technology (1979), '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.'

In 2006, National Curriculum Framework (NCF) defined educational technology as the efficient organization of any learning system, adapting or adopting methods, processes and products, to serve identified educational goals. This would involve:

- Systematic identification of the goals of education, taking into account nationwide needs (like higher scalability), system capabilities and learners' needs and potential

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- Recognition of the diversity of learners' needs and the contexts in which learning will take place and the range of provisions needed for them
- Recognition of not only the immediate needs of children but also of their future needs in relation to the society for which we are preparing them
- Designing, providing for and enabling appropriate teaching-learning systems that could realize the identified goals
- Developing a range of support systems and training, enabling systemic conditions/materials and making them accessible schools
- Training teachers and students to use them
- Research existing and new techniques, strategies and technologies for solving problems of education, enabling judicious and appropriate application of technology
- Appreciation of the role of educational technology as an agent of change in the classroom, influencing the teacher and the teaching-learning process and its role in systemic issues like reach, equity and quality

Association for Educational Communications and Technology (AECT) has given its latest definition of educational technology as the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources. Mangal & Mangal (2010) opine: 'Educational technology should stand for a wise application of available human and non-human resources for providing appropriate solutions to educational problems and to improve the process and products of education.' Aziz Hap (2010) defines educational technology as the considered implementation of appropriate tools, techniques, or processes that facilitate the application of senses, memory and cognition *to* enhance teaching practices and improve learning outcomes.

The wide differences in opinion, regarding the definition of educational technology among theorists and practitioners is well explained in the above definitions. These definitions initially embraced the whole range of activities of educational technology, from the methods of psychology of learning and teaching to audio-visual communication and mass technology.

However, one can list down certain characteristics of educational technology from the above definitions:

- It is concerned with the systematic application of science and technology in the field of education.
- It adds efficiency to the process of teaching-learning within formal and informal situations.
- It includes organization of appropriate learning conditions for realizing the goals of education.
- It stresses on developing methods and techniques for effective learning and evaluation.
- It encompasses the complete teaching and learning process and is not limited to specific aspects.
- It involves input, output and process aspects of education.

- It includes organization of learning conditions for realizing the goals of education.
- It enables and facilitates learning by control of learning situations, media and methods.
- It is not limited to the usage of audio-visual aids, but also extends to the application of psychological principles and instructional theories for improving the teaching—learning process.
- It provides procedural and practical guidance and explanation to the glitches of education.

1.3 NATURE AND TYPES

Sidney Pressey's mechanical teaching machines of the 1920s are considered to be the earliest modern forms of education through technology. Since then it has been evolving and taken many forms: Powerpoint presentations with voice-over; hypertext, i.e., V. Bush's memex in 1940s; B.F. Skinner's work that led to programmed instruction in 1950s; Computer-Aided Instruction or Computer Assisted Instruction (CAI) in the 1970s, through the 1990s and in the present scenario it has taken the form of Computer-Mediated Communication (CMC), e-tutoring and blended learning among others. However, educational technology should not be confused with teaching or instruction or learning or engineering, but it should be taken as sum total of all such aspects which go a long way in shaping the personality of the learner in a meaningful context (Singh, 2006). Further, with changes in the technology, the conception and nature of educational technology has also been adapting itself. Although the term has been in use for long now, it is still considered complex in nature. Educational technology is very versatile and comprises a cyclic procedure, a store of equipment (physical and conceptual) and a multiple-node liaison, mutually between learners and also between them and the facilitators of instructions (Hap, 2010). To understand the nature of educational technology, one needs to ascertain the objectives of educational technology and distinguish between 'technology in education' and 'technology of education'. One is also required to comprehend the components of educational technology.

Components of educational technology

S.P. Ruhela (2002) in his book, *Educational Technology*, has listed three main components of educational technology as a concept; and each component has a defined role to play in the process of education. The three components are:

(i) **Methods:** Making use of a few devices like programmed learning, team teaching, micro-teaching and personalized system of instruction as methods in teaching–learning situations.

(ii) **Materials:** Comprise instructional materials like programmed textbooks, manuals, guides, texts and other written/print materials.

(iii) **Media:** Implies employing audio or visual or both audio-visual media, such as radio, tape recorders, charts, maps, posters, films and educational television as teaching aids to supplement effective teaching and promote better learning.

Specific objectives of educational technology

(from the viewpoint of specific classroom teaching)

(i) To identify the educational needs of the students

(ii) To determine the classroom objectives in behavioural terms

(iii) To evaluate and sort the content of instructions in logical or psychological succession

(iv) To plan teaching methods and strategies of the presentation of content

(v) To make use of aid material, software and hardware, mass media and communication techniques

(vi) To identify human and non-human resources

(vii) To evaluate classroom teaching, in terms of performance of students

(viii) To provide continuous feedback to students and the teacher for improving the teaching–learning process

1.3.2 Types

Technology, media and materials that are useful in the instructional process, comprise simple varieties that help teachers to develop and present their lessons more effectively in traditional classrooms. They also comprise sophisticated machines and mechanisms that completely change the structure and scenario of classroom teaching. A number of technological media and materials can be useful in both teaching and in the management of administrative data that is necessary in modern mass education. Educational technology can thus assume many forms. Often, its only aim is to make the current practices more efficient and effective. However, at times educational technology brings about pedagogical alterations. Though it can be regarded as a design science, it also tackles the basic problems related to learning, teaching and social organization. Hence, the complete use of all features of modern social science and life science methodology are captured by it. Educational technology performs the twin functions of a tool and a catalyst. The three commonly accepted types of educational technologies are: (i) teaching technology, (ii) behavioural technology and (iii) instructional technology. These are discussed below.

(i) Teaching technology

Teaching is a skill. The use of technology in teaching makes this skill simpler, specific, functional and unprejudiced. This form of educational technology rests itself on the knowledge of philosophy, psychology and science, so as to achieve the desired learning objectives. There are two important features of teaching: (i) content and (ii) classroom communication. Substance and interaction are the two factors that form teaching technology. In addition, contemporary teaching focuses on the student and not on the teacher. Thus, it needs a psychological analysis of the learner. Hence, teaching is both scientific and psychological. The system of learning assists the teacher in making right decisions. In addition, it also builds up a sense of professionalism that makes one accountable. It incorporates essential alterations in the idea of teaching, such as teacher's training, formulating the policies of teaching and management objectives of a

teacher. Teaching technology is that form of educational technology, which is concerned with making the process of teaching more systematic.

Assumptions of teaching technology

Teaching technology is based on the following assumptions:

- The nature of teaching process is scientific.
- Teaching activities can be modified as required.
- Pre-determined learning objectives can be achieved through teaching activities.
- A mutual relationship between teaching and learning can be established.
- Proper conditions can be created for effective learning.

Characteristics of teaching technology

E.G. Vedanayagam (1988) has solicited a list of characteristics and fundamental principles of teaching technology. These are as follows:

- Teaching is a scientific process and it major components are content, communication and feedback.
- There is a close relationship between teaching and learning.
- It is possible to modify, improve and develop teaching–learning activities.
- The terminal behaviour of the learner, in terms of learning structures, can be established by appropriate teaching environment.
- Teaching skills can be developed and strengthened by means of feedback devices, with or without sophisticated techniques.
- Pre-determined learning objectives can be achieved by designing suitable teaching activities.
- The use of achievement motivation technique enhances the output of a teacher and a learner.

Technology is a rapidly changing area of the curriculum. For experienced teachers as well as students and novices, technology has evolved the need for a whole new range of knowledge and skills in teaching. Ivor K. Davies (1971), in his book, *Management of Learning*, has presented the contents of teaching technology in four steps— (i) planning of teaching, (ii) organization of teaching, (iii) leading by teaching and (iv) control of teaching. These are discussed in detail, as follows:

(i) **Planning of teaching:** Within this phase, the teacher examines the subject matter, decides upon and describes learning objectives, and puts these objectives clearly in writing. The following three activities are performed by him, as part of this phase: (a) task analysis, and (b) identification of the aim of teaching, (c) noting down learning objectives. As quoted by I.K. Davies, 'in teaching, planning is the work a teacher does to establish learning objectives'.

(ii) **Organization of teaching:** In this stage, an effectual atmosphere is created by the teacher. This is done through the selection of teaching techniques, approaches, procedures and vital benefits.

(iii) **Leading by teaching:** In this stage, the teacher is a source of motivation for the students. They show interest in the teaching and learning objectives

in every phase of this stage. I.K. Davies wrote, 'leading is the work a teacher does to motivate, encourage and inspire students, so that they readily achieve the objectives of learning'.

(iv) **Control of teaching:** In this stage, there is no change in prearranged and described purpose of learning. This stage does not comprise the introduction of any change. However, the prospect is reviewed by the teacher, so that the predefined goals can be achieved. For accomplishing this impressive task, support is sought by the teacher through different techniques of validation and measuring of dimensions. If the teacher comes to the conclusion that the learning objectives have not been accomplished, then it is the teacher's duty to bring essential modifications in the organization's behaviour.

(ii) Behavioural technology

Behavioural technology is a vital constituent of educational technology. It emphasizes that psychosomatic values be used in learning and teaching. The motive is to change the behaviour of the teachers and pupils to match with the objectives of teaching. This form of educational technology is dependent on psychology. Behaviour is the focus of the process of education and learning with their objective to bring persistent changes. Different learning experiences are shared with learners to bring desirable changes in their behaviours. Here, behaviour would mean the cognitive, conative and affective activities of an individual. Behaviour technology, as a form of educational technology, is utilized to study and bring modification in the behaviour of all learning organisms. B.F. Skinner popularized the usage of this term while making use of his 'theory of operant conditioning'. He used the theory to bring desired modifications in the behaviour of learning organisms. In the area of learning and education, behavioural technology focuses on the behaviour of teachers. Hence, it is sometimes also referred to as 'training psychology'. In schools, the task of behavioural technology has become almost synonymous with behaviour analysis and behaviour modification, carried out through the principles of operant conditioning and observation learning. In other words, behavioural technology focuses attention on the use of principles that have a psychological orientation in the processes of learning and teaching. This works to alter the behaviour of the teachers and pupils to match it with the mode of teaching. Behavioural technology is aimed at boosting the growth and development of behaviour and learning. It employs the following to transform the behaviour of a teacher:

- Definition of teacher-behaviour
- Doctrines of teacher-behaviour
- Observation technique of teacher-behaviour
- Study and nature of teacher-behaviour
- Assessment and standards of teacher-behaviour
- Prototypes of teacher-behaviour
- Different tools to develop teacher-behaviour such as: programmed instructions, T-group training, interaction analysis techniques and simulated training of social skills

Suppositions of behavioural technology

Behavioural technology is based on the following suppositions:

- A teacher behaves socially and psychologically.
- A teacher's behaviour can be observed.
- A teacher's behaviour can be measured.
- A teacher's behaviour can be modified.
- Everyone is not a born teacher.
- Teachers can also be made.

Salient features of behavioural technology

Some of the important characteristics of behavioural technology are:

- The basic function of behavioural technology is psychology.
- Strength and responses are strongly focused on behavioural technology.
- The teaching acts are appraised from a purposeful viewpoint in behavioural technology.
- Behavioural technology emphasizes on psychomotor goals.
- Behavioural technology is in terms of the software approach.
- Behavioural technology is widely practised training institutes of teachers.
- The attention of behavioural technology can be based on individual differences between students and teachers.
- Behavioural technology is focused on the elements and direction of behaviour in a classroom.

Behavioural technology would help practitioners to know the nature of the existing behaviour, the nature of the target behaviour, and the ways and means to meet gaps between existing and target behaviours.

(iii) Instructional technology

The evolution of a technology occurs when scientific learning and communication are used in teaching. When physical sciences interact with education, we are provided with traditional support, gear, materials like paper, ink, books, radios, films and televisions and more refined progressive hardware like, computers, space satellites, and language laboratories, etc. Stoluraw (1963) stressed on the theory of existence of three most important factors that are focused on the association of instruction and technology: (i) population explosion of the world, (ii) exponential pace the spread of new knowledge, and (iii) scientific and technological changes in our present social structure. Robert A. Cox defined the technology of instructions as 'the application of scientific process to man's learning conditions.' E.E. Haden opined, 'Instructional technology is that branch of educational theory and practice, concerned primarily with design and use of messages which control the learning process.' The definition given by Unwin (1969) described instructional technology as: 'The application of modern skills and techniques to requirements of education and training (instruction). This includes the facilitation of learning by manipulation of media and methods and the control of environment.'

Another popular and accepted definition has been given by S.M. McMurin (1970): 'Instructional technology is a systematic way of designing, carrying out and evaluating the total process of learning and teaching, in terms of specific objectives based on research, human learning and communication. It employs a combination of human and non-human resources to bring about the more effective instruction.' AECT has defined instructional technology as, 'the theory and practice of design, development, utilization, management and evaluation of processes and resources for learning'.

In the present scenario, instructional technology is broadly necessitated to establish a progress in teaching, in learning and in the process of evaluation. This form of educational technology is meant for helping the instructor and the learner in the desired instructional task for the realization of stipulated instructional objectives, in a particular teaching–learning situation. In other words, focus is on developing the instruction process.

Assumptions of instructional technology

The fundamental assumptions of instructional technology are as follows:

- A student is able to learn in accordance with his requirement and capability.
- A student can learn even if the teacher is not present.
- One can augment a particular instruction by its continuous use.
- Instructional objectives can be achieved with the help of learning objectives.
- The area of discussion can be segregated into different sectors or parts, and every part can be taught in an independent way by use of this technology.

Unique features of instructional technology

Following are the characteristics of instructional technology:

- Instructional technology helps a lot in the achievement of reasonable goals.
- Instructional technology can make teachers more efficient.
- When supported by instructional technology, the students can learn in accordance with their requirement and speed of grasping.
- Instructional technology has control over individual disparities.
- Instructional technology also uses the theory of conditioned response.
- A more detailed examination of subject matter is carried out with the help of instructional technology, which motivates optimism, pertaining to the remarkable manner in which the contents are presented.

Instructional technology suggests many tools, techniques and knowledge which are used in designing and delivering results. Together they provide useful means towards accomplishing educational objectives. It is important to know and be responsive to:

- The destination of delivery of instructions.
- The tools and techniques available to deliver instruction.
- The right time to use these tools.
- Design and delivery of successful learning experiences.
- Proper distribution of content and methods.

- The best place to deliver instruction.
- Ensured meeting of expectations.
- Revision techniques, in case instructions are not met.

The field of instructional technology will only grow if technology improves. The use of technology will help the delivery of education in an efficient manner, by overcoming the limitations and problems faced by the education sector. This form of educational technology is gaining popularity because instructional technologists claim to achieve effective learning by investing less time and cost, than through other means.

The main points of difference between three types of educational technologies (behavioural technology, teaching technology and instructional technology) are listed in Table 1.1.

Table 1.1 Comparison of Three Types of Educational Technologies

Aspect	Teaching Technology	Behavioural Technology	Instructional Technology
Exponents	I.K. Davis, Hunt, Morrison, Herbart	B.F. Skinner, Flander, Ober, Amidon	Lumsdan, Bruner, Asubel, Glaser
Purpose	Development of cognitive, affective and psychomotor domains	Development of cognitive, affective and psychomotor domains	Development of cognitive domain
Base	Philosophy, psychology and science	Psychology	Psychology and science
Approach	Hardware and Software	Software	Hardware
Focus	Teaching	Teacher	Instruction
Application	For making classroom teaching purposeful and effective	For producing effective teachers	Self-study, correspondence, remedial study

1.4 SCOPE AND SIGNIFICANCE

The scope of any subject means the jurisdiction, limits or boundaries of its operation. Similarly, educational technology needs demarcation of boundaries within which the process of education can go on. As has already been acknowledged, educational technology is concerned with bringing about an improvement in the teaching–learning process. It is an applied or practical study which aims at maximizing educational effects by controlling different types of confounding variables. Thus, educational technology is a broad concept that has a wide application. The National Policy on Education (1986) recommends: 'Educational technology will be employed in the spread of useful information, the training and retraining of teachers, to improve quality, sharpen awareness of arts and culture, include abiding values, etc., in both, formal and non-formal sectors. Maximum use will be made of the available infrastructure.'

According to S.S. Kulkarni, the scope of educational technology is: (i) to analyse teaching-learning, (ii) to evaluate the functions of the components of teaching-learning, and (iii) to interpret these components in such a way that effective results can be achieved. In narrow sense, educational technology means a little more than the use of sophisticated

hardware in teaching, including overhead projectors, tape recorders, televised films, cassettes, videodiscs, and gramophones. On a broader scale, it may be interpreted to mean the use of any new technique or method of teaching. Drawing on the same and other related definitions, the scope of educational technology can be encapsulated in the points discussed below.

- **Analysis of teaching and learning process:** Educational technology attempts to discuss the concept of teaching. It also analyses the teaching process, variables of teaching, phases of teaching, levels of teaching, theories of teaching, principles and maxims of teaching, the concept of learning, theories of learning, relationship between teaching and learning, and application of different concepts in specific classroom activities. It optimizes learning and attains optimum educational objectives.
- **Determination of objectives:** Writing objectives in behavioural terms is an essential task for carrying out the process of education. Educational technology has provided different methods and techniques for writing instructional objectives in behavioural terms. The RCEM (Regional College of Education, Mysore) approach, Bloom's Taxonomy and other similar ones have provided options to teachers for setting objectives in their own style, according to their specific needs. The adaptation of the objectives to the changed environment and altered circumstances has been enabled by the use of educational technology.
- **Development of teaching–learning materials:** Teaching–learning materials are an important aspect of the teaching–learning process. Educational technology has contributed to the production and development of suitable teaching–learning material, in view of predetermined objectives, designed curriculum and accessible resources. This covers the techniques of developing software and instructional material like programmed learning material, personalized system of instruction, material for mass education, computer assisted learning material, and material for open university courses.
- **Development of teaching–learning strategies:** Educational technology has tried to describe ways and means of discovering, selecting and developing suitable strategies and tactics of teaching, keeping in mind the different circumstances, the available resources, and other factors. Progressive development of different teaching models and methods has always equipped the teacher with newer teaching–learning strategies.
- **Teacher training:** Educational technology takes into consideration all aspects of the teaching–learning process. Teachers are one of the important aspects for those working in the field of educational technology. The subject has, therefore, been inclined towards the purpose of preparing teachers and has evolved techniques like micro-teaching, Flanders' interaction analysis, and simulated teaching, for teacher education programmes.
- **Development of curriculum:** An appropriate and well-balanced curriculum is the backbone of education, for any group of learners. As new technologies are created, knowing successful strategies for developing and transferring educational material becomes increasingly important. Educational technology can dwell on suitable frameworks, learning experiences, and innumerable factors associated with the development of appropriate curriculum, as per the societal needs.

- **Usage of audio-visual aids:** The selection of appropriate audio-visual aids greatly enriches the teaching–learning process. Educational technology discusses at length, the different facets of audio-visual aids, for example different types and rules governing their selection, development and production, their storage and retrieval and consideration about their applicability, cost-effectiveness and efficient deployment in learning situations.
- **Development and utilization of mass media:** Educational technology has a huge application in educating a large section of people and imparting a large amount of knowledge in a limited span of time. With reference to this, the mass media, i.e., television, radio, newspaper, and other modern technologies like computers and information technology (e-mail, Internet, etc.) has a lot of scope. The illiterate masses can be educated with the help of innovative methods and practices of teaching and learning.
- **Historical information:** Any branch of knowledge that we deal with has a historical base. Such information holds tremendous importance for students to understand any branch of knowledge in its totality. When such incidents occur, they can be recorded on audio/video CDs or documented in the form of written or printed material. Such documents become the source of information for learners. Educational technology has enabled teachers to store such historical information and transmit it to next generation learners. Thus, education technology helps in collection, storage and retrieval of information.
- **Gaming and simulation:** Educational technology provides the option of going through historical events, which is either costly or hazardous and cannot be done through simulation. Computer technology plays a main role here. It can provide a lifelike picture of the phenomena, in different dimensions. Education technology can also show the operation of different parts of a phenomenon and the consequences. The other possibility is games. Through gaming, children can learn many concepts that cannot be taught in the formal setup of a classroom. Besides exhibiting their benefits for children, gaming and simulation have also proved to be useful in the training of teachers at both pre-service and in-service levels.
- **Distance education:** Educational technology has a great scope in distance education and open school programmes. In the present scenario, there is a great need for personnel training and education on regular basis to keep one updated in the field of work. On the same lines, distance education programmes, a relatively less formal process of education, have acquired an important status. Educational technology, with its innovative practices, can educate learners who cannot attend classroom sessions for their education. In this regard, programmed learning materials, modules, contact programmes, and counselling are some innovations that can help distance learners. This has made higher education accessible to the masses.
- **Appropriate tools, techniques and processes:** Techniques and processes have proved their value in the field of education. Teachers have come up with methodologies to fulfil tasks and obtain the targeted learning outcomes. The refinement of these techniques is a continuous process, similar to continuous developments in technology. Here, it is inevitable to understand

that the employed technique should be appropriate; even though the most expensive technology is used, it may not add any value to education.

The above discussion endorses the fact that educational technology is concerned with all variables, phases, levels and aspects of the teaching–learning process. In fact, the scope of education technology cannot be confined to narrow boundaries. The expansion and development of the subject matter would further aid in improving the teaching–learning process. Thus, educational technology is a concept that is expanding continuously.

Role and significance of educational technology

The impact of extraordinary developments in the field of information and communication technology (ICT) has been the strongest on education. The advent of the new millennium brought with it the awareness of being part of one of the most spectacular revolution of technology. This revolution of technology is most focused on the areas of information technology, communication and multimedia. In general, it signifies the start of an information society and, therefore, plays a key role in attributing education to every aspect of life. The purpose of educational technology is also to promote efficiency of education by improving the quality of teaching, of educational administration, and of educational research. Some more examples of significant developments in this direction are given below.

- **Wider participation:** Technology has made it feasible for education to reach across to wider audience. This is, especially, relevant for Indian conditions, where the limitations of geographical, economic, physical and social nature exist. The expansion of distance education at both, school and higher education levels has helped in increasing the educational status of the country. Educational technology has assumed an important role in expanding the services of open education through institutes like, National Institute of Open Schooling (NIOS) and Indira Gandhi National Open University among others.
- **Empowerment of learners:** In traditional terms, a learner takes up a course through a schedule of classes that are conducted at fixed venues, on fixed days. The teacher or coordinator decides the speed and frequency of the classes. The students' requirements and mental levels are assumed by the teacher. Nevertheless, different learners have different capacities of grasping. Every person is not adapted to typical classroom sessions. Learning can be transmitted in a number of ways by the use of technology. Some learners find reading convenient while others prefer audio-visual presentations, group discussions and other interactive means. Technology offers learners the choice to access course material through different media, depending on their preferences. Technology can deliver learning in a way that is most suitable for the individual such that every learner can enjoy a unique learning experience.
- **Facilitate application of senses, memory and cognition:** Learning needs to be understood as a technique to demonstrate ability. This is in consonance with Bloom's Taxonomy, in which a blend of mind and body summarizes the outcome of learning. However, the wants of human abilities are not sufficiently fulfilled by modern teaching and learning conditions. This process is facilitated by

technology, for example, a learner can understand the universe through video facilities, or make use of the Internet to learn about that which is beyond his /her physical reach

- **Differentiated instruction:** Educational technology calls for active participation of students to use different strategies of questioning. It makes individual instructions more generic and propels the growth of personal learning strategies. There is ample motivation for learners to use different aspects of multimedia and make creative use of the knowledge gained by them.
- **Enhance teaching practices:** In the formal system of education, learning can never happen in isolation. This means that only by making information and resources accessible to learners, we cannot consider the job as done. Practically, our system of education runs on the belief that the progress of the learner will be quicker when the person is guided by a teacher (skilled instructor). Educational technology assists and supports teachers in the teaching–learning process.
- **Improve learning outcomes:** Technology, newer methods, incentives, policies; everything planned for education would be a waste if the learning outcomes are not improved. If new technology fails to bring about betterments, then its use should be discontinued. Hence, educational technology involves continuously trying out and exploring newer technologies, such as intelligent classrooms, podcasts, Internet and laptops. These efforts are directed at making gradual changes in techniques and removal of defects. Educational technology has thus, enabled the teachers to improve learning outcomes.
- **Continuing education (lifelong education):** The rapid explosion of knowledge has made it necessary for an individual to learn throughout his life. Continuing education (*nirantar shiksha*) is absolutely necessary for improving the quality of one's life. This has been made possible only through use of educational technology.
- **Multiple learning resources:** Traditional teaching conditions had limited learning resources, but technological revolution has made it possible to present multiple learning resources to the learners easily. Now, we find that a computer not only presents visuals but also speaks to the learner. We also come across many innovations in the field of telecommunications.
- **Rapid adaptability of learning resources to learner's needs:** Generally, learning resources available to learners were mostly impersonal (e.g., a static textbook). These do not change according to the needs of a learner, at different stages of learning. The changes in computer-linked learning resources, as well as methods emerging out of new cognitive psychology and group dynamics stream facilitate learning in different abilities. More and more integrated innovations in educational technology are taking place, and designers of the instructional system are rapidly incorporating newer developments in the field. Programmed learning and personalized system of instruction are examples of the same.
- **Solving the problems systematically:** Educational technology is a continuous and comprehensive programme, providing a scientific basis to the education system. It can work to remove intrinsic shortcomings of the system. This can be

done by use of demonstrations that are regularly broadcasted, or through documents designed for pupils. Educational technology can make the operation of schools slightly flexible. Nevertheless, it cannot be considered as a miraculous solution for all problems in the educational system.

- **Professional development of teachers:** Educational technology offers a number of possibilities for continued professional development of teachers. In the changing scenario, the teacher cannot suffice with the pre-service education that he/she has received. They need to continuously update themselves with newer information and methods. Educational technology in its different forms has enabled teachers by providing them with options like distance education, e-learning, online learning and other similar forms of alternative education.
- **Communication and support:** Communication is the backbone of any form of teaching–learning situation. Educational technology has proposed several systems of communication for both formal and non-formal learning situations.
- **For preservation of knowledge:** Modern electronic gadgets provide tremendous capabilities to preserve knowledge/information for future use, including print media. Information can be preserved in the form of audio-video programmes, computer software, videodiscs, etc., and retrieved when required. Thus, bulk of the information can be preserved electromechanically, for instance, a videodisc is capable of preserving a complete set of encyclopaedia.
- **For transmission of knowledge:** Use of modern media in education can reach and teach students in any part of the globe. Radio and television broadcasts can reach large number of students in different parts of the country. Almost the entire country can be covered simultaneously through radio or television networking systems. Communication satellites have added to the effectiveness and efficacy of communication at a distance, and made it possible to link more than one location and more than one group of students through two-way talkback system.
- **Optimum use of resources:** The idea behind educational technology is not maximization of resources but appropriate use of the resources available. It should be understood that educational technology is not an end in itself but a means to accomplish some educational and instructional objectives, already determined and clearly defined. The objective is to make the whole teaching–learning process more meaningful and effective for both learners and teachers.
- **Future prospects in education sector:** Career has become a priority for students nowadays. For the development of their career, substitute means of education such as distance and open learning, education on demand and other such flexible models are necessary. This again emphasizes the role of educational technology in the teaching–learning process.

Educational technology is enabling multi-modal teaching, changing curricula and spawning rich forms of online research and collaboration. Exceptional prospects of growth have been created by continuous advancements in educational technology. This has deeply impacted the teaching capacity of teachers and the learning capacity of learners. To develop a new learning culture, it is imperative for teachers to gain expertise in ICT skills and their utilization. The amalgamation of technology should be driven by effective learning. This makes it necessary to be in synchronization with technological developments to build practicable solutions. Although, the availability of tools is in abundance, the ability to use them for improving the learning experience should be clear.

Moreover, when educational technology develops, it will give rise to the prospect of creating and recreating new types of educational institutions in future. It would help in reducing wastage of both physical resources and human resources to a minimum. Further, educational technology has value only to the extent that it actively assists learners in obtaining knowledge and skills, as has been in the *Encyclopaedia of Education*. The *Encyclopaedia of Education* mentions: 'Whether any particular device is functionally more efficient than any other will depend primarily upon whether the device is compatible with the dynamics of the learning process, the prior experience of the learner with the body of materials to be presented and the learners' physical, attitudinal and motivational preconditioning for use of hardware, software and the particular response mode of the equipment.'

In essence it can be said that educational technology can contribute to qualitative as well as quantitative improvement of education. There is a silver line to this aspect as observed by the International Commission on Education (1973), 'Educational technology is not just an apparatus to be clamped on to a conventional system, to add or multiply traditional procedures. It can only be of value if it is really integrated into the entire system and if it leads us to rethink and renovate it.'

Schools still need to go a long way in exploring the depth of educational technology. Educators now view technology as a means to explore and create. Even students, who are not doing well, can improve and succeed with the help of educational technology. It develops self-esteem and transforms the reluctance to learn into motivation. Students are empowered through multiple and convenient means of learning and a learning environment that is psychologically stable.

1.5 HARDWARE AND SOFTWARE APPROACHES

Professor Henry Ellington (1993) opined that the key function of educational technology is to bring about improvements in the general competence and efficacy of the teaching—learning process. He further said that these improvements can be introduced by:

(i) Enhancing the quality and capacity of learning.
(ii) Reducting of the turnaround time for learners to achieve the assigned objectives
(iii) Making teachers more efficient.
(iv) Cost-cutting without compromising on quality.
(v) Making learners capable of taking their own decisions.
(vi) Providing education in more flexible ways.

Considering educational technology as multifaceted in nature, Lumsdaine (1964) has listed its three distinct approaches:

(i) Educational technology I (ET1) or the hardware approach
(ii) Educational technology II (ET2) or the software approach
(iii) Educational technology III (ET3) or the systems approach

Hardware approach

The hardware approach implies the use of mechanical materials and equipment in the domain of education. Audiovisual aids like charts, models, filmstrips, slides, audio

cassettes and sophisticated equipment and gadgets like films, projectors, radio, tape recorder, record player, television, video, teaching machines, and computers, fall in the category of hardware. The hardware approach is based on the application of principles of physical sciences and engineering to education and training. In this system, the teaching process is being mechanized gradually so that maximum pupils may be educated in minimum time and at low costs. This approach is a by-product of the scientific and technological developments of the 20th century.

It is to be noted that teaching machines are the only mechanical aids deliberately designed and invented to fulfil instructional requirements. All other audiovisual aids were designed and manufactured for improving the communication system, but now they are being used for instructional purposes.

Mechanization is being introduced for preservation, transmission and advancement of human knowledge. For instance, a teacher can deal with a large group of students by his discourse on radio or television. Thus, educational and training systems are able to deal with an increased number of students and the cost per student has been reduced by the hardware approach to education. Silverman (1968) referred to this type of educational technology as 'relative technology'. This comprises borrowing and applying technology, machines and devices in the process of teaching and learning. In this context, educational technology serves a simple 'service' function in education.

Ivor Davies (1978) calls this approach the 'audiovisual archetype'. This approach stresses on the employment of machines, devices, equipment and similar instructional aids. This approach focuses on the teacher and his/her teachings. Technology is seen as a means of mechanizing or automating the process of teaching with devices that transmit, amplify, distribute, record and reproduce stimuli materials and thus, increase the teacher's impact, as well as widen potential audience. The media had developed this approach during the 1930s. It gained prominence during the post World War II period. According to Davies, this 'audiovisual archetype' considers audiovisual hardware to perform functions like supporting classroom presentations and improving demonstrations by giving access to reality or simulations of reality. It is not possible for a teacher to come up with these, within a short span of time. Nevertheless, this approach has faced several criticisms for the lack of coordination in its application.

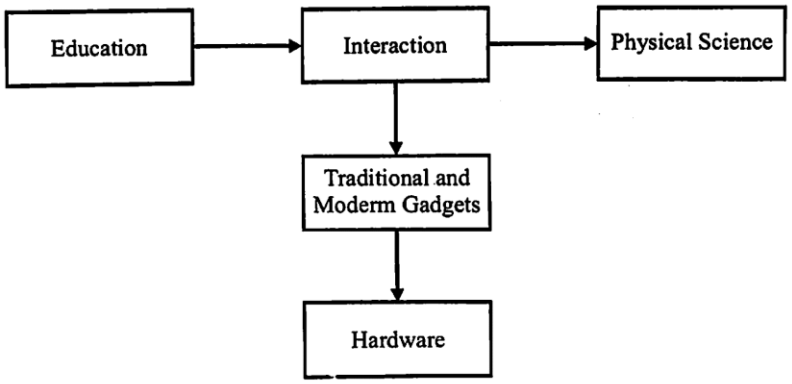

Fig. 1.1 The Hardware Approach

Characteristics of hardware are as follows:

- Hardware components are generally electronic and mostly depend on mechanical systems.
- New techniques and researches are being conducted to evaluate the effect of hardware.
- The outcome of hardware is direct and immediate because of its concrete form.
- Hardware components are the media of communication.

Software approach

The software approach or software technology of education owes its origin to behavioural sciences and their applied aspects concerned with the psychology of learning. It originated from the engineering efforts of Skinner and other behaviourists. According to Arthur Melton (1959), software teaching is directly related to psychology of learning, which comprises behavioural changes resulting from experience. This view of educational technology is associated with modern principles and theory of teaching, models of teaching, theory of instruction, and theory of teacher—behaviour and principles of programmed learning. The components of software technology are closely associated with the modern principles of programmed learning, such as:

- Task analysis.
- Writing objectives in behavioural terms.
- Selection of appropriate instructional strategies.
- Reinforcement of correct responses.
- Constant evaluation.

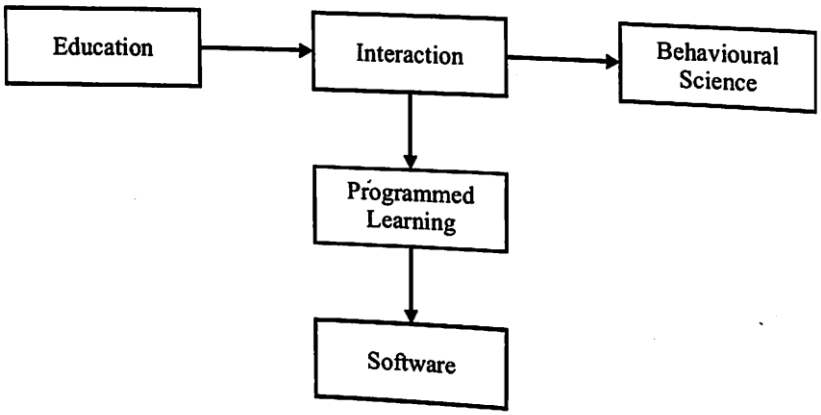

Fig. 1.2 The Software Approach

Leith observed that educational technology is the application of scientific knowledge about learning and the conditions of learning to improve the effectiveness and efficiency of teaching and learning'. Silverman (1968) termed software technology as constructive educational technology due to its constructive nature. Its basic educational applications are in the analysis of instructional problems, selection or construction of measuring instruments required to evaluate instructional outcomes and construction or selection of strategies and tactics to produce desired educational outcome.

Ivor Davies, names this approach as the 'engineering archetype', which applies the principles of behavioural science for the betterment of learning. Despite the use of hardware, this approach focuses on the learner and the learning. Therefore, it is called the software approach. 'Technology is seen as a means of providing the necessary know-how for designing the new, or renewing the current, worthwhile learning experiences. Machines and mechanization are merely viewed as instruments of presentation or transmission' (Davies, 1978).

It was in early 1969 that software approach was developed in the area of programmed learning. It was the outcome of Skinner's efforts on operant conditioning. In the beginning, this approach found its application in the design of materials having sequential content. Soon the it was widely used as part of curriculum and for developing courses. Based on the engineering approach, it takes the form of a series of steps to be followed. These steps comprise a statement of inputs and definition of objectives, intermediate steps which examine and select instructional strategies and resources and a terminal step of evaluation and output. This process always includes feedback. Though conventionally, ET1 went aboard after ET2, it is not to be regarded as a successful version of ET1. The development of both versions was independent and they still exist.

***Table 1.2** Differences between Hardware and Software Approaches*

Hardware approach	**Software approach**
Hardware approach has its origin in physical science and applied engineering.	The origin of software approach is in behavioural science and its allied aspects concerning the psychology of learning.
It refers to the application of the principles of physical sciences or engineering and technology, in the development of electro-mechanical equipment used for instructional purposes.	It refers to the application of teaching–learning principles to direct and deliberate shaping of behaviour.
It tries to adopt a product-oriented approach.	It tries to adopt a process-oriented approach.
It helps in better communication of educational purposes. It makes teaching effective by mechanizing the teaching–learning process. It increases the efficiency of educational means and reduces the cost of education.	It contributes to increase the efficiency of teachers as well as learners. However, it lags behind in reducing the cost of education.
It comprises charts, models, slides, filmstrips, audio cassettes, sophisticated equipment and gadgets like television, film projectors, tape recorders, record players, videos, teaching machines and computers.	It comprises modern principles and theory of teaching, models of teaching, theory of instruction, theory of teacher behaviour and principles of programmed learning.
Hardware technology is concerned with production and utilization of audiovisual aid material, sophisticated instruments and mass media for helping teachers and learners to achieve better results.	Software technology tries to exploit the psychology of learning for production and utilization of software techniques and material in terms of learning material, teaching–learning strategies, tools of evaluation and other devices.
Hardware is of no use without a suitable software that governs its working. It needs the services of software technology for its functioning.	Software approach makes the hardware functional.
Hardware is prepared by assembling different gadgets. The same hardware can be used in different fields like industry, entertainment, education and corporate sector, etc.	Silverman termed educational technology as 'constructive educational technology'. It concentrates on the analysis, selection and construction of whatever is necessary to meet only educational requirements.

Thus, we may conclude that while the hardware approach originated from physical sciences and applied engineering, the software approach owes its inception to behavioural sciences and their applied aspects concerned with the psychology of learning.

Significance of software and hardware

The significance of software and hardware in education are as follows:

- They cater to individual differences of students.
- They contribute to the economy of time, energy and resources of teachers and students.
- They bring clarity and vividness to the subject matter.
- They help to motivate students.
- Their help in developing and sustaining the interest of the students.
- They make the subject matter interesting, attractive, inspirational and effective.
- They provide for active participation of students.

These aspects of educational technology are closely intertwined to serve the cause of education. Hence, a clear demarcation between their constituents is difficult. For every hardware, there is corresponding software, as shown in Table 1.3.

Table 1.3 Educational Hardware and Corresponding Software

Hardware	*Software*
Overhead projector (OHP)	Overhead transparencies
Slide projector	Slides
VCR and monitor	Video programmes
Computer	Computer programmes
Blank paper	Written matter

It needs to be clarified here is that Table 1.2 is not an exhaustive list, but only a suggestive list of components. The list is endless and continuously growing owing to the rapid technological developments taking place and even faster adoption of these newer technologies in teaching–learning situations. What needs to be borne in mind is that with the development of new technologies, the older ones still occupy an important place in our educational system.

1.5.1 Technology in Education and Technology of Education

Education today has grown in leaps and bounds. Technology has made learning easier for both teachers and students. The developments in technology are not limited to gadgets and appliances used by people daily, but they have reached schools and classrooms. In this connection, there are two phrases which are popularly and often interchangeably used—technology in education and technology of education. Though they sound similar, they are different.

Technology in education refers to the use of technological hardware in education. Here, more importance is given to the media used for carrying a message. It is mainly concerned with electrical and electronic gadgets, which are used to facilitate the teaching–learning process. This is a constantly evolving field that depends upon

technological advancements. It involves the increasingly complex range of audio-visual equipment, hardware and sophisticated electronic devices like projectors, films, television, tape recorder, teaching machines, teletext and computer–aided instruction for individual and group learning. The use of technology in education has many advantages, just as technology has enriched every aspect of life. Technology in education is not limited to make learning and imparting of education easier in every possible way. It is also a field of study in itself for those who are involved with developing technological tools for educational purposes.

It is always advantageous to use technology in education because it helps both teachers and students to gain knowledge in a quicker and better way. Technology in education will be useful if it is properly planned and organized on psychological and pedagogical principles. Technology in education serves the following purposes:

(i) Supplies the needed appliances, equipment and mass media for accomplishment of different purposes and functions of education.

(ii) Facilitates in training the teachers to handle and make the finest use of equipment.

(iii) Develops a positive attitude among teachers and learners towards these appliances.

(iv) Signifies the relevance and use of the appliances in the context of individual and group learning, to achieve the goals of formal and informal learning.

Technology of education can be referred to as a purposeful utilization, in combination or separately, of objects, techniques, devices, events and relationships to increase the effectiveness of educational purpose. It deals with applying the resources of technological knowledge in an organized way, through which every individual has to pass, for acquiring and using knowledge. It governs the involvement of educationists in the design and evaluation of systems of learning, involving an understanding of the psychology of learning, communication and information theory. It signifies a technological approach to the system, issues and problems of education. This approach characterizes the methodology appropriate to learners' needs, learning objectives, the process of learning and teaching, as well as availability of resources. Technology of education includes technology in education, as shown in Figure 1.3.

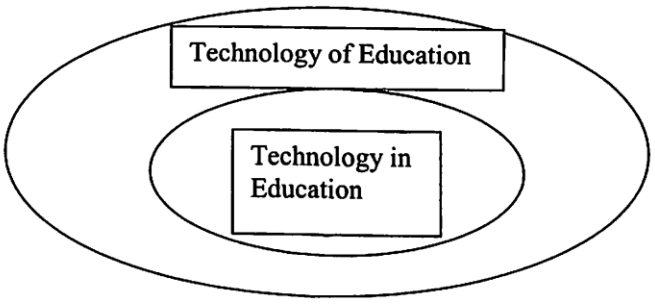

Fig. 1.3 Technology in Education as a sub-set of Technology of Education

Technology of education also includes decisions about different aspects of education like determination of educational objectives to be achieved, the size of learning groups, learning sequence, teaching methods and selection of media. It also comprises the appropriate use of media, knowledge, ideas, human and non-human

resources in systematic planning, designing, production, management and evaluation of the educational process. In other words, it includes the entire process of setting goals, continuous renewal of curriculum, trial and use of new methods and materials, evaluation of the system as a whole and resetting of goals in view of changing circumstances.

Saettler (1978) distinguishes between technology of education and technology in education. According to him, the former is a behavioural science conception, whereas the latter is a machine (device) conception of educational technology. Radio, television, OHP (overhead projector), computer, and tape recorder, constitute technology in education. On the other hand, programmes on radio and television, computer programmes and OHP transparencies that are based on scientific knowledge of education, constitute technology of education.

1.5.2 Electronic Resources

Electronic resources have also made their foray into the field of education, in the last century. In 1920 it was the radio, and in 1950 the television began to be used widely as educational tools. The usage of radio and television in broadcasting for education has assumed three general approaches:

(i) *Direct class teaching:* Where temporarily, teachers are replaced by broadcast programming substitutes

(ii) *School broadcasting:* Where complementary teaching and learning resources are offered by broadcast programming

(iii) *General educational programming:* Which offers general and informal educational opportunities.

Radio

Radio basically transmits signals through free space enabled by modulation of electromagnetic waves having frequencies lower than visible light. This is done by oscillating electromagnetic fields that pass through air and the vacuum of space, which makes electromagnetic radiation travel. By systematically changing (modulating) some property of radiated waves, such as amplitude, frequency, phase, or pulse-width, information is carried from one place to another. The oscillating fields induce an alternating current in the conductor, when radio waves pass an electrical conductor. This can be detected and transformed into sound or other signals that carry information.

According to Butcher (2003), radio has been used in education ever since its availability. Pennycuick (1993) of the Centre for International Education at the University of Sussex, states more specifically that interactive radio instruction (IRI) is characterized by 'highly coordinated' instructional materials and delivery strategies. It includes elements of active participation on the part of the students. In spite of technological advancements, radio remains the key media to which most rural people have access. Educational radio initiatives in different developing countries were effective in providing topical programmes and reaching large numbers of learners rapidly. Further, radio broadcasting is one of the greatest educational tools, which has ever been placed at the disposal of civilized man. It is an instantaneous and universal means of communication. Broadcasting is relatively new, as far as its age is concerned. However, in a short period, it has been determined definitely that it can perform three

separate functions— (i) it can sell goods and services; (ii) it can provide entertainment; and (iii) it can make education, culture and information available. Radio can be educative in formal as well as informal situations. The medium of radio is very effective for broadcast of lectures by eminent educationists, scientists and historical statements. It is a rich medium for broadcast of drama, stories, commentary, sports news, educational news and educational programmes. It is popular in both urban and rural settings. Radio programmes are generally prepared on topics which are more suitable to verbal communication. In India, the all India Radio (AIR) and other radio channels render valuable assistance to classroom instructional programmes. The limitations of radio broadcasting are:

- It uses only the sense of hearing.
- It is one-way communication.

Television

Education television excels as a medium of large-scale delivery of information. In the modern times, television is an integral part of the culture. TV provides entertainment, news, education, culture, weather, sports, etc. It is the most powerful medium of mass communication that has ever existed and it has revolutionized our life in many ways. It appears that the future television is going to have definite positive contribution to make children's life in the classroom happy. Television is already widely being used in schools. It is a powerful medium of communication that calls for the use of auditory as well as visual sense of learners in receiving education.

Television offers many benefits to children and learners in general, including:

- It enables the sharing of cultural experiences and thus, brings the world closer.
- In the Indian setting, specifically where togetherness is valued, shared viewing of programmes gives the family members of all ages, an opportunity to spend time together.
- Television can be used by parents as a catalyst to get children into the habit of reading. This can be done by following up televised programmes through books on same subjects.
- Exhibiting social responsibility, television can spread cultural and family values in an implicit manner.
- Television programmes provides an opportunity to parents to explore and discuss controversial or sensitive issues with children.
- Learning skills and even socialization of young children can be developed through balanced and efficient use of educational programmes.
- Young people can become more aware of other cultures and people through news, current events and historical programming.
- Documentaries can give rise to judgmental thoughts concerning society and the world.
- The world of art and music can be opened for people by cultural programming on television.

- Televised instructions have the potential of improving the process and products of learning as they involve thorough planning, systematic presentation and integration of a wide range of audiovisual material and appliances.

Television is an important aid to teachers, supervisors and educational planners. It has been utilized for informal and formal education and for distance and correspondence education. There are some limitations associated with television in the form of one-way communication, impersonal nature, passive learning, no interaction, and expensive media.

India, like other developing countries, has been using television for enriching and improving the quality of education at every level. It has been particularly used for expanding educational facilities, particularly in rural and backward areas, for normal and informal systems. New dimensions have been added to the use of television for instructional purposes with the advent of satellites. So far there has been use of open circuit television in India. Closed circuit use of television for educational purposes has not been explored much. Closed circuit television broadcasting is a sort of micro-level local arrangement limited to a single school, or several schools located in a particular region. The schools are connected by a cable or microwave system. The telecast cannot be received outside the selected network and signal is not required to meet the commercial broadcasting regulations.

Closed Circuit Television (CCTV)

Televisions systems have assumed an important place in our daily life as they are one of the most indispensable means of information and communications. Television broadcasts are a form of' open-circuit system', which are accessed by indefinite number of people. Another form of circuit systems are 'closed-circuit systems', which are designed to provide video to specified viewers. CCTV system is a system that has been primarily designed for surveillance purposes. CCTV is very useful in areas associated with security, disaster prevention, energy and manpower saving, sales promotion and information services, production management, industrial measurement, medical care, education and military fields. Specifically in the field of instruction and education, CCTV has a wide applicability. It enables schools or institutions to develop and allow their students to access specific programmes that are needed for their overall growth and development.

The definite advantages offered by CCTV have been highlighted as follows:

- Many CCTV systems are suited for distant viewing. The images broadcasted by them probably comprise photographs from space, snapshots of furnaces or other industrial equipment, and biological hazards.
- The use of CCTV would ease the shortage of good instructors or teachers, reduce instructional costs, provide uniform instructions to a large number of students simultaneously, and facilitate repetitive representation of resource persons or material.
- The use of CCTV provides a platform for desired exchange of man-material resources, learning and instructional activities, courses and events not only among students and staff of the same institution, but also among various institutions on the network of CCTV.

Video cassette recorder

The video cassette recorder (VCR) is an electronic device that plays VHS or beta tapes containing recorded movies and other programmes (like music videos, exercise videos). A VCR has to be connected to a TV for viewing a recorded programme. A number of variants of VCR have been produced over the years, in addition to the traditional home VCR. These include combined 'all-in-one' devices such as the televideo (a TV and VCR in one unit) and DVD/VCR units and even TV/VCR/DVD all-in-one units. A camcorder merges a video camera and VCR in one machine.

VCR can not only play pre-recorded cassettes, but also record any programme and replay it. Thus, educational television programmes can be recorded and later on shown to students. With the help of video cassette recorders, educational and other useful events can be recorded for teaching purposes. The replay of those programmes in colour makes viewing very interesting and leaves a considerable impact on viewers.

Advantages of VCR

The advantages of VCR are as follows:

- The operation of a video cassette recorder is very simple.
- It is portable and can be moved from one place to the other easily.
- Knowledge acquired by video is permanent.
- It is helpful to students in providing them knowledge of social and political conditions of different countries.
- It is helpful in developing the thoughts and reasoning power of students.
- It is equally useful for children of varying abilities.
- The teacher can remove the doubts of students simultaneously, which is not possible in a television lesson.
- The teacher can control video presentation.
- Pictures on a VCR can be repeated as many times as required.
- Video films on different teaching subjects are easily available.

Motion picture

A motion picture (sometimes called a movie or film) is a series of still pictures (frames) usually 8 mm or 16 mm in size, taken in rapid succession. When projected by a motion picture projector, they give an illusion of motion Films vary in length from one minute or less, to 50 minutes or more. If a 6-mm motion picture runs for more than 50 minutes in length, it is usually stored on two or more reels. The speed at which a film is projected varies with the format of the film. A sound 16-mm film is projected at 24 frames per second (fps) and super 8-mm films, at 18 fps. Therefore, it is possible to show films in such a manner as to create three types of images:

(i) Normal motion

(ii) Fast motion

(iii) Slow motion

Motion pictures are very useful in teaching various subjects like literature, drama, history, geography and science subjects. They motivate students as they enjoy the

medium. They bring people, country, events, etc., on the screen. However, they are expensive and subject to damage, if used extensively.

Hoban and Ormer have revealed the following educational advantages of motion pictures:

- Good films can be used as sole means of imparting certain factual information and developing performance skills.
- Pupils will change or develop attitude and opinions, as a result of viewing films.
- Pupils will learn more from films if they are properly prepared and motivated.
- Learning will increase with repeated screenings of a film. Short single-concept films have certain advantages.
- Pupils can develop the will of problem-solving by viewing well-produced films.
- The ability to learn from films will increase with practice.

Amid these advantages, it should not be assumed that learning would occur only by watching films. The method of presentation may be inadequate or the film may not be suitable for students of a particular age. Therefore, sufficient care should be taken while selecting a film. It should be borne in mind that films with built-in viewer participation and repetition of key points increase learning. If these factors are lacking in a film, then these should be supplied by the teacher during or immediately after screening of the film.

Tape recorder

A machine with built-in speakers and audio power amplification to drive them is usually called a tape recorder. If this machine does not have the record functionality, it is a tape player; while one that requires external amplification for playback is usually called a tape deck (regardless of whether it can record).

An audio tape recorder, tape deck, reel-to-reel tape deck, cassette deck or tape machine is an audio storage device that records and plays back sounds, including articulated voices. It usually uses magnetic tapes, either wound on a reel or in a cassette, for storage. In its current form, it records a fluctuating signal by moving the tape across a tape head that polarizes magnetic domains in the tape, in proportion to the audio signal. There are various types of tape recorders, from small hand-held devices to large multi-track machines.

The invention of tape recorder has brought about a revolution in the teaching-learning process. Its main function is recording and reproducing of sound. Microphone, amplifier and reproducer are its three parts. It is an instrument which is used to record speeches, songs, music, etc. It may be played back any time and any number of times. Teaching with tape recorder is an extension of a teacher's work.

The educational utility of tape recorder in education has been highlighted in the following points:

- There is no fixed time schedule for tape recorded programmes and thus, no changes are required in the school timetable. It can be used anytime and anywhere.

- It helps in supplementing the educational output of radio and television broadcasts and guest lectures.
- Recorded educational programmes can be used for instruction in schools and colleges.
- It helps students in developing oratory skills by repeated practice. Further, it helps in overcoming poor speech habits and correcting speech defects.
- Tape recorders are immensely used in developing conversation skills, expression power and techniques of dramatization.
- They are significantly used in teaching specific subjects like music, dramatics and language.
- They are also used in organizations for conducting and evaluating various co-curricular activities.
- They may help in modification of behaviour and for encoding classroom events.
- They can supplement other educational tools like projectors and video players.

A tape recorder is very easy to operate and useful in group teaching as well as individual learning. It is also easy to erase a recording, if not required.

Computer

A computer is an electronic device that accepts data, performs operations on it in a sequence (decided by a programme) and gives the resulting output. Computers can be of various sizes and types like mainframe computers, mini-computers and microcomputers. Apart from size, computers are differentiated according to their specifications. These specifications include the amount and type of storage, capabilities of the central processing unit (CPU), and type and nature of the peripheral equipment (such as disc storage) that can be connected to it.

A computer has several applications in instructional situations. It is used to analyse the level of knowledge in entry level students, at the time of enrolment. It is also used to plan and print individual programmes, monitor a student's progress and compile tests and scores. Computers are aid to the instructional process of education. In terms of technological advancement and educational utility, they have surpassed all the audiovisual aid material and equipment. The demand for computers is increasing day-by-day, at all levels of education.

In various forms and at various levels, computer technology has been able to make a strong impact on education. The advantages of computers in education include efficient storage and rendition of information, quick information processing, and the most important benefit being saving paper.

Some of the characteristic features of application of computers in education are:

- Modern systems of education have been greatly influenced by the usage of computers. Students find it easier to refer to the Internet for searching information rather than look for it in books. The process of learning is not limited to learning from prescribed textbooks, it is much more.
- Computers have played an essential role in promoting education to a large number of learners. By taking education outside the classroom, this .

technology has made the dream of distance learning a reality. It has been able to bridge geographical barriers in the process of education. In other words, computer networking has brought physically distant locations closer. This has benefited all those in the field of education.

- Efficient storage and effective presentation of information has been enabled by use of computers. There are several presentation software like PowerPoint and animation software like Flash, which have proved to be of immense help to teachers while delivering information.
- Computers have the potential to add an element of fun to education. It is a good break from the monotony of 'chalk and talk' classes. They can turn out to be a brilliant aid in teaching, if used properly. Computers facilitate making the process of learning interactive and interesting by audiovisual presentation of information.
- Computers have helped in going 'green'. They help in saving paper by facilitating an electronic format for storage of information. There have been instances where schools have gone far and even collected homework and test assignments as soft copies and thus saved paper. It is well known that electronically erasable memory devices can be used repeatedly. They offer a robust storage of data and reliable data retrieval techniques. Computer technology, thus, eases the process of learning.
- The Internet can play a significant role in different aspects of education. Being a colossal information base, it can be used well for retrieval of information on a wide variety of subjects. There is no subject taught to students for which the Internet cannot be used to gather information.

Though computers have contributed in different spheres of education, the most important contribution is in the domain of instruction; in the form of computer assisted instruction (CAI) and computer managed instruction (CMI). Here, it needs to be emphasized that computers should be used as an educational tool, rather than a means of education. Nothing can replace interactions between students and teachers.

1.5.3 Still Projected Displays

Visual displays that are without movement are known as still projected displays. These displays rely on optical projectors. The visual aids involved in still projected displays are discussed in this section.

Overhead projector

An overhead projector (OHP) is a machine which projects light from a lamp through a transparent surface, onto a wall or a screen. The transparent surface (transparency) is the small sheet of plastic that has text or drawing on it. This writing or a drawing appears much enlarged and in exact form and shape, on a blank surface (wall). It helps a teacher to explain a point to the learner with the help of a visual.

Principle: Light is furnished by a 500 to 1,000 watts lamp, and is reflected upward to a projection stage or screen and into an objective lens, which is centrally supported above the stage. The hght strikes a mirror and is reflected onto the screen

behind the operator. The lens and mirror stand above the machine. The machine may rest on a desk or it may be on a projection stand, or table. Thus, the teacher may sit or stand in front of the class. The screen can be a flat, smooth, white/pale wall. A good and inexpensive screen can also be made from a hardboard. The rough side of the hardboard should be covered with two coats of white emulsion paint. This board may be hung in one corner of the room. The screen should not be reflective.

An overhead projector provides educators with an easy, low-cost interactive environment. Plastic sheets are used as teaching material, which facilitate the educator to write on them with the help of non-permanent and washable coloured board pens. These transparencies can be pre-printed and used in repetition. Thus, they save a lot of time for the teacher or any other user.

The overhead placement should be such that it is convenient for the instructor to use. Further, the educator should be able face the class, to facilitate better interaction with the students. Since the projector is able to enlarge small script, the educator can write in his own desired font size. He does not need to continuously stretch his arm to write on the board. Unlike a blackboard, time is not wasted in erasing what has been written. Once transparencies are used, they can be restored to their original unused state after washing them with soap and water.

Advantages of overhead projector

An overhead projector has the following advantages:

- When using OHP, a teacher can always face the class and thus, maintain eye contact with the students.
- Pre-prepared matter can also be displayed with the help of OHP.
- **OHP** transparencies can be used repeatedly, which gives the teacher more time to engage in discussions with learners.
- The subject displayed on OHPs also helps learners to retain the lesson learnt.
- Many techniques (free-hand writing or drawing, typing, photocopying, desktop publishing and so on) can be used to prepare **OHP** transparencies.
- In comparison to other types of visual aids (e.g., charts), overhead transparencies are relatively compact and can thus, be easily stored in suitable boxes, large envelopes, folders or files.
- All the lights of a room need not be switched off when using an **OHP.** This enables students to take notes.
- Small objects may be shown on the machine simply by placing them on the projection stage. They will be projected as silhouettes.
- No extra projectionist or person is required to project.
- The clarity of display in an **OHP** is higher than that on a blackboard.
- The instructor may prepare an entire course which is time saving.
- The operation of **OHP** does not require any technical skill and knowledge, making it is user-friendly. Moreover, it is also clean and quiet.

Disadvantages of overhead projector

The disadvantages of overhead projector are as follows:

- OHPs run on electricity and require white surfaces for projection.
- When compared to chalkboards, their maintenance is somewhat time-consuming.
- They have a tendency to break down at times.
- Light from the projector can be irritating.
- Sometimes, positioning of the screen becomes difficult.
- Any error in spelling or pictures are magnified and distract the participants.
- Efficient usage of OHP requires sufficient time, effort and display material in the form of transparencies.

Basic instructions for using OHP

The following basic rules need to be followed for making optimum use of OHP:

(i) The appropriate positioning of the projector and the screen is of utmost importance. They should be placed in such a manner that every participant is able to see the screen easily. Generally, the screen should be placed in one of the front corners of the room, because that leaves the teacher with access to the fixed chalkboard or marker board, which he/she might need at anytime during the session.

(ii) The placement of the projector and screen should reduce or done away with two forms of keystoning. One form of keystoning emerges when the axis of projection is not horizontally perpendicular to the screen. This can be reduced when the projector is kept opposite to the centre of the screen. Another form of keystoning emerges when the axis of projection is not vertically perpendicular to the screen. Often, this can be lessened to a reasonable extent if the screen is tilted forward a bit. If the screen is fixed vertically, the problem can only be resolved by raising the level of the overhead projector. However, this should not block the learners' view of the screen.

(iii) The distance of the projector from the screen should be adjusted in such a manner that the entire screen covers the image proportionally, when in proper focus. If the focus is not proper, the people sitting far away from the projector will not be able to see the details on the screen clearly.

(iv) The surfaces of the lens should be clean and dust-free. Dusty surface of lens make the images opaque. It is recommended to use methylated or surgical spirit and soft cloth to clean the lens.

Slide projector

Slide projector or diascope is popularly known as 'magic lantern'. It is an optical aid to the process of teaching. It is used for projecting pictures from a transparent slide onto a wall or a screen. Since it is used to project slides, it is called a slide projector. A slide projector is useful for small as well as large groups. It comprises four sections: (i) electric incandescent light bulb or similar source of light (usually fan-cooled), (ii) reflector and 'condensing' lens to focus the light onto the slide, (iii) a holder for the slide, and (iv) a focusing lens. It helps to project a larger image of

the slide. When the figure or illustration is very small and it is required that the whole class should see it clearly, a transparent slide of this small figure is prepared. The slide is placed inverted on the slide carrier of the magic lantern (slide projector). The slide projector projects its erect image on the wall or screen by enlarging its dimensions and making the vision sharper and clearer. A coloured slide or filmstrip is more attractive.

Filmstrip projector works on the principle of direct projection. Light rays emerge directly from the projection lamp or other source of illumination, pass through condenser lenses, the filmstrip/slide and the objective lens to produce an enlarged image on the screen. The source of light can be an electric bulb or a kerosene or petromax lantern. Images are directly projected as they are, when a filmstrip/slide is used. This allows them to be projected even if the room is semi-darkened, at a desired speed.

Advantages of slide projector

The advantages of slide projector are as follows:

- Educational information: The slide projector has immense educational value because of the variety of information it can transmit like maps, drawings, and diagrams, photographs. It enables a subject to be taught clearly and in detail. To make it more effective, a tape recorder can also be used along with the slide projector. The teacher can record a narration on a tape recorder and synchronize it with the slide projector such that it gives the necessary commentary pertaining to the slide without the teacher's intervention.
- Motivational force: It arouses the attention and interest of students. Aprojected image is more effective in capturing the attention of the audience for a longer duration. It is the best way to motivate students towards better learning.
- Easy to transport: Slide projectors are light and easy to transport.
- Easy to use: Slide projector is easy to use. It is a simple device that can be operated and focused using a remote control.
- Consistency of images: Images can remain on the screen as long as the students want them to.
- Interesting: The whole activity arouses interest in students.
- Economical: There is no wastage of time and energy.
- Inexpensive: Slide projectors are not costly. Any school can afford it.
- Non-fragile: It is not easily broken.
- Non-inflammable: It is non inflammable.

Disadvantages of slide projector

The disadvantages of slide projector are as follows:

- *Not always suitable:* Every type of material cannot be projected by the slide projector.
- *Not excessive use:* Since glass slides are becoming expensive now, the slide projectors may not be used excessively.

Filmstrips

Filmstrips may be used in slide projectors as well as filmstrip projectors. Instead of using different slide for different topics or more slides for one topic, one strip or piece of still film is prepared. Slides produced on fikns are called fiknstrips. A filmstrip is made of cellulose acetate and is 16 mm or 35 mm wide and 2 to 5 feet long. It usually consists of 40 to 100 separate pictures related to a particular subject, topic or theme. These pictures maybe connected with series of drawings, photographs, diagrams, or combination of these. Such a strip or a piece of still film serves the same purpose as served by a number of slides.

In a slide projector we use separate slides, while in a filmstrip a strip of film (having many slides) is exhibited. The filmstrip projector is a recent development and it is becoming a more popular means of pictorial representation. Various commercial firms sell such readymade fiknstrips for different topics of different subjects for different age groups. Filmstrips are also available on loan, free of charge from the Central Film Library, Central Institute of Educational Technology, and NCERT.

Advantages of filmstrip

The advantages of filmstrip are as follows:

- It is easy to operate.
- A frame may be held on the screen as long as it is requked.
- Strips of educative value, according to special needs, are available.
- It is possible to review previously exhibited frames again for reference.
- It can be used to transmit varieties of information.
- Now fiknstrips are available with commentary recorded on tapes.
- The teacher can also record his comments and play the tape, synchronizing it with the frame of the filmstrip.
- Fiknstrips are light in weight and easy to carry.
- Even a low voltage lamp can serve the purpose while using filmstrips.
- With every filmstrip projector, a 2 x 2 slide attachment is also provided and the same projector can also be used for projecting slides.
- Its use does not restrict the normal flow of conversation between the teacher and the class.
- Numbered filmstrips are advantageous for the learner, especially when one or two students use them in independent work. Numbering makes it possible to locate the frames.
- Since filmstrips present pictures in a fixed sequence, they provide a structure for the subject.
- Fiknstrips provide economic means of presenting information.

Disadvantage of filmstrip

Fiknstrips lack audition: The teacher has to work like a commentator along with the filmstrip being projected.

Epidiascope

An epidiascope projects small opaque images of, say, maps, photographs, and pages of a book, on a screen, in an enlarged format. It is a combination of an episcope and diascope. The epidiascope works by reflecting light from an opaque surface (opaque projection). A lamp illuminates the material. The image is reflected by a mirror, through a lens onto the screen.

It is used for making classroom teaching more interesting and effective. This device does not require slides. Teaching aids like maps, charts, small pictures, graphs, line drawing are directly projected on the screen. The size of small pictures can be magnified or enlarged by the epidiascope. In epidiascope slides, transparencies are also used. It also facilitates books and original matter or teaching aids to be directly projected on the screen. Therefore, the epidiascope is commonly used in classroom presentations. It also makes lesson interesting and effective.

Advantages of epidiascope

The epidiascope has general and specific advantages: *General*

- Easy to handle.
- Projects a wide variety of materials in a magnified form.
- The colour of object is also transmitted onto the screen.
- Teachers can have time for class discussions.
- Often, an excellent outlet for creative work.
- It has a robust mechanism. *Specific*
- Photographs and pictures can be projected (these are difficult to draw).
- Teaching material can be directly projected from books or other original sources.
- Small objects can be projected after demonstration.

Disadvantages of epidiascope

Some of the limitations associated with epidiascope are as fallows:

- Pages must be flat when books are being used.
- Material sensitive to heat is to be avoided.
- Projection by reflected light is less efficient and requires total darkness.
- Machine is too bulky to be easily carried.
- The operator cannot face the audience.
- Projector must be kept near the screen.
- Expensive in terms of cost.

Precautions to be kept in mind while using epidiascope

- Before starting the class, the epidiascope and the screen should be set in the classroom.
- It requires a dark room for projecting teaching aids for which proper arrangements should be made.

- The size of teaching aids should be according to the size of the epidiascope's aperture.
- The teacher should give his comments simultaneously while projecting the teaching material.
- The teacher should make use of a pointer for indicating the aspects of a diagram or picture.

Microfilm and Microfiche

Microfilms are 35-mm films, which contain photographed reading material. Each frame contains materials of one page. The rolls of microfilm are placed in microfilm readers which project each page on a revision screen. "Microfiche" is a miniature form of microfilm. This is a sheet of film carrying many rows of images of printed matter. Microfiche is reduced in size, in comparison to microfilm. Both microfilm and microfiche can be stored, retrieved, and projected for reading. They have great educational potential.

1.6 OBJECTIVES OF EDUCATIONAL TECHNOLOGY AT MICRO AND MACRO LEVEL

Micro-teaching is one of the most recent innovations in teacher education/training programme which aims at modifying teacher's behaviour according to the specified objectives. Recent researches in advanced countries in classroom teaching have proved that classroom teaching may be objectively analysed and modified, according to the requirements, to develop desirable teaching skills and competencies in the student teachers and even in in-service teachers. Micro teaching is one of the important innovations in this direction. It is a process of subjecting samples of human behaviour to 5 R's of video tape-recording, reviewing, responding, refining and redoing. Micro teaching is a controlled practice that makes it possible to concentrate on teaching behaviour in the student-teacher training programme.

Definition and meaning of micro teaching

Micro teaching has been defined in a number of ways. Some selected definitions are given here.

Allen, D.W. (1966): Micro teaching is a scaled down teaching encounter in class size and class time.

Allen, D.W. and Eve, A.W. (1968): Micro-teaching is defined as a system of controlled practice that makes it possible to concentrate on specified teaching behaviour and to practise teaching under controlled conditions.

Bush, K.J.V. (1968): Micro teaching is a teacher education technique which allows teachers to apply clearly defined teaching skills to carefully prepared lessorts in aplanned series of five to ten minutes encounter with a small group of real students, often with an opportunity to observe the result on video tape.

Clift, J.C. and others (1976): Micro teaching is a teacher training programme which reduces the teaching situation to a simpler and more controlled encounter achieved by limiting the practice teaching to a specific skill and reducing time and class size.

Encyclopedia of Education (Ed. Deighton, L.C:-1971): Micro-teaching is areal, constructed, scaled down teaching encounter which is used for teacher training, curriculum development and research.

Flanders, Ned. A. (1960): Micro teaching programme is organised to expose the trainees to an organised curriculum of miniature teaching encounters, moving from the less complex to the more complex.

Jangira, N.K. and Singh, Ajit (1982): Micro teaching is a scaled down teaching encounter or miniatured classroom teaching.

MX. Alease, W.R. and Unwin D (1970): The term micro teaching is most often applied to the use of closed circuit television to give immediate feedback of a trainee teacher's performance in a simplified environment.

Passi, B.K. and Lalita, M.S. (1976): Micro teaching is a training technique which requires student teachers to teach a single concept using specified teaching skill to a small number of pupils in a short duration of time.

Singh, L.C. (1977): Micro teaching is a scaled down teaching encounter in which a teacher teaches a small unit to a group of five pupils for a small period of 5 to 20 minutes. Such a situation offers a helpful setting for an experienced or inexperienced teacher to acquire new teaching skills and to refine old ones.

Meaning of micro teaching. Micro teaching is a training procedure aimed at simplifying the complexities of the regular teaching process. In a microteaching procedure, the trainee is engaged in a scaled down teaching situation. It is scaled down in terms of class size, since the trainee is teaching a small group of four to six pupils. The lesson is scaled down in length of class time and is reduced to five or ten minutes. It is also scaled down in terms of teaching tasks.

These tasks may include practising and mastering of a specific teaching skill such as lecturing, questioning or leading a discussion; mastering of specific teaching strategies; flexibility; instructional decision-making; alternative uses of specific curricula, instructional materials and classroom management.

The short lesson is recorded on an audio or video-tape recorder and the trainee gets to hear and see himself immediately after the lesson. The pupils who attend the lesson are asked to fill in rating questionnaires evaluating specific aspects of the lesson. The trainee' own analysis of the lesson based on the authentic feedback from the tape together with the pupils' reaction and a supervisor's analysis and suggestions, assists the trainee in restructuring the lesson, which he then immediately reteaches to a new group of pupils. Further assessments by the learners and the supervisor lead to further improvements when he teaches again, either immediately after or several days later. This micro teaching sequence is practised usually in a micro-teaching laboratory in a teacher-training institution, or an inservice training programme in regular schools. (Fig. 1.4)

Three volunteers from the participants play the teachers' roles in front of VTR camera and other participants also take part of pupils' roles. After discussing how the teaching behaviours should be improved, three volunteers teach other participants again. The comparison is made between two teaching traits in each teacher on the evaluation sheet, (see Fig. 1.5)

Main propositions of micro teaching. Allen and Ryan in their book on the subject give the following main propositions of micro teaching:

(1) Micro-teaching is real teaching, although a teaching situationis constructed in which the student-teacher and pupils worktogether in a practice situation. Bona fide teaching does take place.

(2) Micro teaching lessens the complexities'of normal classroom teaching. Class size, scope of content and time are all reduced.

(3) Micro teaching focusses on training for the accomplishment of specific tasks. These tasks maybe the practice of instructional skills, the practice of techniques of teaching, the mastery of certain curricular materials, or the demonstration of teaching methods.

(4) Micro teaching allows for the increased control of practice. In a micro teaching setting, the time, number of pupils, methods of feedback and supervision, maybe manipulated.

(5) Micro teaching greatly expands the normal knowledge of results or feedback dimensions in teaching. Immediately after teaching a brief micro-lesson, the trainee is engaged in a critique of his performance. All this feedback can be immediately translated into practice when the trainee re-teaches shortly after the critique conference.

Two related areas can be pointed out where there are clear advantages: (i) training in teaching skill, (ii) research in teacher-training.

Phases, activities and components of micro teaching

According to J.C. Clift and others, micro-teaching procedure has three phases: (i) knowledge acquisition face (ii) skill acquisition face and (iii) transfer phase. (Fig. 1.6)

N.K. Jangira and Ajit Singh present these phases as under: (Fig.)

(z) **Knowledge acquisition phase:** In this phase, the student teacher attempts to acquire knowledge about "the skill—its rational, it role in classroom and its component behaviours. For this he reads relevant literature. He also observes demonstration lesson— mode of presentation of the skill (modelling). The student teacher gets theoretical as well as practical knowledge of the skill.

(ii) **Skill acquisition phase:** On the basis of the model presented to the student teacher, he prepares a micro lesson and practises the skill and carries out the micro teaching cycle. There are two components of this phase: feedback and micro-teaching setting. Micro-teaching setting includes conditions like size of the micro-class, duration of the micro-lesson, supervisor, and types of students.

(Hi) ***Transfer phase:*** Here the student-teacher integrates the different skills. In place of artificial situation, he teaches in the real classroom and tries to integrate all the skills.

Phases of micro teaching

Following are the three phases of micro-teaching as represented by J.C. Clift and others.

The three phases involve certain steps which are given as under:

1. ***Orientation of the student teachers:*** This involves providing necessary information and theoretical background about micro teaching on the following aspects:
   (i) Concept of micro teaching
   (ii) Rationale or significance of using micro-teaching
   (iii) Procedures of micro teaching
   (iv) Requirement and setting for the adoption of micro-teaching technique
2. ***Discussion of teaching skills:*** Under this step the knowledge and understanding of the following steps is to be developed:
   (a) Analysis of teaching into component teaching skills
   (b) Discussion of the rationale and role of these teaching skills in teaching
   (c) Discussion regarding the component teaching behaviours comprising various teaching skills

3. ***Selection of a particular skill:*** Each skill needs to be practised at a time. Student teachers should be given necessary background for the observation of a model of demonstration lesson on the selected particular skill.

4. ***Presentation of a model demonstration lesson—a particular skill:***
Demonstration lesson by the teacher educator before the student teachers on the use of a particular skill is given. This is also known as modelling. Demonstration can be given in a numberof ways: (i) By exhibiting a film on a video tape

(ii) Byproviding written material such as handbooks, guides amd illustrations, (iii) By making the trainees listen on audio tape

(iv) By arranging a demonstration from a live model i.e. a teacher educator or some expert

5. ***Observation of the model lesson:*** An observation schedule designed for the observation of the specific skill is distributed for the guidance of the student teachers to observe the lesson.

6. ***Criticism of the model lesson:*** A critical appraisal of the model lesson is made by the student teachers.

7. ***Preparation of the micro-lesson plan:*** *For* the preparationof the micro-lesson plan, on the skill demonstrated, help may be taken from sample lesson plans and from the teacher educator.

8. ***Creation of a micro-teaching setting:*** The Indian model of micro teaching developed by NCERT gives the following setting:
   (a) Number of pupils: 5-10
   (b) Type of pupils: Real pupils or preferably peers.
   (c) Type of supervisor. Teacher educators and peers.
   (d) Time duration of a micro lesson: 6 minutes
   (e) Time duration of a micro-teaching cycle: 36 minutes. This duration is

   divided as under:

   Teaching session: 6 mts. Feed-back session: 6 mts. Replan session: 12 mts.

9. ***Practice of the skill:*** (teaching session) Under this step, the student teacher teaches the prepared lesson for 6 minutes to a micro-class of 5-10 real pupils or peers (student teachers). This lesson is supervised by the teacher educator and other student teachers (peers). Where possible, the student teacher may also have the lesson taped on a video or audio tape.

10. ***Providing feedback:*** The peers and the teacher educators observing the micro lesson may provide immediate feedback.Where possible mechanical gadgets like the video-tape, audio-tape,closed circuit television may be used for getting feedback.

11. ***Replanning*** (re-plan session): In the light of the feedback, the student teacher replaces his micro lesson. He is given 12 minutes for this purpose.

12. ***Reteaching*** (re-teach session): This session lasts 6 minutes and the student-teacher re-teaches his micro-lesson on the basis of his replanned lesson.

Providing re-feedback (re-feedback session): The student teacher is provided re-feedback on the re-taught micro-lesson.

Integration of teaching skills: This is the last step and is concerned with the task of integrating several skills individually mastered by the student teacher. It is helpful in bridging a gap between training in isolated teaching skills and the real teaching situation faced by a teacher.

Important features of micro teaching

T. ***The micro element:*** The micro element, which systematically attempts to simplify the complexities of the teaching process is the cardinal feature of micro-teaching. Underlying this is the basic supposition that before one attempts to understand, learn and perform effectively, the complicated task of teaching, one should first master the components of that task. By focussing the training on a specific task, and by reducing the complexities of the trashing situation by diminishing the number of students, the duration of the lesson and subject-matter to be covered, it is possible to concentrate on the training process and assure greater effectiveness.

2. ***Technical skills of teaching and teaching strategies:*** A repertoire of teaching skills such as lecturing, questioning or leading a discussion and mastery of teaching strategies is the second important feature of micro teaching. The concept of teaching skills is not new, and many text books on teaching methods refer to specific skills or teaching strategies. But never before has there been such a systematic approach to analysing classroom interaction for the purpose of research and training. For example, teaching skills can be classified under five general headings of response, questioning, increasing student participation, creating student involvement, and presentation, with three or four skills further delineated within each category. Detailed manuals and series of model films explaining and illustrating these skills have been prepared for training purposes.

3. ***The feedback element:*** The feedback element is the third important feature of micro-teaching. At present, feedback in the supervision of student teachers is ordinarily based on a supervisor's recall and selective note-taking. His over-all impressions providethe basis for subsequent analysis of the student teacher's performance. But subjective factors enter into his assessment (as they do into the student's ability to recall details of the lesson) and in the absence of objective criteria the student may covertly oppose the supervisor's evaluations and suggestions.

   (1) The most simple source is the oral feedback of the laboratorysupervisor. Experience has shown that the relatively non-threatening atmosphere in the laboratory creates better communication between the supervisor and the trainee, even if his feedback is subjective. The micro-elements of the laboratory help the supervisor in focussing and concentrating his observations, thus, ensuring greater accuracy of feedback.

   (2) Another source of feedback consists of questionnaires filled in by the pupils learning in the micro lesson. These questionnaires—geared to specific skills with well-defined questions—provide the most important, although subjective, feedback from the teacher's clients'. When teachers

are used to the pupils' feedback and accept it with some ease, it is possible even to conduct short discussions with the pupils in which the teacher and his supervisor try to elaborate on the feedback provided by these questionnaires.

(3) Audio tape-recordings are an important source of accurate feedback Recent technological developments have resulted in small, portable tape recorders, operated by batteries and relatively low-priced. This calls for expanding their general use in schools and particularly in micro-teaching laboratories. They are, however, limited to verbal interaction in the class and, thus, do not provide the 'whole picture'. A supervisor's comment, based solely on an audio-tape might be considered by the teacher as one-sided. In addition, the peculiarity which causes many people not to recognize their own voice on tape, disturbs sometimes its acceptance as a source of feedback.

(4) The most accurate and powerful source of feedback is the video tape-recording. Newly developed portable video tape- recorders consist of a small camera and a small television monitor. Classroom activities can be, thus, recorded with minimum disturbance to teacher and students. It provides instant and accurate feedback of classroom interaction (verbal and non- verbal) in the teacher's natural habitat and thus provides a basis for reliable analysis.

The effectiveness of video tape-recordings and playback techniques has been confirmed in a number of studies of teacher training and in related areas such as counsellor training and counselling, psychotherapy and human relations.

4. ***Safe practice grounds:*** Providing a safe practice ground is another important feature of micro teaching. Amicro teaching laboratory seems to be one effective answer, for it appears to posses all the inherent features of the real classroom. The student teaches the relevant subject matter to genuine pupils (at whatever level isdesired).

5. ***The teaching 'models':*** The tapes or films of teaching models are an important facet to the learning process in the micro teaching laboratory, and provide the trainee with many opportunities to study desired patterns of teaching behaviour. There are, of course, many styles of good teaching and trainees will develop their own individual styles using these models as a guide.

6. ***The research laboratory:*** The micro-teaching laboratory simplifies the act of teaching and provides opportunities for controlled research to a degree never possible before. According to Allen and Ryan, the following areas of research seem to make the most effective use the micro teaching settings: (a) in-house stud-ies designed to optimize the procedures and sequences in the micro teaching situation; (b) research in modelling and supervisingtechniques; (c) task analysis of the teaching act and the investiga-tion of the relationships between teaching behaviours and student performances; *(d)* aptitude treatment interaction studies, to try to provide optimal training procedures for teachers with different abilities, interests and backgrounds.

Important characteristics and features of micro teaching may be summarised as:

1. Micro teaching is relatively a new innovation in the field of teacher education.
2. It is a training technique and not a teaching technique.
3. It is scaled down teaching:
   (a) which reduces the class size 5 to 10 pupils.
   (b) which reduces the duration of period 5 to 10 minutes.
   (c) which reduces the size of the topic.
   (d) which reduces the teaching skill.
4. It provides adequate feedback..
5. Micro teaching provides opportunity to select one skill at a time and practise it through its scaled down encounter and then take others in a similar way.
6. Micro teaching is a highly individualised training technique.
7. Micro-teaching permits a high degree of control in practicing a particular skill.
8. Use of video tape and closed circuit television makes observation very objective.
9. Micro teaching is an analytic approach to training

Micro teaching

At a macro-level, sociologists work to identify how various social forces, such as politics, economics, culture, etc., creates variation in schools. In other words, what effects do other social institutions have on the educational system?

Macro teaching is when a teacher teaches a large group of people. This style is utilized in the large lecture halls often seen on college campuses. Although there is less one-on-one interaction with this teaching style, a larger amount of material is often covered because this teaching style does not utilize repetitive skill practice.

The objectives of educational technology at the macro level or broad level are as under:

1. To identify educational needs of the community.
2. To determine the aims of education.
3. To develop a suitable curriculum.
4. To determine appropriate strategies.
5. To identify the resources-human and non-human.
6. To locate the major obstacles in the way of proper development of learners.
7. To suggest remedies to overcome the above traced out obstacles.
8. To manage the whole system of education.

1.7 SYSTEMS APPROACH

Systems analysis or approach is a term used to describe the systematic application of educational technology to an educational or training problem starting with the input (entry behaviour) and output (terminal behaviour) and determining how best to progress

from the former to the latter. Systems approach is an educational tool developed to make the educational adventure more flexible, holistic, logical, orderly, responsible and self-correcting rather than intuitive, undefinable and unordered. What is unique about the systems approach is that it enables the analysis of not isolated components, but of the whole and helps one to think in a Gestalt way rather in a fragmented manner. Aristole's statement, 'the whole is more than the sum of its parts' indicates the basic nature of a system.

Definition of systems analysis

1. *The Advanced Learner s Dictionary of Current English* definesa system as "Group of things or parts working together in a regularrelation."
2. *A.K. Jalaluddin* (1981): "A system maybe defined as adynamic, complex, integrated whole consisting of self-regulatingpattern of interrelated and interdependent elements organised toachieve the pre-determined and specified objectives."
3. A. *Angyaim Foundations for a Science of Personality* (1941)defined systems approach as a holistic organization, where parts ofthe system are arranged (organized and interrelated) in a way thatdistinguishes them from a simple collection of objects.
4. *Banghart* (1969) defines a system as "an integrated assemblyof interacting elements, designed to carry out co-operatively apredetermined function."!

All systems are made of parts called the sub-systems and are parts of the higher order system called the supra- system. *A* simple system is illustrated in Figure 1.8. In the figure, the system consists of four distinct elements or components, A, B, C and D, which are related to or dependent upon one another as indicated. Some inter-relationships may be two-way, while others may be one-way only.

Systems approach in Education

Education is a dynamic system, its efficiency being determined by the inputs and the outputs. It is a dynamic organization of mutually related components in a meaningful pattern and any change in one component may affect the overall performance ofthe system, either beneficially or adversely.

Systems approach as applied to education is a rational problem solving method of analysing the educational process taken as a whole, incorporating all of its parts and aspects, including the students and teachers, the curriculum content, the instructional materials, the instructional strategy, the physical environment and the evaluation of instructional objectives.

Vandana Mehra in an article gives the systems model of the process of education as given in Figure 1.9. As is evident from the figure, input to an educational system consists of people, resources and information and the output consists of people whose performance has improved in some desired way. The output is improved through increasing the efficiency of educational process for enabling optimum assimilation of knowledge and skills to occur during the educational process and hence, maximize the quality of the output.

Components of an instructional system are:

(i) Stating instructional objectives which helps system designer to decide what to teach (ii) Pupils (hi) Teachers (iv) Content (v) Determining optimum learning conditions to attain instructional objectives i.e. task analysis, keeping in mind the entry behaviour of learners, (vi) Deciding upon the instructional strategy and media, and (vii) Conducing evaluation (formative and summative and feed-back).

Processes involved in systents approach. Following processes are involved in the systems approach:

1. Identifying objectives
2. Designing learning experiences
3. Evaluating effectiveness in achieving the objectives
4. Improving learning experiences in the light of evaluation to better the objectives

1. Determining the broad aims of the course
2. Deciding as to what kind of people you are helping yourstudents to become
3. Finding out the range of backgrounds, interests, attitudes, aptitudes, skills and understandings of the students
4. Deciding learning experiences that the learners should process
5. Deciding about the test you will use as a criterion for evaluation when checking the extent to which objectives have been achieved
6. Deciding about the various techniques you would use, i.e., paper-pencil test, interviews, observation, and questionnaire

II. Designing learning experiences. This includes:

1. Visualising conditions necessary to achieve these objectives
2. Identifying learning sequences
3. Deciding teaching strategy for reaching the goal
4. Selection media of teaching-learning, i.e., lecturing, discussion, field trips, role playing, textbook, models, programmed learning, and multi-media.
5. Documenting experiences which include film also.

HI. *Evaluating effectiveness in achieving the objectives.* This implies:

1. Engaging students in the learning experiences you have designed.
2. Applying criterion tests to determine how students have changed as a result.
3. Determining which objectives have been most widely attained,which remain unattained and by which set of students.
4. Determining whether any unplanned objectives have been attained.

IV. Improving learning experiences. This means:

1. Determining the strengths and weaknesses of the course
2. Identifying remedial weaknesses
3. Trying out the revised learning experiences and evaluating again
4. Updating the course
5. Restarting the course

Advantages of systems approach

1. Systems approach provides a framework on which the plans for implementing changes in education can be built.
2. It assists in identifying the suitability or otherwise of there source material to achieve the specific goal.

Fig. 1.13 *Flow Chart Showing in Detail the Path Followed by a Teacher in an Instructional System.*

3. It helps in assessing the resource needs, their sources and facilities in relation to quantities, time and other factors.
4. It assists in making use of technological advance to provide integration of machines, media and people for attaining the defined goals.
5. It permits an orderly introduction of components required to be demonstrated for systems' success in terms of student learning.
6. It avoids rigidity in plan of action as continuous evaluation affords desired changes to be made.

Role of the teacher in systems approach

As a matter of fact, best teachers have always done something of the sort of systems approach. It has, therefore, been stated by Michael Eraut and Geoffrey Squires that systems approach is a 'response different in degree rather than kind from the other good method.

A system-oriented teacher does the following:

1. Thoroughly assess the inputs of his system
2. Gathers as much data as possible about his subject-matter
3. Thinks of alternative processes for achieving his objectives
4. Analyses his objectives into well-defined learning tasks
5. Makes discussions regarding processes and components based on the best means of furthering the purposes.

6. Activates the system by putting the plan into action.
7. Gathers feedback data accordingly and systematically.
8. Modifies the system's components and processes based on the feedback
9. Assesses the effectiveness of the system by comparing the outputs with the inputs
10. Modifies the system based on all resources of feedback.

1.8 SUMMARY

In this unit, you have learnt that:

- Educational technology is a complex and integrated process, involving people, procedures, ideas, devices and organization, for analysing problems and devising, implementing, evaluating and managing solutions to those problems, involved in all aspects of human learning, says Association for Educational Communication and Technology.
- This fivefold meaning of educational technology represents the primary and central concept of educational technology. Each of these types can stand alone and yet be integral to others.
- There are wide differences of opinion regarding the definition of educational technology among theorists and practitioners.
- Educational technology should not be confused with teaching or instruction or learning or engineering, but it should be taken as sum total of all such aspects which go a long way in shaping the personality of the learner in a meaningful context.
- Educational technology has three components — methods, materials and media. Manpower is an essential component of educational technology, which intertwines the web of methods, materials and media.
- The three commonly accepted types of educational technologies are: (i) teaching technology, (ii) behavioural technology and (iii) instructional technology.
- The use of technology in teaching makes this skill simpler, specific, functional and unprejudiced. This form of educational technology rests itself on the knowledge of philosophy, psychology and science, so as to achieve the desired learning objectives.
- Behavioural technology emphasizes that psychosomatic values be used in learning and teaching.
- The evolution of a technology occurs when scientific learning and communication are used in teaching.
- In narrow sense, educational technology means a little more than the use of sophisticated hardware in teaching, including overhead projectors, tape recorders, televised films, cassettes, videodiscs, gramophones, etc.
- The hardware approach is based on the application of principles of physical sciences and engineering to education and training.

- Technology of education deals with applying the resources of technological knowledge in an organized way, through which every individual has to pass, for acquiring and using knowledge.
- Technology of education also includes decisions about different aspects of education like determination of educational objectives to be achieved, the size of learning groups, learning sequence, teaching methods and selection of media.
- Television is an important aid to teachers, supervisors and educational planners. It has been utilized for informal and formal education and for distance and correspondence education.
- The video cassette recorder (VCR) is an electronic device that plays VHS or beta tapes containing recorded movies and other programmes (like music videos, exercise videos, etc.).
- Slide projector or diascope is popularly known as 'magic lantern'. It is an optical aid to the process of teaching. It is used for projecting pictures from a transparent slide onto a wall or a screen.
- Micro-teaching is one of the most recent innovations in teacher education/training programme which aims at modifying teacher's behaviour according to the specified objectives.
- Systems analysis or approach is a term used to describe the systematic application of educational technology to an educational or training problem starting with the input (entry behaviour) and output (terminal behaviour) and determining how best to progress from the former to the later.

1.9 KEY TERMS

- **Behavioural technology:** It is a form of educational technology which is utilized to study and bring modification in the behavior of all learning organisms.
- **Filmstrip:** A filmstrip is made of cellulose acetate and is 16 mm or 35 mm wide and 2 to 5 feet long.
- **Microfiche:** It is a miniature form of microfilm. This is a sheet of film carrying many rows of images of printed matter.
- **Systems approach:** It is an educational tool developed to make the educational adventure more flexible, holistic, logical, orderly, responsible and self-correcting rather than intuitive, undefinable and unordered.

1.10 ANSWERS TO 'CHECK YOUR PROGRESS'

1. Education technology, according to Finn, is a process, an attitude, a way of thinking about certain classes of problems.
2. Kulkami has defined educational technology as the application of the laws as well as recent discoveries of science and technology to the process of education.

3. Objectives of educational technology as observed by Leith are (i) to modernize learning methods and techniques according to the changing world (ii) to make classroom teaching clear, effective, objective and scientific.
4. The different types of educational technology are teaching technology, behavioural technology and instructional technology.
5. Behavioural technology emphasizes on the psychosomatic values in learning and teaching.
6. According to S.S. Kulkarni, the scope of educational technology is: (i) to analyse teaching-learning, (ii) to evaluate the functions of the components of teaching-learning, and (iii) to interpret these components in such a way that effective results can be achieved.
7. The purpose of educational technology is also to promote the efficiency of education by improving the quality of teaching, of educational administration, and of educational research.
8. Hardware approach implies the use of mechanical materials and equipment in the domain of education, such as audiovisual aids like charts, models, filmstrips, slides, audio cassettes and sophisticated equipment and gadgets. The software approach or software technology is associated with modern principles and theory of teaching, models of teaching, theory of instruction, and theory of teacher-behaviour and principles of programmed learning.
9. Technology of education can be referred to as a purposeful utilization, in combination or separately, of objects, techniques, devices, events and relationships to increase the effectiveness of educational purpose. It deals with applying the resources of technological knowledge in an organized way, through which every individual has to pass, for acquiring and using knowledge.
10. VCR helps in developing thoughts and reasoning power of students, while it is equally useful for children of varying abilities.
11. Microfilms are 35-mm films, which contain photographed reading material. Each frame contains materials of one page. The rolls of microfilm are placed in microfilm readers which project each page on a revision screen.
12. Micro teaching is a training procedure aimed at simplifying the complexities of the regular teaching process.
13. The three phases of micro teaching are knowledge acquisition, skill acquisition and transfer.
14. Systems approach is an educational tool developed to make the educational adventure more flexible, holistic, logical, orderly, responsible and self-correcting rather than intuitive, undefinable and unordered.
15. The advantages of systems approach are (i) It provides a framework on which the plans for implementing changes in education can be built (ii) It assists in identifying the suitability or otherwise of the resource material to achieve the specific goal.

1.11 QUESTIONS AND EXERCISES

Short-Answer Questions

1. What are the essential characteristics of educational technology?
2. What are the features of instructional technology?
3. What are the significance of software and hardware in education?
4. Write a note on how radio can be used in education.
5. Briefly state the phases of micro teaching.
6. Briefly state the advantages of any two visual aids in still projected displays.

Long-Answer Questions

1. How have educationists defined educational technology? What in your opinion is the most appropriate definition? Give reasons.
2. Explain the various types of educational technology.
3. Discuss the significance of educational technology.
4. Discuss the effects in television in facilitating education.
5. Discuss the important features of micro teaching.
6. How can systems approach be applied in education? Give your views.
7. Discuss the objectives of educational technology at the micro and macro level.

1.12 FURTHER READING

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UNIT 2 TEACHING-LEARNING PROCESS

Structure

2.0 INTRODUCTION

Today's rapidly changing and complex world has thrown new and varied challenges to the education system. While there is a general awareness of the necessity to change and develop the preparation of students for productive functioning, there is a consistent demand to simplify the complex system and address the multitude of problems. One way of doing so is adoption of updated technological devices; the others could be treating the learner at that level of understanding where the child is comfortable. This would include the teacher to be intuitive in. understanding the behavior of the child. This would also mean that learning is meaningful and holds significance in context to the child's environment. Learning experiences should be diverse and there should be an atmosphere of support. Ernst von Glasersfeld believes that education has two main purposes: to empower learners to think for themselves, and to promote in the next generation ways of thinking and acting that are deemed important by the present generation (Glasersfeld, 1995).

The teaching-learning process involves a method of monitoring and judging the quality of learning or teaching based on objective, data and scientific criteria. It is the most powerful tool to bring about desired changes in the students. Learning domains, also referred to as categories of learning outcomes, are critical to consider the approach towards teaching. Bloom's Taxonomy divides educational objectives into three domain —cognitive, affective, and psychomotor.

In this unit, you will learn about these educational objectives, the nature and levels of teaching-learning process.

2.1 UNIT OBJECTIVES

After studying this unit, you will be able to:

- Discuss the meaning of education and evaluate its objectives
- Describe the cognitive, affective and psychomotor approach of learning
- Interpret the nature of teaching-learning process
- Explain the variables and phases of teaching
- Identify the levels and operations of teaching-learning

2.2 EDUCATIONAL OBJECTIVES

The word education has a very wide connotation. It is hard to define. There is no single objective which can cover the whole of life with its various manifestations. The two poles of our concern; the temporal and the world of spirit are widely apart. Philosophers and thinkers from Socrates (469-399 B.C.) to Dewey (1859-1952) in the West and Yajnavalkya (about 600 B.C.) to Gandhi (1869-1948) in the East have defined education in accordance with their philosophy of life with the result that there emerged divergent concepts and definitions of education. The concept of education is like a diamond which appears to be of a different colour when seen from a different angle.

Like the proverbial elephant and the blind men, everybody i.e. a biologist, a priest, a philosopher, a psychologist, a statesman, a teacher, a shopkeeper, a merchant, an artisan seems to have his own concept of education which is influenced by his own outlook on life and his past experiences in a limited field.

Education a tripolar process: Education is also regarded as a tripolar process involving the interaction of the personality of the educator on that of the educand in a social setting which affects the modification of the behaviour of the educand. The knowledge of the nature of the educand is at once very useful and essential. Similarly, the educator also must thoroughly understand himself—his assets and limitations and act accordingly in educating the educand. The social setting has to be presented by the educator to the educand in a simple and purified manner. It must be remembered that the unconscious influence of the environment is subtle and pervasive.

Education a deliberate process: The process of education is not only conscious but also deliberate. The educator is fully aware of the fact that his aim is to develop the personality of the child along definite lines through the modification of his behaviour.

Education a psychological and sociological process: According to the psychological aspect of the process, the educator must understand the nature, interests, capacities and limitations of the child. The sociological aspect implies that the educator must interpret the endowments of the child in a social setting.

Education a process of self-realisation: It curbs the animal instincts in man and shows him the way to realize his latent powers. It, thus, makes the potential actual. It makes explicit what is implicit in us, It is, therefore, development from within and not an accretion from without. It modifies the behaviour of the educated. Ross points out, 'Education, thus, consists in a modification of natural development which as a result

of education, is other than it would have been without it.' Education emancipates us from our oddities and infirmities. It is a process of sublimation of instincts. Education, therefore, maybe visualised as a process of self-realisation and emancipation.

The self-realisation aspect of education is well emphasized by Gandhi. To him, education is 'an all-round drawing of the best in the child and man — body, mind and spirit'. Education is a 'pouring out' and not a 'pouring in' process. The word 'V means 'out of and *duco* means T lead'. In other words, education means leading out the inborn powers and potentialities and enabling the child to become what he is capable of becoming. The word 'self-realisation' implies development of individuality in the child. We do not want our educands as dumb-driven, credulous creatures. Nunn points it out by saying that 'the complete development of individuality is the essence of education'. It is through this that 'he (educand) can make an original contribution to human Ufe according to his best capacity.' The emancipation aspect of education has also been put forth by Tagore. According to him, education aims at 'Enabling the mind to find out that ultimate truth which emancipates us from the bondage of oust and gives the wealth not of things but of inner light, not of power, but of love, making thus its own and giving expression to it.'

Etymological meaning of education. Etymologically, the term education has been supposed to be derived from some Latin words and the meanings of these words are given below:

Educatum means the act of teaching

Educere means to lead out or to draw out

Educare means to bring up or to raise or to nourish.

Educo means to lead forth or to extract out

Great educators as great psychologists

Plato (427 to 347 B.C), the Greek philosopher has discussed the various aspects of education in his book *Republic.* He believed that the knowledge of human nature was one of the essentials for a well equipped teacher. It was the function of education to provide nurture to the main elements of human nature.

Rousseau (1712-1778) pointed out the need of the application of psychological principles to education. T wish', says he, 'that some discreet person would give us a treatise on the art of observing children—the art which would be of immense value to us, but of which the fathers and school masters have not as yet learnt the very first rudiments.'

Pestalozzi (1746-1827) believed that to fulfil the aim of education as harmonious, natural and progressive development of the pupils, the teacher must have an insight into the working of the child's mind.

Herbart (1776-1841) emphasised that lesson must be connected with the salient ideas in the child's mind. For relating new ideas the teacher must pay attention to the interests of the child. He formulated the famous formal steps of teaching—Preparation, Presentation, Comparison, Generalisation and Application. Understanding of the interests of the child is a key-note in Herbart's philosophy.

Herbert Spencer (1820-1903) stressed the importance of the application of psychology in his books *Principles of Psychology* (1855) and *Education* (1861). He is the author of the famous maxims of teaching—From Simple to Complex, from Known to Unknown, from Definite to Indefinite and from Concrete to Abstract.

Dewey (1856-1952) in his book *Pedagogic Creed* wrote, "Education must begin with a psychological insight into the child's capacities, interests, and habits.. . These powers, interests, and habits must be continually interpreted, we must know what they mean. They must be translated into terms of their social equivalents—into terms of what they are capable of in the way of social service."

Montessori (1870-1952), the originator of the Montessori Method of Teaching felt that with a deep psychological insight, the teacher would easily understand when he is to step in to guide the pupil's behaviour in order to make steady progress.

Gandhiji (1869-1948), was not only a great leader but also a great educational philosopher. His basic system of education reflected psychological thinking when he said, "I hold that true education of the intellect can only come through a proper exercise and training of the bodily organs, e.g., hands, feet, eyes, ears, nose, etc. In other words, an intelligent use of the organs in a child provides the best and quickest way of development of his intellect. But unless the development of the mind goes hand in hand with a corresponding awakening of the soul, the former alone would prove to be a poor lopsided affair." He further observes, "In my scheme of things the hand will handle tools before it draws or traces the writing. The eyes will read the pictures of letters and words as they will know other things in life, the ears will catch the names of the things and sentences. The whole training will be natural, responsive and, therefore, the quickest and the cheapest in the land."

The above explanation makes it clear the close relation between psychology and education. Psychology deals with the nature of the child. Psychology provides an insight to the educator about the nature of the child. The educator adopts appropriate techniques to unfold the nature of the child.

2.2.1 Cognitive Approach

Cognitive or mental development implies the progressive changes in the mental process which go on from birth to death. Mental process is an activity on the part of the organism which is of a psychological nature or involved in the mind. There are mental tests to evaluate a specific ability or performance. Mental development includes various aspects such as development of concepts, perception, language, memory, reasoning, thinking, imagination and intelligence. Jean Piaget wat the first to develop the theory of cognitive development. Various dimensions of mental development are interrelated. The mental development of the child includes the overall development of various abilities.

Mental development is sometimes described as adding to the stock of information and knowledge. But if it is not accompanied by understanding and wisdom, such knowledge is barren.

Mental development or intellectual development is the development of the mental abilities and capacities which help an individual to adjust his behaviour to the ever

changing environmental conditions or to enable him to accomplish a task that needs complex cognitive abilities. According to J.S. Bruner (1964), 'Intellectual development is the capacity to deal with several choices at the same time.'

Various aspects of mental development

1. **Intelligence and mental development:** Mental development implies increase in intelligence. The results of intelligence tests show that mental or intellectual growth is rapid in infancy, moderate in childhood and slow in youth.
2. **Sensation and perception:** Both sensation and perception are considered important aspects of mental development. Senses are the elementary impressions gathered by sense organs. Impressions take the form of perception when they are interpreted and some definite meanings are attached to them.

   Through experience, a child's sensations become perceptions and he is able to give meaning to it. Child's sensory equipment becomes mature at the age of five. He shows great interest in seeing, hearing, touching, smelling and tasting. However, the child's sensations do not automatically assume meaning. During early childhood, the child is more likely to misrepresent things and objects because of lack of experience. For example, when viewed from a distance, a train may appear to a child as a toy train. But gradually the child's perceptions become more and more accurate through right kinds of experiences. By the time a child enters the school, she/he has gains enough experience. Yet the needs assistance and guidance to improve the ability to perceive by having first hand experiences and observations of objects, persons and situations around. Gradually the child develops a proper perception of space, time, form, movement and distance.

   Perception patterns become more organised and refined when an individual passes through the years to adolescence. Now they tend to become more definite, detailed and rich. Now they need not be associated necessarily with objects. They are beginning to be influenced by beliefs, ideals, opinions, etc.
3. **Concept formation:** Another important aspect of the child's mental development is the acquisition of concept. A concept is the generalised meaning that is attached to an object or idea. It is the result of one'sperceptual experiences. It involves both discrimination and generalisation.

   Discrimination begins sometimes after the child tries to generalise his perceptual experiences. Thus, he begins to acquire concepts. Experience is an important factor in concept formation. In early childhood, a child tries to develop various concepts from the concrete experiences in the form of actual objects.

   Normally, concept formation proceeds from concrete to abstract, from vague to clear and from inexact to exact, depending on the type of experiences a child receives. The child has a very poor concept of time. As stated by Crow and Crow, 'Time as such means little to the young child. He cannot distinguish among today, tomorrow, and next week except as they represent words rather than actual duration of time.'

   In later years, various experiences provided by reading, lecturing and motives help in concept formation.

Generally, concepts may be broadened and developed. They may even take a new shape. Wrong concepts can be altogether abandoned.

Gradually as a result of learning and maturation, the child's concepts become clear, definite and specific.

4. **Development of language:** The development of language contributes to the mental growth and development of the child. Important aspects of language development are speech, vocabulary and length of responses.
5. **Development of memory:** Memory is also an important element of mental development. There is little memory at birth but it gradually increases with maturation and experience. This has been explained by Hurlock and Schwartz in these words, 'Memory of an impressionistic kind appears in the first half of the year and instances of the true remembrance appear by the end of first year. During the first year memory is only aroused by sensory stimuli. With the learning of speech the child is able to remember ideationally by the end of the second year. During the first and second years the memory is stronger for persons and objects than for situation. In pre-childhood from three to six years, situations become significant factors in the child memory. Also the emotional quality of the impressions influence memory. By three years the child can recount the story heard a few days ago and he can also give information about past experiences.'

   A child has a good memory in the earlier stages but this memory is generally a rote memory. Memorisation is without reasoning and the child seldom uses logic and insight in memorisation. A child can cram and reproduce the matter easily. The memory tends to function more logically during later childhood and adolescence. A selection process of remembering and forgetting begins to operate. After that memory tends to decrease.

   Memory depends upon person to person. It is generally affected by health and situation of the child. The stimuli which are associated with a kind of memory influence significantly, its remembrance or forgetting.
6. **Creativity:** It may be stressed that creativity is the most singleability which is at the root of human progress. Like many other activities, it can be developed at a young age. In a general sense, creativity is the ability to think in novel ways which result in some new and original solution.
7. **Problem solving:** All thinking and reasoning involve meeting difficulties, facing complex situations and finding out solutions. An individual is beset with all these since childhood. Thinking and reasoning powers are used in problem solving and these begin to grow as early as two and a hal for three years of age Gradually the ability to reason grows.

Stages of mental development

Various stages of mental development are given below

1. **Period of infancy, beginning of awareness:** In the beginning mental activity consists of awareness of oneself. Later on, this awareness extends to the environments. The nervous system begins to grow during the prenatal period.

As the nervous system keeps growing before and after the birth, the process of mental development also goes on accordingly.

2. **Mental development before three years of Age:** During these years, the process of mental development is much faster. Important characteristics of this stage are (i) curiosity (ii) rote memory (iii) creativity (iv) time concept not yet developed (v) very little development of powers of observation, perception and concentration.
3. **Period of pre-school age:** During the age of two half or three to six, the mental abilities of the child develop rapidly. His perceptual powers increase and his curiosity is aroused to a great extent.
4. **Childhood and before adolescence:** During this period, the sensory powers increase rapidly and the child becomes more accurate in his observations. From a make-believe type of imagination, the child now starts thinking on creative lines. During this period, the likes and dislikes, interests, thoughts and plans of the child begin to shape themselves. The child begins to imagine things. The power of deductive and inductive reasoning increases and the child is able to generalise from a data given. The child develops the concepts of length, time and distance and teams to express herself himself in various ways.
5. **Mental development during adolescence:** Discussed in detail separately.
6. **Mental development during early adulthood:** The most important mental abilities needed for learning and adjustment to new situations, such as recall, reasoning and creative thinking reach their peak during the twenties and men begin a slow and gradual decline.
7. **Mental development and middle ages:** Studies conducted by L.M Terman and M.H Oden (1959) on a group of individuals followed from pre-school years to middle life have shown that mental decline does not set in during middle ages among those with high intellectual abilities.
8. **Mental development during old age:** Old people take more time to integrate their responses. They tend to lack the capacity for or interest in creative thinking. Old people tend to have poor recent memories but better remote memories. There is slight deterioration in vocabulary. The mental rigidity that sometimes sets in during middle age often becomes more pronounced as the person grows older

Cessation of mental growth: Psychologists have tried to give various ages ranging from thirteen to the early twenties or even much later as the age alter which there is no further mental growth. Sorcnson (1948) has tried to arrive at some conclusion regarding the age of cessation of mental growth. He writes, it is probably safe to conclude that a person reaches the maximum mental level at about the age of twenty or perhaps a little before or a little after twenty. It is true that on the average there is only a little mental growth during the late teens—nevertheless, this small amount may be very important.'

It may be remembered that all the changes in mental development do not occur all of a sudden or they strictly conform to a specific stage. The changes that are mentioned here are no doubt, signs of increasing maturity but no distinct stages in

mental development are noticeable. An individual or the child does not pass from the stage immediate and concrete to the stage of the remote or the abstract, at a particular level of his development. The process of maturity continues throughout all stages of development. At the same time it must be kept in view that there are certain behaviour patterns and certain development trends which are absent at one stage but are visible in the next stage or still in another higher stage.

Factors affecting intellectual development

1. **Heredity:** Intellectual development of an individual is greatly affected by the interaction between inherited intelligence and the individual's experience.
2. **Physical growth:** There is a strong relation between physical growth and intellectual development. A healthy person is likely to have a better intelligence than a person who has a poor physique.
3. **Physical environment:** Physical environment like fresh air, sufficient light and ample space has a great bearing on intellectual development.
4. **Family environment:** The kind of discussions held in the family, type of reading material like books and magazines read by the family affect the intellectual development.
5. **Socio-economic status** of **the family:** Parents of high socio-economic group have better access to send their children to good schools.
6. **School environment.** The methods of teaching, availability of good reading material in the library, attitudes of teachers and school discipline, etc. affect intellectual development.

It is concluded that intellectual development is the result of a large number of factors and is not an automatic process. It is a gradual and pain-staking process.

Mental development and educational implications

Mental development is influenced by both heredity and environment. Very little can be done to change the influence of heredity. But a good deal of work in this regard can be done by the parents, the teachers and the school to provide a healthy and motivating intellectual environment for the child. The cultural and social experiences, learning opportunities and discipline which he gets for the development process, contribute significantly towards his mental development. The child should be exposed to" opportunities of narrating, observing, imagining, thinking, reasoning, questioning, doing independent work, manipulating and improvising. Among the important activities for the mental development are: *(i)* story making, telling, writing and listening, *(ii)* picture compositions, *(Hi)* essay writing involving imagination, (z'v) assembling of parts of some dismantled objects, (v) modelling, *(vi)* arranging colour cubes to form new designs, *(vii)* quiz competitions, *(viii)* debates and elocution contests and *(ix)* problem solving.

Jean Piaget's theory of cognitive development (mental or intellectual development)

Jean Piaget (1896-1980) is regarded as one of the pioneers in psychological investigation of children although he neither undertook formal study nor passed any

examination in psychology. He was a biologist by training. At an early age of 22, he obtained his doctorate degree in Zoology on Mollusks of Valias. He worked on child development for more than 50 years and produced enormous literature on developmental psychology. He read philosophy, psychology and sociology. He pursued clinical research at the Alfred Binet Laboratory at Paris. By observing, dissecting and experimenting with children, he developed his educational theory regarding cognitive development or learning by children. His work as a professor of child psychology at the University of Geneva (Switzerland) made him famous.

Piaget began his study of child development with the observation of his own three children. From this beginning, his investigations were gradually extended to other children. These investigations resulted in the publication of a large number of papers and books which are often quoted by eminent psychologists and other thinkers on education.

Before we describe Piaget's four stages of development we shall consider his views on education and learning and on some of the important concepts stated by him.

Piaget stressed the following aims of education:

1. The principal goal of education is to create men who arc capable of doing new things, not simply repeating what other generations have done. Education should create men who are creators, inventors and discoverers.
2. The second aim of education is to form minds which can be critical, can verify and do not accept every tiling they are offered.

Writing in his book, *To Understand is to Invent - The Future oj Education,* for the International Commission on the Development of Education, UNESCO, Piaget stated, 'The author of these lines is by no means a professional educator, but rather a psychologist led by his research to study the problems of the formation of man.' In other words, education in its real sense deals only with the formation of man and nothing else.

He revolutionised thinking and understanding about the intellectual growth of young children. According to his theory, a child goes through a scries of developmental stages which are as follows:

1. Sensori-motor stage (birth to two years)
2. Preconceptual stage (two to four years)
3. Intuitive stage (four to seven years)
4. Concrete operation stage (seven to eleven years)
5. Former operations stage (eleven to adolescence)

Piaget introduced four concepts in the building of his theory. These are as under: (i) Schemes (ii) Assimilation (iii) Accommodation (iv) Equilibration

Schemes (cognitive structures): Piaget called 'schemes' as cognitive structures or the patterns of behaviour that children and adults use in dealing with objects in their environment. These patterns can be simple as well as complex. As the development proceeds, each pattern enlarges and changes. It is coordinated with other patterns to form more complex patterns. The infant sucks the breast of the mother, looks at the objects of the environment, listens to different voices in his environment and finally tries to comprehend, conceptualise the articles, animals, space and many other behaviour patterns or structures.

Assimilation: Assimilation implies incorporation of something from the environment. New ideas, concepts and stimuli are taken in and incorporated into one's 'existing set of scheme.'A scheme is the organised pattern of behaviour which the child develops when engaged in any activity. For example, when a child is engaged in sucking, there is a certain pattern of movements of the cheeks, lips and hands. When a child is confronted with a new object, child will try to understand the new object by applying the old scheme to it. The child grasps, adapts herself/himself to a new object by assimilating it. The child's old scheme does not change in the process.

Accommodation: Accommodation involves modification or change of some elements of an old scheme or learning a new scheme which is more appropriate for the new object. A baby who has already got a scheme of sucking mother's breast accommodates to the object placed in the mouth — finger, pencil, a toy—depending on its shape, form and the size. The baby develops a new scheme or a modified scheme. This is called accommodation.

Thus, a baby assimilates when he understands and perceives the new in the light of his old perceptions. A baby forms a new scheme 'modifies or changes the old perception to suit the new. This implies adjusting or accommodating. In this way a baby forms new structures or new schemes, and consequently develops cognivity.

Equilibration: The structures or the schemes change from one stage to another by the process of equilibration—^maintaining balance between the child and the changing environment. According to Piaget, when by the existing scheme, the new situation is not fully handled, then there is created a state of disequilibrium or an imbalance between what is understood and what is encountered. In such a case, the individual tries to reduce such imbalances. This is done by him by focussing his attention on the stimuli that has caused the disequilibrium and developing new schemes or adapting old ones until equilibrium is restored. This process of restoring balance is called equilibration. Piaget believes that learning depends on this process

Stages of child development

Piaget divides the stages of cognitive development of the child into the following categories:

1. **Sensori-motor stage:** This stage covers the period from birth to two years. This stage is marked by sensation. Simple learning occurs but the child does not think at this stage. These early sensori motor experiences of the child have a great bearing on the development of his later intellectual abilities. In the world of the child an object exists when it is physically present. He then gains some consciousness about the stability of the object. He starts comprehending casually.

It is sometimes said that the child's mental development at this stage is equal to that of an intelligent animal. By the end of two years, the child develops the concept which is characterised by relationship among objects and between objects and his own body.

2. **Preconceptual stage:** This stage is roughly between two years and six years. The child develops ways of representing events and objects through symbols, including verbal symbols of language. He can now think about things that are not immediately present.

   The child now becomes ego-centric i.e. primarily concerned himself.

3. **Intuitive stage:** This covers the age four to eight years. The reason of the child is not logical and is based on intuition rather than systematic logic. The intuitive thought is primarily concerned with static conditions but the child is able to use concepts as stable generalization of his past and present experiences. He, however, cannot adequately link a whole set of successive conditions into an integrated totality.

4. **Concrete operations stage:** The stage of development is usually between the age of six and eleven or twelve years. At this stage a child is concerned with the integration and stability of his cognitive system. The child develops logical operations from simple associations. He learns to add, substract, multiply and divide. He is in a position to classify, concrete objects. These operations are called concrete because they relate directly to objects. These operations do not involve abstract thinking. Piaget has coined a new term grouping to describe a set of operations. Piaget has given a long list of operations which make it possible to handle numbers in various relations to each other, the arrangement of objects into classes and sub-classes and the ordering of objects according to one or more attributes.

5. **Formal operations stage:** This stage is roughly from twelve years to adolescence. At this stage the thought process of the child becomes quite systematic and reasonably well integrated. The child is in a position to free himself from the concrete operations related directly to objects and to groups. He is capable of reasoning with propositions removed from the concrete. He develops an experimental spirit. Now he solves problems more systematically and the bases of action are not trial and error. The youngsters at this stage are able to organize information, reason scientifically, build hypotheses based on understanding to causality and test their hypothesis.

Piaget's views on various aspects of learning

1. **Meaning of learning:** Learning includes the wide range of activities. Rigid distinctions like classroom for instruction, laboratory for practicals, recess for amusement, mathematics for developing computational ability, and athletics for strengthening the body muscles, are unnecessary. Piaget's approach helps to tie together what have been treated as separate subjects.

2. **Role of learner's actions:** Action stresses the role of active exploration. Achild is active when he stares at objects. A child is active when he stares at an organism. A child is active when he studies his body parts. A child is active when he lifts something. A child is active when he carries things. A child is active when he

arranges things. Children are usually active for most of their time. There is no doubt that some of these activities maybe rather aimless or unnecessary. However, most of these activities are purposeful.

3. **Role of practice:** An important part of Piagetian model is repetition of an act by a child. The role of practice varies the development. Concepts are the products of a long history of action. A child may take three or more days to complete a puzzle. Each day he appears to go through the same sequence. Child's actions upon the environment are repeated again and again with slight modifications each time. Piaget depicts the child as somewhat slower and methodical and systematic in acquisition of new ideas.
4. **Motivation:** According to Piaget, a learner desires to reduce his internal conflicts by keeping his thoughts harmonious and in equilibrium. It is only through playing, imitating, exploring and questioning that a child gradually comes to distinguish the achievable from non-achievable, and logical from the illogical. To Piaget, the progress towards this end is inherent, a property of cognitive style as are eating, drinking and breathing in the physiological field.
5. Memory: Memory is a symbolic representation of how the child has schematised what he saw. Experiments conducted by Piaget reveal that after six months, 61 per cent of the children from 4-8 years of age regressed in their memory ability if tested by recall or evocation.

   A reconstruction test involving the child with some material showed regression in 4-5 years old but 48 per cent progression among 6-7 years old. Piaget holds that recognition is perceptual and reconstruction is internalized imitation. Each experiment reveals that the pattern of accuracy, improvement and regression (gradual loss of memory) is determined by initial conceptual understanding and is altered by new understandings.
6. **Interest:** According to Piaget, the interest of the child at any given movement depends upon the system of ideas he has acquired plus his affective perception. A child tends to fulfil his interests in the direction of greaterequilibrium. Equilibrium according to Piaget is development and the abilityto think in a logical and natural manner.

General educational implications of Piaget's cognitive theory of development

1. It provides a broad development perspective to the educator for building a curriculum for the children.
2. The description of developmental stages and qualitative aspects of intellectual growth is very useful in providing suitable educational practices.
3. The cognitive theory states that the child is to be actively involved in the teaching-learning process for his intellectual growth.
4. Piaget-based curriculum requires that children should not skip any stage
5. The pre-school child is at the pre-operational level. The educational programme at this stage should provide concrete operations.
6. Educational programme should enable the child to integrate the information.
7. A child should be helped to develop internal consistency of the system.

8. Most of the activities of the Piaget type require simple equipment and material.
9. Drilling in skills is to be avoided
10. Teaching learning situation should be geared to a point where the child is neither too familiar nor too unfamiliar with the objects and ideas
11. Variety of cognitive activities like story telling, rhymes, and singing are included in the programme in a systematic manner. There is a deliberate attention of developing cognitive growth.
12. A child's development is retarded if he is not allowed a fairly wide sensory and motor experience in his early years.
13. Real events and concrete objects play an important role in learning.
14. In science and mathematics, learning from physical environment is more important than what is learnt from people, books or television.
15. A teacher should arouse curiosity of the child through planned activities.
16. Children like to find out by themselves by their own spontaneous activity.
17. Children learn speedily if we provide concrete material to them.

Educational implications at the pre-school and primary stage

1. The teacher should familiarise himself with the theoretical and practical aspects of Piaget's theory of cognitive development.
2. The teacher should try to assess the level and type of thinking of each child in his class.
3. Each child may be asked to preform some of the experiments as suggested by Piaget.
4. The teacher should spend a lot of time in listening to each the child's reaction to the experiments.
5. Plenty of equipment materials and opportunities should be given to children to learn on their own.
6. For social interaction, group situations maybe arranged so that children learn from each other.
7. Learning experiences should be so arranged as they take into account the level of thinking of mental development attained by an individual or group.
8. It should be kept in mind by the teachers that the children may be influenced by egocentric speech or thought.

Secondary classes

1. The teacher should familiarise herself with the nature of concrete operational thinking and formal thought so that she is able to note when the students are applying either of the two or a combination of them.
2. Students may be asked to conduct a few experiments suggested by Piaget.
3. Each student may be asked individually to explain how they would arrive at solutions to problems in response to the experiments similar to those devised by Piaget.

4. Students should be guided to be more systematic regarding solving problems.
5. Care should be exercised to ensure that class discussions are constructive and do not go astray.
6. Students should be trained to appreciate the viewpoints of others. They should not become egocentric.

Criticism of Piaget's Theory of Development

Several psychologists do not agree with Piaget's theory of cognitive development. According to R.M. Gagne (1968), stages described by Piaget are not necessarily the inevitable result of a inborn time-table. Instead they are a consequence of children having learned sets of rules that are progressively more complex and these rules are taught by their physical and social environment. Gagne thinks that Piaget was indifferent to the role of learning in developmental changes.

Some psychologists do not agree with the view of Piaget that infants are born with some elementary mental structures that are starting points for their attempts to deal with their environment.

Piaget's views are not new to educational thought. What is new is that they have been stated in the context of the classroom situations. Instruction in the classroom would serve the function of setting into motion the processes of assimilation and accommodation for a particular area of exploration.

2.2.2 Affective Approach

Affective domain (Krathwohl, Bloom, and Masia, 1973) involves the way humans tackle things and incidents emotionally, such as feelings, values, appreciation, enthusiasms, motivations, and attitudes.

Emotions play an important role in life and contribute to the personal and social development of an individual. Continuous emotional disturbance affects the individual's growth and development and gives rise to mental, physical, social and other problems. It hampers intellectual training. On the other hand, an emotionally stable individual leads a happy, healthy and peaceful life. The individual is then at ease with ourself, the surroundings and other fellow beings. Therefore, the development of emotions is extremely important for the harmonious development of the personality of an individual. Emotions influence all aspects of an individual's personality. Proper training and education will go a long way to enable the young people to control their emotions and obtain mental balance and stability. Emotions are the prime motive forces of thought and conduct and their control is very important. It has been rightly said, 'To keep ones emotions under control and be able to conceal them is considered a mark of strong character.'

Child A is a *happy* child.

Child B gets *angry* over small things.

Child C always looks *sad.*

Child D is *very jealous* of his younger brother.

All these children show signs of expressing emotions.

Meaning of emotions

Etymologically the word emotion is derived from the Latin word emovere which means to stir up, to agitate or to excite.

R.S. Woodworth (1945), by making use of this explanation has defined emotion, as, 'Emotion is a moved or stirred up state of an organism It is a stirred up state of feeling that is the way it appears to the individual himself. It is a disturbed muscular and glandular activity—that is the way it appears to an external observer.'

According to Crow and Crow (1973), 'an emotion is an effective experience that accompanies generalised inner adjustment and mental and psychological stirred up states in the individual, and that shows itself in his own behaviour.'

William McDougall (1949) says, 'An instinct is an inherited or innate psychophysical disposition which determines its possessor to perceive and to pay attention to, objects of a certain class, to experience an emotional excitement of a particular quality upon perceiving such an object, and to act in regard to it in a particular manner, or, at least, to experience an impulse to such an action.' This statement gives us the nature of emotions as well. According to McDougall, an instinctive behaviour has three aspects: (i) cognitive or knowing or perceptual aspect, (ii) affection or feeling or emotional effect, (iii) conative or doing or strivjng or executive, active or behavioural aspect.

Let us take an example. A child sees a bull coming towards him. He experiences an instinctive fear and undergoes the above three processes. Firstly, he perceives the bull, secondly he experiences an emotion of fear and thirdly he tries to run away. It is, therefore, concluded that an emotion is an affective experience that one undergoes during an instinctive excite-ment.

McDougall discovered fourteen basic instincts and pointed out that each and every emotion, whatever may be is the product of some instinctive behaviour.

The instincts in their alphabetically order with their associated emo-tions are listed as under:

Table 2.1 *Instinct and Emotions*

S.No.	*Instinct*	*Emotion Accompanying an Instinct*
1.	Acquisition	Feeling of ownership
2.	Appeal	Distress
3.	Construction	Feeling of creativeness
4.	Curiosity	Wonder
5.	Flight or Escape	Fear
6.	Food seeking	Appetite
7	Gregariousness	Feeling of loneliness
8	Laughter	Amusement
9.	Parental	Tenderness, Love
10.	Pugnacity or Combat	Anger
11.	Repulsion	Disgust
12.	Self-assertion	Positive feeling or Elation
13.	Sex, Mating	Lust
14.	Submission	Negative feeling

Kimball Young notes, 'Emotion is the aroused psychological state of the organism marked by increased bodily activity and strong feelings directed to some subject'

Chief characteristics of emotions

1. The emotional experiences are associated with some instincts or biological drives.
2. Emotions, in general, are the product of perception.
3. The core of an emotion is feeling which is essentially linked withsome sort of urge or impulsive act to do. There is only a difference of degree between feeling and emotion.
4. Every emotional experience involves several physical and psychological changes in the organism Some of these changes like the bulge of the eyes, the flush of the face, the flow of tears, and the pulse rate, are easily observable. There are also internal physiological changes like circulation of blood, the impact on the digestive system and the changes in the functioning of some glands, etc.
5. Emotions are frequent.
6. Emotions are expressed in relation to the concrete objects or situa-tions.
7. Emotions are temporary.
8. Emotional expressions in early childhood are intense irrespective ofthe intensity of the stimulus.
9. Small children fail to hide their emotions and express them indirectly through different activities like crying, nail-biting, thumb-sucking and speech difficulties.
10. Emotions are prevalent in every living organism.
11. Emotions are present at all stages of development and can be aroused in young as well as in old.
12. Emotions differ from person to person.
13. Same emotion can be aroused by a number of different stimuli-objects or situations.
14. Emotions rise abruptly but die slowly.
15. Emotions are subject to displacement. The anger aroused on account of one stimuli gets transferred to other situations. The anger caused by the rebuking ofthe officer to his subordinate may be transferred in beating the children at home.
16. One emotion may give rise to a number of likewise emotions.

Effects of emotions on the developing individual. Following are the important effects of emotions on the developing individual:

1. Emotions provide energy to an individual to face a particular situation.
2. Emotions work as motivators of our behaviour.
3. Emotions influence our adjustment in the society

4. Highly emotional conditions disturb the mental equilibrium of an indi-vidual.
5. Highly emotional conditions disturb the reasoning and thinking ofanindividual.

Inter-relation of physical and emotional factors. There is a close relationship between the physical and emotional factors. An imbalance or disturbance in the child's physical growth is most likely to be reflected in his intellectual functioning and personality adjustment. An unhealthy emotional climate is likely to affect the physical health of the child and it may hinder his normal physical growth. A child under emotional strain is likely to be physically unhealthy and show signs of physical ailments. This relationship is illustrated in the following figure.

Kinds of emotions: Positive and negative

Emotions, in general can be categorised into two kinds—positive emo-tions and negative emotions like affection (love), amusement, curiosity, happiness and joy which are very helpful and essential to the normal behaviour are termed as positive emotions. Unpleasant emotions like anger, fear and jealousy which are harmful to the individual's development are termed as negative emotions.

It should be borne in mind that it is not to be assumed that all the positive emotions are always good and the negative emotions are bad. Excess of everything is bad. Whether an emotion will prove to be helpful or harmful to an individual depends upon the following factors:

(i) The frequency and intensity of emotional experience.

(ii) The situation, occasion and the nature of stimulus which arouses the emotion.

(iii) Kind of emotional experience.

Emotions with too much intensity and frequency whether positive or negative bring harmful effects. Emotions may be external or physiological and internal or psychological. Important signs of emotions in an individual include increase in heart rate, rise in blood pressure, occurrence of changes in blood composition, and increase in respiration, hair standing on end, dilution of eye-pupil, increase in muscle tension, increase in perspiration.

Difference in children's emotions and adult's emotions

1. Children's emotions are frequent. They are angry and happy several times a day. This is not the case with adults.
2. Children's emotions are brief. Their duration is short. Adult's emotions are of longer duration.
3. Children's emotions are transitory and there is a shift in emotions.
4. Children's emotions are relatively intense. If a child is to weep, she weeps aloud. Intensity is not observed in the emotion of adults.
5. Children usually express their emotions. On the other hand, adults may try to conceal their emotions.

Approximate ages at which different emotions appear

Appr Age	*Appearance of Emotion/Emotions*
First month	Excitement
3 months 6	(i) Distress (ii) Delight
months 12	(i) Fear (ii) Disgust (iii) Anger
months 18	(i) Elation (ii) Affection
months 24	(i) Affection for Adults (ii) Affection for Children
months 5	(i) Jealousy (ii) Joy
years	(i) Shame (ii) Anxiety (iii) Fear (iv) Disappointment (v) Envy (vi) Hope.

Symptoms of unsatisfactory emotional development

Some of the more common symptoms of unsatisfactory emotional adjustment are: resistance to learning, speech problems, excessive day dreaming, oversensitivity, extreme dependence on peers or adults, resistance to the requirements of the classroom or the group and temper tantrums.

Theories of emotions

Important theories advanced to explain the nature and origins of emo-tions are:

1. McDougall's theory of emotions.
2. James Lange's theory of emotions.
3. Sherrington's theory of emotions.
4. Cannon's theory of emotions.

McDougall's theory of emotions. This theory of emotions tries to relate the stimulus situation to the state of the organism and the bodily situations. An instinct is an innate disposition which determines the organism to perceive a certain emotional excitement of behaviour in relation to that object. The instinctive tendencies detennine the end oi all activities. According to McDougall, in the operation of an instinct, the first step is cognition—that is perception which is followed by emotion and it is the emotion which gives rise to certain organic changes in the body.

James Lange's theory of emotions. James reverses this process. According to this theory, the experience of emotion is merely a mental reverberation of the massive bodily changes that take place during an organism's response to the situation. Bodily changes follow directly upon the perception of an exciting fact (stimulation) and our

feeling of these changes as they occur in emotions. The sequence, according to 7traditional theory is: situation—mental state—bodily expression. James Lange's theory rejects this sequence and states this sequence: situation—bodily disturbance— men-tal state. In other words, we should not say 'we meet a bear, are frightened and then run' rather we should say 'we meet a bear, we run and we are frightened.' Therefore, James Lange's theory may be said to insist on two propositions: (1) that emotion is nothing but an organic sensation and (2) that bodily expressions and organic disturbances, which are said to be effects of emotions are really their causes.

Sherrington's theory of emotions. C.S. Sherrington performed certain nerve-cutting operations on his laboratory dog and came to the conclusion that animals gave evidence of emotional character and showed anger, disgust, fear and joy. These experiments indicated that the emotions were not the results of some organic changes in the body. Organic changes can even be produced artificially without the presence of emotions

Cannon's theory of emotions. W.B. Cannon made a physiological experiment on a cat. He cut off the sympathetic nerves of the cat making impossible the organic state of anger dependent on those nerves. He concluded that the bodily changes are neither consequents nor antecedents of conscious states: they are simply the accompaniments.

Factors influencing emotional development

Emotional development of an individual is influenced by a number of factors—health and physical development, intelligence, family environment, school environment, peer groups' environment, neighbourhood, community and society's environment

1. **Health and physical development of an individual.** There is a positive correlation between health and physical development and emotional development. Any deficiency in health and physical development— internal or external leads to emotional disturbance. Children who are weak in structure or who suffer occasional illness are more emotionally upset and unstable than children whose health is better. Any abnormal increase or decrease in the normal functioning of the glands creates obstacles in the proper emotional development.
2. **Intelligence and emotional development.** H. Meltzer (1937) as quoted by E.B. Hurlock has observed, 'There is less emotional control, on the average, among those of the lower intellectual level than among children of the same group who are bright.' An intelligent person, with his thinking and reasoning powers, is in a better position to exercise control over his emotions.
3. **Family environment and emotional development.** A cordial environment i.e. healthy relationships between the parents is very conducive to the emotional development of the child. The treatment meted out to the child by the parents and other members of the family influences his emotional development. The order of birth (whether the first or the younger child), sex (son or daughter), size of the family, socio-economic status of the family, discipline in the family, the parental attitude towards the child (pampered, overprotected or neglected)— all are important factors in the emotional development of the child.
4. **School environment.** The attitude of the teachers, school discipline, academic facilities available, physical facilities, methods of teaching, and co-curricular activities—all influence emotional development of children.

5. **Peer group relations and emotional development.** The influence of the classmates and other members of the group affects emotional development.
6. **Neighbourhood, community and society's environment and emotional development.** A child lives in the society and picks up so many traits of emotional behaviour from the surroundings.

Educational implications of emotional development

There are several situations and things at home and school which make a child unhappy rather than happy. It is common to note that children experience too many unpleasant emotions like anger, fear and jealousy than positive emotions of affection, joy and pleasure. Here it may be stressed that it is the experience of positive emotions that helps the child to develop a positive outlook on life. However, it is also true that the experience of only positive emotions in life is not always possible for everyone. One does come across a number of both pleasant and unpleasant situations. This means that a child must learn to accept unpleasant emotional experiences in such a way as he does not show undue concern and disturbance. He must learn to adjust himself to such experiences, situations, events, ideas and persons that cause annoyance. But as far as possible, the home and the school should create more and more situations in which pleasant experiences predominate.

Following suggestions are offered to help children's emotional balance:

1. E.B. Hurlock states five causes which disturb emotional stability—
   (a) **Fatigue:** Tired children are difficult to handle. Therefore, efforts may be made not to cause undue fatigue to them.
   (b) **Poor health:** Children with poor health are irritable. Hence, health of the children should be properly looked after.
   (c) **Association with emotional people:** Children imitate the behaviour of their elders—parents, teachers and other adults and peer groups. Suitable examples of emotional stability should be presented by the elders.
   (d) **Thwarted desires:** The more restrictions are imposed on children, the more revolting they become. This means that a suitable disciplinary mechanism should be evolved.
   (e) **Unpreparedness:** A child shows emotional outbursts when she is faced with a strange situation or for which she is not prepared. Proper training to face such situations needs to be given gradually.
2. Children should be helped to express their emotions in a natural way.
3. Children should be helped to develop a realistic understanding about the situations that arouse unpleasant situations.
4. Children should be helped to learn how to control their feelings which may offend others.
5. Children should be gradually directed to exercise more of internal self control.
6. Counselling may be useful in cases of highly disturbed emotional states of minds.

Development of emotions and maturity

Certain instincts with their corresponding emotions are lying dormant in early stages but are matured afterwards. The sex instinct is the most important one which is lying in a latent state in childhood and consequently lust, its corresponding emotion, is also not apparent at that time. But during the period of adolescence when the hormones of sex glands begin to work the distinct is stirred up along with its emotion. The child does not carry any fears when he is born. But further experiences and conditioned reflexes beware him of many risks and dangers and he begins to develop many fears, real as well as imaginary. Some emotions begin to be weaker in maturity. With maturity the child learns to control and moderate his emotions. He learns how to dominate over his crude and wild emotions with the help of noble sentiments which are themselves organized forms of various emotions.

Role of education in the emotional development of children

The main aim of education is to modify and direct the behaviour of the child so that he becomes a useful member of the society. In this task, instincts and their potential allies i.e. the emotions have to be refined by training and education.

There are some emotions often based on temporary or imaginary dangers, which are constantly stirring up the child. These are worry and fear. Every emotion is taxing and tiresome for the child as it produces tension both mental and physical, and wastes energy. If this tension continues for a long time it causes damages to the child. Therefore, it is our duty to see that children are not harbouring these dangerous emotions. Anger is another furious emotion which is dangerous to the health of the child and also to the peace of the society. We should redirect it to useful channels. Hatred is also a devilish trend and needs sublimation.

Character formation of children is one of the main duties of the teacher. We can succeed in this aim only if we harness various emotions and synthesize them into sentiments and master sentiment. Strong will power also depends upon the synthesis of emotions.

Training and modifying emotions

Emotions can be modified through the following devices:

1. **Redirection:** An emotion is dynamic in nature and cannot be suppressed totally. It cannot be destroyed. It is just like a tumultuous stream which cannot be obstructed permanently without giving some outlet. But as we can harness a wild stream by building a dam against it and giving new channels to the powerful waters, quite in the same way, emotional waves can also be rechannelled for the advantage of the organism itself and for the whole society to which he belongs. Let us take the example of anger'. It is a furious emotion. It exists in its wild form in every organism. We have simply to tame and redirect it to broad and beneficial channels for the benefit of the person and the society.
2. **Sublimation:** Sublimation is also a sort of redirection with this difference only that in the former case the emotion does not lose its original form while in the latter case it is so much elevated that it changes its form. It takes up much nobler and higher form. Lust is transformed into love for fine arts or social

services or devotion to some deity. Anger turns to be zeal and enthusiasm. Fear takes the form of anxiety for the betterment of mankind.

3. **Catharsis:** Intensity of emotions is dangerous for health, especially when they do not find expression. Even their expression in original form is very costly for the mind and the body. Therefore, catharsis of pent-up emotions is necessary for the well-being of the organism. Play and extra- curricular activities are very useful devices for this purpose.
4. **Inhibition:** Human life is very complex in the present civilization. We need to control our emotions at every step. Redirection, sublimation and catharsis are not possible always and at every moment. Often we have to suppress our emotions for a short time or for a long time. It can be done with the help of strong will. But we should know that inhibition should not be permanent and we should give some outlet to the pent-up emotions as soon as possible.
5. **Mental occupation:** Empty mind is a devil's workshop. If a child is busy in some mental or even physical activity, other stimuli cannot disturb his emotions. Moreover, he is already undergoing the process of catharsis. Even if his emotions are stirred up when he is quite exhausted after enough mental activity, the stimulation will not be too intense for him.
6. **Positive suggestions:** Suggestions may be used as an effective tool by the teacher for the formation of positive sentiments in pupils. Negative suggestions should be avoided.
7. **Affectionate environment:** For healthy emotional development, child should be given a feeling of belongingness and security by sympathetic behaviour and affectionate attitude.
8. **Example is better than precept:** The parents and teachers should reflect maturity in expression of emotions. Whatever form of behaviour is expected from the students, the teacher should adopt the same in his own dealings.

2.2.3 Psychomotor Approach

The psychomotor domain includes physical movement, coordination, and use of the motor-skill areas through use of sensory cues. These range from sensory stimulation, through cue selection to translation. Development of these skills requires practice and is measured in terms of speed, precision, distance, procedures, or techniques in execution.

'Healthy mind in a healthy body' is an old adage and is true to the core. The physical development of the child is very important for a number of reasons. Appropriate physical development makes valuable contribution to the all-round development of an individual. When a child is busy in some physical activity, he is emotionally as well mentally involved in it. Physical development of the individual is important both for the individual and social development. It is also important for ethical, moral and spiritual development. A physically unhealthy person, other things being equal, is unable to perform his duties to wards ourself, to the community.

By not giving proper attention and care to the physical development of the child, we may be guilty of causing serious handicaps to the total development of the

child, including his emotional, intellectual and social, even ethical and spiritual. Aknowledge of the process of the physical growth of the child and development will enable the teacher to equip him for setting his programmes according to the needs of the children.

Meaning and dimensions of physical growth and development

Physical growth and development refers to a process which brings about bodily and physiological changes—internal as well as external—in an organism from the conception till his death. Generally, these changes take place in the following dimensions:

(i) **Gross physical structure or physique:** It involves changes in height, weight, body proportions and general physical appearance.

(ii) **Internal organs:** It involves changes in the functioning of glands, nervous system and other body systems—circulatory, respiratory, digestive, muscular, lymphatic and reproductive

Although there are wide individual differences among children, yet physical growth and development seems to follow to some extent a general pattern. This general pattern of development and growth may be summarised as under.

(i) **Increase in height and weight:** The table illustrates increase in height and weight at different ages.

. On the average, at birth a baby is about 56 cm in height and between 4 and 5 kg. in weight, boys being sightly taller and heavier. During the first two years, there is rapid increase in both height and weight There is a steady and slower growth from the third year till the on-set of puberty. By five years the height of the child, approximately increases by 80 per cent and he acquires almost *VA* times his birth weight. During the period of adolescence we again find a sudden increase in both height and weight. Girls reach puberty about a year or two earlier than boys do. Therefore, at the age of 12 they are found slightly taller and heavier than boys. But they are again surpassed by the boys at about the age of 14. By the end of adolescence, the young men are generally higher and heavier than the young women. Generally both men and women get their maximum height and weight upto the end of adolescence. But there are very much variations in weight as it is more susceptible to environmental influences. Therefore, it is no surprise to note the sudden increase or decrease in weight in later years after attaining maturity.

Weight of the brain increases rapidly in the early years of life. By the time the child completes the age of four his brain gains almost 80 per cent of its final weight, another 10 per cent being added by the time he com-pletes his eight years. By the 20th year, the brain gains almost all its weight.

(ii) **Changes in body proportions.** There are changes not only in the size of the body of the child but also marked changes in the proportion of the different parts of the body. For instance, the head constitutes about one-fourth of the height of the body at birth. The size of the head is relatively much larger than tha arms and legs. As the child grows older, the proportion of the head decreases.

By the end of the adolescence, head becomes one-eighth of the body. The other parts of the body, legs, arms, etc. also change in proportion.

Table 2.2 Mean Height and Weight of Male and Female Children (All India)

Age Group	*Mean Height (cm.)*		*Mean Weight (kg.)*	
	Male	*Female*	*Male*	*Female*
3 months	56.2	55.0	4.5	*42*
4-6 months	62.7	60.9	6.7	5.6
7-9 months	64.9	64.4	6.9	6.2
10-12 months	69.5	66.7	7.4	6.6
1 year	73.9	72.5	8.4	7.8
2 years	81.6	80.1	10.1	9.6
3 years	88.8	87.2	11.8	11.2
4 years	96.0	94.5	13.5	12.9
5 years	102.1	101.4	14.8	14.5
6 years	108.5	107.4	16.3	16.0
7 years	113.9	112.8	18.0,	17.6
8 years	119.3	118.2	19.7	19.4
9 years	123.7	122.9	21.5	21.3
10 years	128.4	128.4	23.5	23.6
11 years	133.4	133.6	25.9	26.4
12 years	138.3	139.2	28.5	29.8
13 years	144,6	143.9	32.1	33.3
14 years	150.1	147.5	357	36.8
15 years	155.5	149.6	39.6	36.8
16 years	159.5	151.0	43.2	41.1
17 years	161.4	151.5	45.7	42.4
18 years	163.1	' 151.7	47.4	42.4
19 years	163.5	151.7	48.1	42.4
20 years	164.1	151.7	49.2	43.5

Source: Growth and Physical Development of Children.

All India - Indian Council of Medical Research. New Delhi, 1968.

Common causes of delayed motor and physical development

1. Poor physical conditions caused by illness, and malnutrition.
2. Lack of opportunities to develop manual skills.
3. Nagging, scolding and ridiculing of the child by parents and teachers when he does not succeed in an activity.

Factors affecting physical growth and development

1. The traits and characteristics inherited at the time of conception.
2. The physical as well as mental health of the mother during pregnancy.
3. Nutrition received by the embryo within the womb of the mother.
4. Conditions and care at the time of delivery.
5. Normal or abnormal delivery.
6. Single birth or multiple births.
7. Care of the baby and its mother.
8. Presence or absence of physical defects.
9. Presence or absence of illness and diseasi
10. Proper or improper medical care.
11. Nutrition received by the child after birth
12. The living conditions--physical, social and cultural.
13. The opportunities for recreation, self expression, play and exercise.
14. Adequate or inadequate rest and sleep.
15. Emotional and social adjustment of the child.

Suggestions for the guidance of parents and teachers

It has been observed by W.F. Dearborn, "There is organic need for strenuous, and physical activity. Skeletal muscles are developing and require exercise. Nine to eleven years old dash breathlessly from place to place, never walk when they can run, never run when they can jump or do something more strenuous."

Some of the important activities which facilitate physical development are:

1. Provision of nutritious diet.
2. Regular medical check-up and follow-up.
3. Provision of healthful environment.
4. Free and guided play activities.
5. Activities involving handling of tools and materials,
6. Exercise and morning walk.
7. Yogic exercises.
8. Preparing charts and models.
9. Proper postures.
10. Games and sports.
11. Opportunities for skipping, hoping, jumping, throwing, grasping, etc.
12. Excursions.
13. Community cleanliness programmes.

Motor development

Motor development maybe defined as the development of strength, speed and accuracy in the use of muscular parts of the body such as arms, eyes, legs and neck muscles. Motor abilities involve bodily movements of various organs and co-ordinated functions of nerves and muscles. Skill in motor activity depends on not so much on gross body movements but fine coordination of the smaller muscles. Motor development is closely related with emotional, mental, physical and social development

Motor development starts since pre-natal period. Adequate motor development during the prenatal period provides the neonate (newborn baby), great potentiality to be active. Movements of the fetus are reported during the third month and these are considered fundamental to later development. The world of the infant expands and the stimulation increases greatly when he learns to move about by the end of the first year.

One of the most important responses shown by a newborn is called Moro reflex. When there is a sudden change in the head position of the infant, he throws his arms out to the side and then brings them back, as if he were«embracing someone. Any sudden change in stimulation, like hitting the sides of the pillon elicits the Moro reflex. It vanishes when the infant is three or four of age. As the infant matures she is able to exercise control over her various parts and coordinate functioning of nerves and muscles. Studies donebyC.B. Skinner and P.L, Harriman(1941) and Mar. M. Shirley (1960) report the developmental sequences of sitting up, standing and walking.

Motor development characteristics

Three years: A child

1. Manipulates play materials
2. Alternates feet going upstairs
3. Rides a tricycle
4. Counts to three
5. Feeds self with little spilling
6. Throws objects overhead
7. Fashions objects with clay
8. Stands on one foot
9. Jumps upward

Four year

1. Skips on one foot
2. Laces shoes
3. Dresses and undresses
4. Cuts on lines with scissors
5. Runs broad jump

6. Saws with handsaw
7. Throws overhead with less body participation **Five** years

1. Tics shoe laces
2. Skips on alternate feet
3. Draws recognizable figures
4. Picks up small items skilfully
5. Draws alphabet letters

Six years

1. Engages in all five-year activities but with more skill and feeling
2. Throws and catches ball
3. Climbs up rope, swings
4. Builds blocks shoulder height with lighter touch
5. Cuts, pastes, models and colours skilfully
6. Builds crude items in workshop

Principles of motor development

1. Development takes place from head to tail. This principle explains that head starts developing first, and other parts of the body in the direction of legs mature later.
2. Development takes place from near to far. This principle states that parts near the brain or spinal cord will develop earlier to which are those away from spinal cord such as arms and fine muscles of the fingers.
3. Development of specific movements proceeds from mass activity. The newborn babies tend to move away their whole body later on. As they develop, they are able to move a specific body part.
4. Both motor coordination and strength increase with age.
5. The development of motor skills depends not only on neuro-muscu- lar maturity but also on environmental opportunities, particularly the availability of equipment, the opportunity to observe and imitate other children and the opportunity to experiment.

Sex difference in motor development. The development level for doing or performing a task increases with age. However, a wide variation in the motor ability of children of the same age is noticed after infancy. This variation is more pronounced if there is difference in the sex of children. The average boy is superior to the average girl in tests of strength, speed and in many motor skills. These differences are aggravated with the increase in age. Girls further reach their maximum at about the age of fourteen in the ability to perform motor acts, while the boys continue to improve even upto eighteen years. Boys are found to be superior to girls in activities that require brute force and speed. Girls surpass boys in activities requiring greater concentration, accuracy

and precision and delicate coordination. In activities like badminton, tennis, table tennis, folk dance, and dramas both girls and boys can participate on almost equal footing.

2.3 NATURE OF TEACHING-LEARNING PROCESS

Teaching—learning has four aspects: teacher, student, learning process and learning situation. The teacher creates the learning situation for the student. The process is the interaction between the student and the teacher. Teaching and learning relationship or interaction may be explained with the help of a diagram.

Teaching-learning process is a means through which the teacher, the learner, the curriculum and other variables are organised in a systematic manner to attain predetermined goals and objectives.

Teaching-learning process implies that all the various elements of the teaching-learning situation have to be brought into an intelligible whole. The teaching-learner activities which are varied and complex have to be harmonised. These elements and activities include learners and their individual differences, the methods of teaching, the material to be taught, classroom conditions, teaching devices and aids, questioning and answering, assignments, tliinking, enjoying, creating, practical skills, discussions and many others.

Teaching-learning process is influenced by the totality of the situation. Teaching learning is fruitful and permanent if the total situation is related to the life situations. Teachers can play an important role in facilitating learning when they take into account the needs of the learners.

Teacliing-learning process is a means whereby society trains its young ones in a selected environment (usually the school) as quickly as possible to adjust themselves to the world in which they live. In primitive societies this adjustment meant conformity with the things as they were. In advanced civilisation of the modern times, effort is made not only to adjust to things as they are but also to make an advance in the improvement of conditions of life by training the young in the modes of thinking and acting which will help to improve the conditions of living that surround them.

Teaching-learning process is as old as human beings on earth. It has been carried out not only by human beings but also by animals to teach their young ones to adjust themselves successfully with their environment. With the passage of time, it has undergone revolutionary changes.

If the teaching-learning process is effective, then the child is able to make the best use of the things in the world around him. If a child has not learnt the art of living harmoniously with others, he will find himself beset with more difficulties than the person who has learnt how to establish social relations with his fellows. So, the acquisition of knowledge, skills and attitudes which enable us to adjust ourselves in an effective manner to the environment may be said to be the aim of teaching-learning.

Important aspects of the teaching-learning process

Teaching and learning are interlinked. We cannot think of teaching without learning. The teacher teaches and the students learn. Teaching is not in a vacuum. It is obvious that for making teaching-learning sound and effective in our educational institutions, we must look into its various aspects very carefully and critically so that they contribute in making teaching-learning inspirational and relevant. Following are the chief aspects.

1. Command, planning and organisation of the subject matter or content and activities: There are no two opinions about the important factor that the success of the teachmg-learning process greatly depends upon the thoroughness of knowledge of the subject matter to be taught by the teacher. The soul of effective teaching learning is good command of the subject matter.

The next aspect is to present the subject matter to the class. Here we enter into the field of organisation of the subject-matter and the use of methods of teaching and teaching technology. The teacher's endeavour will be to use different dynamic and progressive methods of teaching and learning. He should encourage the students to develop proper habits of learning. He should stress self-learning on the part of the students.

2. Class control and discipline: Appropriate class control and discipline is one of the most important characteristics of a successful teacher.

A good teacher is one who can control his class not through fear or high handedness but by virtue of his interest in the learner, good command on the subject-matter and the ability to present it interestingly and effectively. The learners also appreciate good teaching and cooperate with the teacher in the teaching-learning process.

3. Psychology of learners: A teacher must realized her/his knowledge of the subject-matter, ability to present it methodically and effectively and ability to control the class situation ably, teaching-learning will be effective only if he takes into consideration the interests, abilities, aptitudes and limitations of the learners. A teacher must learn to understand his learners and encourage them. She/he has to be sincere and honest towards the learners. An ideal teacher is always humble. The has to practise tolerance and patience in dealing with the learners. The participation of the learners is equally important and necessary.

4. Evaluation: Evaluation has an important place in the teaching-learner process. A teacher should carefully evaluate his students to find out how they can make more

progress. He may use a variety of methods for this purpose. Self-evaluation by both the teacher and the student in very important.

Traditional teaching-learning process **and the modern teaching-learning process**

Modern teaching-learning process assigns an important place to student activity. It calls for a child-centred approach. The most distinctive feature of modern society is its science-based technology which has been making a profound impact not only on the economic and political life of a country but also on its educational system. The changes that occur as a result of the impact are broadly described as 'modernisation'. This modernisation has affected the teaching-learning process in many ways. The recent changes in the concept of teaching-learning process have led to the development of newer ares of educational endeavour. In a traditional society the aim of teaching-learning was the preservation of the accumulated stock of knowledge. But in the modern society, the main aim of teachmg-learning is not acquisition of knowledge alone. It is the awakening of curiosity, the stimulation of creativity, the development of proper interests, attitudes and values and the building of essential skills such as independent study. Teaching-learning process has to serve as a powerful instrument of social, economic and cultural transformation of the society. Teaching-learning process is conditioned by the nature and demands of society to which the learner should get adapted and attuned. One of the main aims of teaching-learning in the modern society is to keep pace with the advancement of knowledge and skills.

For a pretty long period, the teaching-learning process has been by and large, a process dominated by the institution of professional teachers. Now, the process is to be replaced to a great extent by a process in which the individual learner is expected to take up challenges through an inevitable intellectual revolution. The intellectual revolution has been set in by forces of hardware technologies at lowcost, and socialization process due to interdependence. Besides, projects, farms, factories, markets, excursions and play-grounds will become classrooms in the new teaching-learning process.

2.3.1 Teaching Learning: A Three-way Communication

Interaction between the teacher and the learners is the core of the teaching-learning process. This interaction through a sort of three-way communication, results in behaviour changes in the learners. (See figure 2.3)

A learner needs the help of a teacher when he wants to learn any subject and to solve any problem. The process of guiding the learner involves eight steps— communication from the teacher to the learner (steps 1 and 2), from learner to teacher (steps 3 and 5) and again from teacher to learner (steps 6 to 8). Through this three-way communication, teacher could direct his course of teaching concretely. On the other hand, learner can know how well his learning is progressing and how sure he can make his way of learning. So, teacher should establish firmly this three-way communication between many learners and himself.

The formative evaluation in step 7 and KR in step 8 are important to conduct the effective teaching learning processes. KR is a kind of feedback information which has

many types. For example, in responding to his behaviour, teacher, says: 'good,' 'wrong,' 'no', 'well', 'huum' 'wonderful', 'interesting' and some-times repeats and summarizes learner's opinions. Sometimes teacher gives many non-verbal KR, nodding, smiling, winking, and making gestures.

Teaching learning and evaluation

Teaching remains central to both learning and evaluation. There is an inter-relation between teaching objectives (ends), learning experiences (means) and evaluation (evidence of what is taught and learnt). Evaluation is the process of determining (i) the extent to which an objective is achieved (ii) the effectiveness of the learning experiences provided in the classroom and (iii) how well the goals of teaching have been accomplished.

- In evaluation, one has to know where students were at the beginning if we are to determine what changes are occurring.
- In evaluation one has to obtain a record of the changes in pupils by using appropriate methods of appraisal.
- In evaluation one has to judge how good the changes are in the light of the evidence obtained.
- Evaluation may lead to changes in teaching technology and also in learning technology.

Thus, evaluation comes in at the planning stage when teaching objectives are identified. At every point of learning, evaluation is an attempt to discover the effectiveness of the learning situation in evoking the desired changes in students.

Evaluation is integrated with the whole task of teaching and learning and its purpose is to improve learning and not merely to measure its achievement. In its highest sense, evaluation brings out the factors that are inherent in student growth such as proper attitudes and habits, manipulative skills, appreciations and under-standing in addition to the conventional acquisition of knowledge.

It has been rightly observed, "The definition of evaluation places it in the stream of activities that expedite the educational process; these activities can be reduced to four essential steps: identification of educational objectives, determination of the experiences students must have to attain these objectives, knowing the pupils well enough to asign appropriate experiences and evaluating the degree to which pupils attain these objectives."

Objectives provide the starting point on which are based all the learning experiences which in their turn are the material of evaluation.

Teaching objectives: Our'teaching objectives are the changes we wish to produce in the child. The changes that must take place through education are represented in:

1. The knowledge children acquire.
2. The skills and abilities children attain.
3. The interest children develop.
4. The attitudes children manifest.

If education imparted is effective, then the child will behave differently, from the way he did before he came to the school. The pupil knows something of which he was ignorant before. He understands something which he did not understand before. He can solve problems he could not solve before. He can do something which he could not do before. He revises his attitudes desirably towards things.

Specific classroom objectives: These objectives must involve points of information, the skills and attitudes to be developed and interests that could be created through the particular topic or subject taken up for work in the classroom:

A statement of classroom objectives;

(1) serves as a basis for the chorus of classroom procedures that should provide for suitable experiences to the children.

(2) serves as a guide in seeking evidence to determine the extent to which the classroom work has accomplished what it set out to do.

Learning experiences: A learning experience is not synonymous with the content of instruction or what the teacher does. Learning results from the active reaction of the pupil to the stimulus situation which the teacher creates in the class. A pupil learns what he does. He is an active participant in what goes on in the class. Changes in a pupil's way of thinking and developing concepts, attitudes and interests have to be brought about gradually. No simple experience will result in the change. Many experiences, one reinforcing another, will have to be provided. They may have to be repeated in increasing complexity or levels in meaningful sequence extended over a period of time. A cumulative effect of such experiences will evoke the desired change of behaviour with reference to a specific, objective.

The following consideration will be useful in the selection of such experiences:

1. Are they directly related to goals?
2. Are they meaningful and satisfying to the learners?
3. Are they appropriate to the maturity of the learners?

Teaching, learning and improvement: It is worth bearing in mind that learning is what students do, teaching is what the academic staff does and that improvement in

teaching can only be demonstrated if there is consequential improvement in learning. On the other hand, improvement in learning may occur for reasons that have nothing to do with teaching, for example students are able to spend more time, gain better access to libraries and become more strongly motivated.

As observed by prof. R.S. Adams and others, "Students may learn what the teacher intended them to; they may not. Further, teachers, like others, are fallible, they may not always teach correctly. It follows then that in any learning situation, students may learn correctly what the teacher taught incorrectly or may learn incorrectly what the teacher taught correctly—or fortunately, the opposites."

Finally, although students do learn because of the instruction they receive, they also learn in spite of the instruction they receive. In the process of accommodating to what is being taught students attempt to 'fit' the new experience into their past experience—into the knowledge, insights and understandings that they have accumulated previously. It is this capacity of human beings to transcend their immediate circumstances, to add into their 'learning', their past experiences, that complicates the instructional process and makes it difficult for teachers to tailor the learning experience appropriately for their (unusually diverse) students. As a consequence, instructional strategies are often based on different assumptions. Some deliberately set out to exercise control over the learner by: (i) either trying to exclude outside influences; or (ii) by trying to build beyond them; or (iii) by trying to overpower them. For example some earlier attempts at programme learning tried to confine student attention precisely and exclusively to the material to be mastered. Other more sophisticated mastery learning programmes attempt to both discover and start from what the learner's basic knowledge is and to provide 'branch' programmes catering for individual differences. Operant conditioning, of course, has always represented an attempt to 'override' other influences, however powerful they might be. Outside these more mechanistic strategies, other instructional strategies have been based on other assumptions. For example, where students are expected to learn by emulating their instructors (e.g. as in medical and veterinary training) reliance is placed on observational 'learning.'

Teaching operations and learning operations

Teaching operations and learning operations are interlinked. Nevertheless teaching operations to be successful must take into account the learning operations needed to accomplish the teaching objectives which themselves are based on learning objectives. It is therefore, desirable to consider the learning operations first. Learning Operations are as under:

1. Discrimination of stimulus situation
2. Response or cognition
3. Assimilation of relationship between specific elements of the situation and the response
4. Developing application and control over the environment

Definite behavioural changes

Teaching operations may be enumerated as under:

1. presentation of stimulus in a specific control
2. Bringing suitable responses by organising appropriate learning experiences.
3. Elucidation and elaboration
4. Setting up drill and review exercises for fixing up the behaviour in the repertoire of learning
5. Evaluating learning outcomes

Table 2.3 Historical Perspective of Teaching-learning

Stages of Development	*Aims*	*Concern*	*Context*	*Curriculum*	*Class-room Authority*	*Process*
First Stage.	Mortification ofsoul :	Moral	Dominance of faith over wisdom	Ethics, Religion	Religious institutions, churches, etc.	Discourses, Memorization of spoken/ written word
Second Stage	Enquiry into the nature of things and universe	Social and Educational	Renaissance (Reaction to Church dominance)	Logic, ethics, Science of universe	Reformers, Thinkers and their disciples	1. Discourses 2. Experiences 3. Memori zation
Third Stage	Productive Academic	Political Dominance	Industrialized Society, Vocational	Teacher	Controlled and conditione d learning	
Fourth Stage	Learning and Earning	Socialization of the Individual	Equalization ol Opportunities Democratic Ideals and Values	Integrated but more biased towards professional courses	Partnership of teacher-taught	1. Self-learning 2. Programmed learning 3. Group interaction

2.4 TEACHING VARIABLES

Teaching is an important part of the process of education. Its special function is to impart knowledge, develop understanding and skill. Teaching is usually associated with three Rs i.e. reading, writing and arithmetic—imparting knowledge of school subjects. Educa-tion, on the other hand, has a wider connotation in terms of seven Rs i.e. reading, writing, arithmetic (denoting school subjects) and rights, responsibilities, relationships and recreation (new requirements and ideals of a democratic set up). In teaching, we limit our outlook omitting those more important means of education which are involved in the school as a systematically organised social community, including its tone or general moral atmosphere, its government and discipline, and that potent influence—the personality of the teacher. James Welton thinks, "We treat of teaching by itself, because it is an aspect of school life which can be singled out in thought, though it cannot be separated, in reality, from the whole of which it forms a part and because it covers a fairly consistent body of doctrine. It is true that the value and success of all school teaching depends on those wider and deeper elements of

school life—tone and discipline—which are omitting. But it is also true that while the latter may be excellent the former may be of poor quality."

Teaching is a relationship which is established among three focal points in education—the teacher, the student and the subject matter. Teaching is the process by which the teacher brings the student and the subject-matter together. The teacher and the taught are active, the former in teaching and the latter in learning.

Modern teaching is not a mechanical process. It is exacting and intricate as well. Teaching is not 'telling and testing'. Teaching is the complex art of guiding students through a variety of selected experiences towards the attainment of appropriate teaching-learning goals.

2.4.1 Structure of Teaching: Three Variables

Structure of teaching consists of three variables which operate in the processof teaching and create learning conditions or situation. These are classified as under:

1. Teacher as an'independent variable.
2. Students as dependent variables.
3. Content and the strategy of presentation as intervening variables.

1. Teacher as independent variable: The teacher plans the role of an independent variable. Students are dependent on him in the teaching process. The teacher does the planning, organizing, leading and controlling of teaching for bringing about behavioural changes in the students. He is free to perform various activities for providing learning experiences to students.

2. Student as the dependent variable: The student is required to act according to the planning and organization of the teacher. Teaching activities of the teacher influence the learning of the students.

3. Content and the strategy ofpresentation as intervening variables: The intervening variables lead to interaction between the teachers and the students. The content determines the mode ofpresentation—telling, showing and doing.

Functions of variables

The independent and dependent variables perform three functions: (i) diagnostic function (ii) Prescriptive function and (iii) Evaluative function.

(i) Diagnostic function: The initial task in bringing about desirable changes in the behaviour of the students is to have a proper diagnose of the existing situation. Accordingly a teacher has to perform the following diagnostic functions:

(a) Diagnosing the entering behaviour of the students in terms of cognitive, conative and affective abilities.

(b) Formulating specific educational objectives, the type and quality of behavioural changes to be introduced in the students in the light of the entering behaviour and environmental conditions.

(c) Analysing the content, instructional material and environmental facilities available for carrying out the task.

(d) Diagnosing his own capabilities and potentialities and bringing about desirable changes in his own behaviour for achieving success in his mission of moulding the behaviour of the students under his charge.

Like the teacher, a student has to perform certain diagnostic functions as listed below:

(a) Diagnosing strength and weakness of his entering behaviour.

(b) Assessing himself in terms of the tools of learning like power of expression, ability to think and analyse, psychomotor skills, and emotional behaviour.

(c) Making efforts to understand the behaviour of the teacher, the type of teaching methods and strategies, the nature of the content and instructional material for the purpose of initiation on his part. In the process of initiation, both the teacher and the student diagnose for initiation and response.

(ii) Prescriptive function: Prescriptive function is based on the diagnosis for achieving the stipulated objectives. In the prescriptive function, teacher is more active. He has to work for meaningful interaction. Cooperation of student is also essential in carrying out the prescriptive function by the teacher. The prescriptive function involves:

1. Selecting appropriate contents and organising them into proper sequence.
2. Selecting proper teaching methods, media and strategies and feed-back devices in view of the individual differences of the students.
3. Seeking desired cooperation from the students for a purposeful interaction.

(Hi) Evaluative ***function:*** Evaluative function is concerned with the task of finding out the progress and outcome of the teaching process. It is done in order to test the diagnostic and prescriptive functions of teaching. Evaluation is very important from the teacher as well as the point of view of the student. Evaluation is conducted with the aid of several measures like tests, inventories, observations, interviewing, and rating scales etc. If the results are favourable, it is taken for granted that the prescriptions were correct. In case the results are contrary, necessary changes are made in the

teaching learning process to get the desired results. Evaluation serves as a feedback. Teaching strategies are planned in the light of the feedback obtained from evaluation.

2.4.2 Phases of Teaching

Teaching is a complex task. For performing this task, a systematic planning is needed. Teaching is to be considered in terms of various steps and the different steps constituting the process are called the phases of teaching. Jackson thinks that if we are to obtain a complete description of the teaching activity, we must consider what the teacher does before and after his regular teaching in the class. Jackson divides the teaching act into three phases of teaching as shown below:

(1) *Pre-active stage:* Before actual classroom teaching or what Jackson calls 'calm' part of teaching, a teacher has to perform many tasks. These tasks include preparing lesson plans, arranging furniture and equipment within the classroom, manning papers, studying test reports, reading sections of a textbook and thinking about the aberrant behaviour of a particular student. These activities are very crucial to the teacher's performance during regular teaching session.

Pre-active behaviour is, more or less deliberative. The teacher at this stage hypothesises about the possible outcome of her/his action. As the teacher decides what textbooks to.use or how to group the children for reading or whether to notify students' parents of their poor performance, her/his behaviour is at least analyzable.

Following operations or sub-stages are involved in pre-active stage of teaching:

1. Forming or fixing up goals.
2. Taking decisions about the content.
3. Managing or sequencing appropriate means and ways of presentation.
4. Deciding about appropriate strategies and tactics of teaching.
5. Developing teaching strategies for the specific subject matter.

(it) Interactive stage: This is actual classroom teaching. At this stage, the teacher uses a number of strategies for achieving the goals already set. In the interactive setting, the behaviour of the teacher is more or less spontaneous. Research suggests that things happen quickly during the teaching session. For example, the elementary teacher may change the focus of his concern as many as 1,000 times daily. Amid all this hustle and bustle the teacher often has little time to think.

Many teachers try to devote sometime alone with individual students but the teacher-student dialogue is usually public rather than private. When a teacher is alone with a student, he is not faced with the problem of control and management that frequently absorbs a major portion of his energies in a group setting. There is a greater sense of physical and psychological intimacy between the teacher and the student during individual sessions than when the teacher is responding to the class as a group.

The task of keeping pupils involved may entail explanation, demonstration, definition, and other logical operations that have come to be thought of as the heart of teaching.

The interactive stage of teaching involves the following operations:

(i) Perceiving the size of the class by the teacher to identify students.

(ii) Diagnosing the achievements of the learners.

(iii) Action or achievement (initiation or response). This involves the following operations: In the above paradigm:

- (a) Selection of stimuli
- (b) Presentation of the stimuli
- (c) Feedback of reinforcement
- (d) Development of strategies of teaching

(iii) Postactive stage: The post-active stage concerning evaluation provides necessary feedback to the teacher and the students in bringing desirable improvement in their performance. It is related with both teaching and learning.

The teacher analyses as to what extent the students have grasped the material presented to them. It is, in fact, the assessment of the interactive process. It helps the teacher to teach things better in future. It also helps the students to learn things better. It enables the teacher to decide whether he should proceed with the new contents or re-teach what has already been taught.

In short, following operations are involved at the post-active stage of teaching:

1. Assessing the suitability of the objectives determined.
2. Deciding regarding re-teaching the content or further taking up the content.
3. Assessing the suitability of the instructional material and aids.
4. Assessing the impact of the classroom environment and effecting desired changes.

It may be stressed that all the above mentioned three phases of teaching are closely inter-related. All those stages may be depicted by the following paradigm.

Three stages in paradigm for teaching act

1. *Pt* stands of the teacher's perception of the pupil's behaviour.
2. *Dt* is the teacher's diagnosis of the pupil's state of interest, readiness, knowledge etc., made by inference from the behaviour of the pupil.

3. *Rt* is the action taken by the teacher in the light of his diagnosis.

4. Pp is the pupil's perception of the teacher's behaviour.

J. *Dp* is the pupil's diagnosis of teacher's state of interest what he is saying and is inferred from the teacher's behaviour.

6. *Rp* is the reaction of the pupil to the action of the teacher. Each unit marked off by the double vertical line is an example of a teaching unit.

Each unit consists of a teacher-pupil inter-action. There are two sub-units within the teaching cycle which are divided by single vertical line.

The sub-units *(Pt -^Dt —>Rt)* is referred to as an act of teaching.

The sub-unit *(P -» D —>R*) is what we call the act of learning or taking instruction.

The act of teaching and the act of taking instruction are reciprocating acts and when performed under appropriate conditions they result in behavioural changes or achievement. Teaching according to this paradigm implies that someone gives instruction and someone takes it.

Analytical description of teaching

An analysis is concerned with the process of breaking or separating out the elements or constituents of a substance or an idea. Therefore, an analytical description of teaching would demand the breaking or separating the different components or elements of the process of teaching. Gage (1968) analyses teaching in terms of technical skills. According to him, 'Technical skills are specific instructional techniques and procedures that a teacher may use in the classroom. They represent an analysis of the teaching process into relatively discrete components that can be used in different combinations in the continuous flow of the teacher's performance.'

N.K. Jangira and Ajit Singh (1982) state, 'Teaching can be analysed in terms of teacher behaviour at least at three levels viz. component teaching skills, component teaching behaviours comprising skill and atomistic teaching behaviours.'

Thus, an analytical description of teaching will relate to the following activities: (i) Activities undertaken in the teaching process, (ii) Teaching objectives to be achieved through these activities.

Some of the attempts made in the analytical description of teaching are given here in brief.

Komisar (1906): Komisar has analysed teaching into various specific activities: introduction, demonstrating, contrasting, explaining, proving, justifying, defining, rating, appraising, amplifying, vindicating, interpreting, questioning, elaborating, identify-ing, designing, conjecturing, confirming etc.

B.K. Passi (1976) has concluded that teaching constitutes a number of verbal and non-verbal teaching acts like questioning, accepting pupil response, smiling, rewarding and nodding to pupil response, movements in the class, gestures, etc.

2.5 LEVELS AND OPERATIONS OF TEACHING-LEARNING

Classical conditioning as suggested by Pavlov and Watson involves repetition and consistency which may be utilised for learning emotional reactions to previously neutral stimuli. For instance, if a child develops hatred for a school subject due to severe reprimands, the student be provided emotional experiences which are positive and in conjunction with school related work by the teacher.

The theory of contiguity association developed by Guthrie, which has contiguity of the elements of'S' and H' may be utilized for learning rote responses to simple questions. The teacher should present stimulus for obtaining quick accurate responses. For example, a child learns to speak 'rose' if a rose flower is presented to him.,

The theory of reinforcement advocated by Thorndike and Skinner, involves the linkage of' S' and 'R' when 'R' is followed by reinforcement and may be utilized for moulding the behaviour of the child by modifying existing patterns and more firmly establish-ing existing behaviours. Any rewarding situation, a word of praise or a pat on the back may improve the reading ability or the handwriting of a student. The teacher's ingenuity lies in selecting suitable reinforcements. The teacher is expected to analyse desirable behaviours and provide reinforcement as soon as he feels that the desirable behaviour has approximated.

Piaget's theory of concept learning aims at building up understanding of common characteristics of making a class. The teacher may assist the child in structuring and organising basic experiences into systems by the process of verbalisation or through frequent exercises.

Theory of imitation developed by Bandura implies that learning new behaviour by observing a model may be used in the learning of skills, attitudes, social and moral behaviours. Teacher's own behaviour may act as model for children. Demonstration methods may be effective in handling scientific instruments.

Dewey's problem solving theories aim at utilising principles to reach goals, otherwise blocked. Teacher encourages free thinking and allows flexibility m thinking.

A close study of the various theories of learning brings out the following principles of learning round which teaching should centre:

1. There are individual differences in learning activities.
2. Meaningful practice is essential in building cognitive structures.
3. Learning is a development process
4. Learning becomes more effective under satisfying conditions
5. Goal setting facilitates learning
6. Transfer takes place in learning situations
7. Motivated forgetting helps in breaking away incorrect S.R. bonds
8. Greater intelligence leads to better and complex learning
9. Understanding is dependent upon habits and meaningful structures

Learning conditions and teaching methods may be used synony-mously. It must be realized that learning theories and principles go hand in hand.

Teaching and learning at memory level

In memory level presentation, drills and exercises occupy a very important role for promotion of learning. Stress is laid on the presentation of information and facts in a very systematic manner with a view to develop memory. Recall and recognition become very prominent. Students mug up the essential contents of the subject-matter and reproduce them. The learner is reduced, by and large, to a passive role. The mind of the learner is considered as a container of information. Following are the important features associated with learning at memory level:

1. Analysis of the subject-matter
2. Definite and fixed order of the subject-matter
3. Rigid adherence to the presentation of the subject-matter
4. Mechanical handling of the various segments of the contents

Classroom implications of teaching at memory level

1. *Subject-matter as the focus:* In such a presentation it is the subject-matter which gets the focus of attention and not the experience of the learner.
2. *Learning is short-lived:* Memory learning does not make an impact on the personality of the learner. Learning outcome is very short-lived.
3. *Great strain on the learner*. Such type of learning puts a great strain .on the mind of the learner and hinders the proper development of learning with regard to particular subject.
4. *Motivation:* The teacher must remain constantly on toes to attract the attention of the learner.
5. *Testing:* Essay type as well as objective type questions form the basis of testing. Questions are framed in such a way as to measure the process of recall and recognition.
6. *Interaction:* The interaction between the teacher and the student is at the lowest level.
7. *Superficial knowledge:* The learner may not develop a commendable control over the subject still he may reproduce facts and figures.

Use of memory level teaching: It would be wrong to assume that memory level presentation is hundred per cent vicious. The teacher can derive useful information from this and place emphasis on practice. It may be remembered that for certain disciplines and knowledges, teaching at memory level is a necessity. The teacher should link old knowledge with the new one so that the old knowledge is utilized and remains in the memory for a longer period.

Teaching-learning at understanding level

The dictionary meaning of understanding is to perceive the meaning of, to grasp the idea of or to comprehend. Understanding occurs when we come to see how to use produc-tively, in ways which we care about, pattern of general ideas and supporting facts. The key figures in developing teaching and learning at understanding level are Herbart, Judd, Morrison and J.S. Bruner.

Herbart mentions three forms of mental reality which play an important role in teaching learning at the understanding level. They are sense impressions, images and affective elements of pleasure and pain. In Herbart's arrangement, the teacher is conceived as an architect and the builder of the minds of the students by manipulating ideas to construct student's circle of thought. He advocated five steps of teaching: preparation, presentation, comparison, generalisation and application. In step 5 (application) students are expected to demonstrate their understanding by applying it to a novel situation.

Morrison very clearly stated that understanding is not simply being able to recall something; it is not only a generalisation deducted from specific facts but insight into how it may be used in future situations. Morrison asserted that the outcome of all teaching is 'Mastery' and not memorisation of facts. He proposed a unit plan, each unit representing an insight which is relatively complete in self.

J.S. Bruner assigns a functional approach to the problem of teaching at the understanding level. He observes that human beings possess tremendous capacity to discriminate objects or processes in their environment. An individual can make common sense out of his environment by enabling'himself to select from an almost infinite number of discriminate objects and events, those which appear to have something in common.

Classroom, implications of teaching at the understanding level To make teaching-learning meaningful at the understanding level, the teacher must keep in view the following points:

1. Objectives must be kept very clear
2. Proper role of practice must be understood
3. Productive motivational techniques should be avoided
4. Lesson plans should be used properly
5. Students and lesson must be paced advantageously
6. The significance of spiral curriculum should be recognised
7. Programmed learning and machine teaching should be given a fair trial for teaching at the understanding level

Teaching-learning at reflective level

Big places teaching-learning levels on a continuum which ranges from 'thoughtless' to 'thoughtful' modes of operation. Memory level is the most 'thoughless' and the reflective level the most 'thoughtful'.

The learner gains little insight at the memory level. At the understanding level, the learner gains insights and at the reflective level, the the learner can further achieve insights independently. At the reflective level the learner can reconstruct the learnt material into classes and systems. The chief characteristics of the reflective level are the learnings associated with understanding level plus the sense of purpose and goal. The reflective level is in conformity with democratic-non-authoritarian teacher-student relationships.

Every educational system cherishes this most coveted goal of teaching for promoting reflection. Reflective level teaching is a kind of problem-centred teaching. Two essential features of teaching at reflective level are:

1. Problem raising
2. Problem solving

According to Biggs, reflective level teaching should result in students emerging with an enlarged store of tested insights of a generalised character and an enhanced ability to develop and solve problems. These two are essential ingredients in any reflective level teaching.

Reflective teaching resembles with that of the scientific method and same steps are followed. The spirit behind is that of an objective equity.

In reflective level teaching classroom presentation is almost open-ended and a free discussion between the teacher and the students takes place. Some of the characteristic features of a procedure followed by a teacher teaching at reflective levels are:

1. Discussion
2. Critical reacting
3. Dispassionate probe into the truth of the matter

There is a genuine concern for getting doubts removed and for deeper intellectual curiosity. The classroom atmosphere is of teacher-learner mutual enquiry wherein genuine problems are posed and solved.

Motivation in teaching at reflective level: At the reflective level teaching, the motivation is relatively intrinsic and arises from the fact that both students and the teacher are thoroughly involved in the situation. They are interested not only in framing appropri-ate questions but also in formulating suitable solutions and getting answers to them.

Role of the teaching: It would be wrong to assume that the role of a teacher is that of a 'soft hearted baby sitter'. Very frequently the teacher has to be tough minded. He must persistently ensure that the students sift all pertinent avail-able evidence.

Subject-matter best amenable to reflective teaching: Bigge in this connection has observed, "The problem-centred teaching seems to spring into existence in those situations where minds of teacher and students are engaged. It grows more from a unique relationship between the teacher and students than from any different nature of formal course materials."

Assumption. Bigge points out, 'True problem centred teaching like any teaching which leads to understanding is necessarily unhurried procedure. Consequently it is very difficult and usually impossible to pursue problem centred teaching in situations characterised by rigid scheduling of time for units to be covered. To make problem-solving teaching a success, a teacher may need to make several false starts; when one plan for bringing students to feel a problem fails, he tries another until he hits on one that works. The period during which given problem is studied is necessarily rather unstructured and frequently it is impossible to predict how soon a class will device

anything resembling an answer. Even though a problem has been under study for a week or more and anything educational seems to have happened so long as the teacher feels there is still a chance that some useful insight will emerge, study should be continued.'

Classroom implications at the reflective level of teaching

1. Classroom atmosphere is free, frank and that of mutual enquiry
2. Teaching resembles the method of scientific enquiry
3. Advisable to permit students to make mistakes
4. Atmosphere of the class should be permissive and not restrictive
5. Teacher should promote open-mindedness which helps in building suitable class environment for reflective teaching
6. Democratic leadership should be provided by the teacher for promoting reflective level teaching
7. Teacher should encourage voluntary participation by students as this is a good class climate for reflective level teaching

Meaning and significance of mastery learning (ML)

Mastery learning is defined as a teaching learning approach which asserts that under appropriate instructional conditions, all students can and almost will learn most of what is taught in schools. The ML starts with the assumption that almost all students can and will master a great deal of what is taught, if instruction is approached systematically, if the students are helped when and where they have learning difficulties; if they are given sufficient time to achieve mastery, and if there is some clearcut criteria of what constitutes mastery.

According to B.S. Bloom (1968), most students can master what teachers teach them. The instructional variables can be easily manipulated so that almost all students achieve the prescribed degree of mastery.

Studies by J.H. Block (1971, 1974) indicate that in many subject areas, all students can achieve some defined level of mastery. It has been found that even gifted students need individual methods of study suited to their personality, rather than the conventional stereotyped techniques of teaching.

T.R. Guskey (1980,1987,1988) concluded (through the synthesis of researches . on mastery learning) that mastery approach has allowed many teachers to dramatically increase the number of students in their classrooms who learn, and learn very well what they as teachers have set out to teach. Therefore, if systematically practised, mastery learning strategy could be of immense help to the teachers and administrator in arresting the rising rate of dropouts by raising achievement, self-concept and attitude towards schooling of the learners.

Mastery learning strategy (MLS): MLS was first used by J.F.S. Keller (1968). Since then it has become popular in several advanced countries. It is estimated that half of the total courses in the USA are based on the mastery learning concept and such courses are offered in the form of learning packs using individualized instruction.

The studies conducted in India by Das Gupta (1977,1980), Mathur (1977,1980, 1981) and Kishore (1981,1982) and others have proved that from the points of view of consolidation, achievement, recall and favourable student response, the mastery learning model based on the individualized system of instruction has shown promise.

Through this strategy, the student is motivated to interact at his own pace with a given learning segment. He consolidates his learning by getting his difficulties removed individually by taking individual guidance from his instructor and the fast-pacers.

With a view to motivative the student to learn, the course material is broken into small segments and each segment has an interesting introduction, a list of behavioural objectives, a suggested procedure for learning and a set of self-assessment exercises.

In this learning strategy, the student is allowed to proceed on to the next learning segment when he passes a criterion test. The criterion test is to be passed by the student with a minimum cut-off score of more than 80% marks indicating the mastery of his on-going learning segment.

If a student is unable to pass the criterion test, he is given individual guidance by the instructor and peer-tutors. The student repeats the learning segment and takes retests until he passes the criterion test.

The mastery learning model places focus on the following aspects:

1. ***Behavioural objectives:*** The specific objectives for learning a study unit are made clear to the learner, so that he knows what is expected of him from the course of study.
2. ***Small learning segments:*** The subject matter of a study unit is broken into several blocks each followed by self-assessment questions which work as learner's own evaluation checks.
3. ***Self-pacing:*** The learner learns the study unit at his own speed. The time for learning a study unit is different for different learners while the degree of mastery is the same.
4. ***Individual attention:*** As and when a student is unable to understand a portion of the study unit, he takes the individual help from a fast-pacer or instructor.
5. ***Criterion-referenced testing:*** A minimum level of performance is specified which indicates the mastery of the study unit and readiness for learning new material.

Criterion-referenced testing

In recent years, with mastery learning models gaining wide currency, there has been a renewed interest in the concept of criterion-referenced tests (Glaser, 1971; Mayo, 1970; Popham and Husek, 1969). Such tests yield measures directly interpretable in terms of specified performance standards. The data from criterion-referenced test is also useful in evaluating the instructional procedure.

Criterion-referenced test determines the degree of the mastery of the study unit. It is used primarily to determine whether or not the learner is ready to advance to another study unit.

The criterion-reference test has yet another advantage that of diagnosing the specific difficulties of learners and prescribing cer-tain remedial treatments. Also, concern for criterion-referenced testing has gained importance with the emphasis on behavioural objectives (Bloom, 1964) while structuring and individualizing instructions. Therefore, mastery or lack of it in individualized instruction implies whether or not a learner has achieved the objectives of the instructions.

The criterion-referenced tests are used primarily in the courses based upon the mastery learning concept. A student pursuing such a course is asked to consolidate a given subject matter at his own pace of learning assisted by an instructor. The relationship between the criterion-referenced test and mastery learning procedure is shown below:

2.6 SUMMARY

In this unit, you have learnt that:

- The word education has a very wide connotation. Philosophers and thinkers from Socrates (469-399 B.C.) to Dewey (1859-1952) in the West and Yajnavalkya (About 600 B.C.) to Gandhi (1869-1948) in the East have defined education in accordance with their philosophy of life with the result that there emerged divergent concepts and definitions of education.
- According to the psychological aspect of the process, the educator must understand the nature, interests, capacities and limitations of the child.
- The word 'self-realisation' implies development of individuality in the child.
- Mental development or intellectual development is the development of the mental abilities and capacities which help an individual to adjust his behaviour to the ever changing environmental conditions or to enable him to accomplish a task that needs complex cognitive abilities.
- A child has a good memory in the earlier stages but this memory is generally a rote memory.
- The process of maturity continues throughout all stages of development.
- Mental development is influenced by both heredity and environment.
- The cultural and social experiences, learning opportunities and discipline which he gets for the development process, contribute significantly towards his mental development.
- Piaget is regarded as one of the pioneers in psychological investigation of children although he neither undertook formal study nor passed any examination in psychology.
- According to Piaget, a child goes through a series of developmental stages which are as follows:
  - Sensori-Motor Stage (Birth to 2 years)
  - Preconceptual Stage (2 to 4 years)
  - Intuitive Stage (4 to 7 years)
  - Concrete Operation Stage (7 to 11 years)
  - Former Operations Stage (11 to adolescence)
- Piaget called 'schemes' as cognitive structures or the patterns of behaviour that children and adults use in dealing with objects in their environment. These patterns can be simple as well as complex.
- A baby assimilates when he understands and perceives the new in the light of his old perceptions. A baby forms a new scheme 'modifies or changes his old perception to suit the new.
- According to Piaget, learning includes the wide range of activities. Rigid distinctions like classroom for instruction, laboratory for practicals, recess for amusement, mathematics for developing computational ability, and athletics for strengthening the body muscles are unnecessary.

- According to Piaget, a learner desires to reduce his internal conflicts by keeping his thoughts harmonious and in equilibrium.
- Memory is a symbolic representation of how the child has schematised what he saw.
- Variety of cognitive activities like story-telling, rhymes, and singing are included in the programme in a systematic manner. There is a deliberate attention of developing cognitive growth.
- The teacher should try to assess the level and type of thinking of each child in his class.
- There is a close relationship between the physical and emotional factors. An imbalance or disturbance in the child's physical growth is most likely to be reflected in his intellectual functioning and personality adjustment.
- Emotions may be external or physiological and internal or psychological.
- Some of the more common symptoms of unsatisfactory emotional adjustment are resistance to learning, speech problems, excessive day dreaming, oversensitivity, extreme dependence on peers or adults, and resistance to the requirements of the classroom or the group and temper tantrums.
- Physical growth and development refers to a process which brings about bodily and physiological changes—internal as well as external—in an organism from the conception till his death.
- Motor abilities involve bodily movements of various organs and co-ordinated functions of nerves and muscles. Skill in motor activity depends on not so much on gross body movements but fine coordination of the smaller muscles.
- Teaching—learning has four aspects: teacher, student, learning process and learning situation.
- Teaching-learning process is a means whereby society trains its young ones in a selected environment (usually the school) as quickly as possible to adjust themselves to the world in which they live.
- Modern teaching-learning process assigns an important place to student— activity. It calls for a child-centred approach.
- Interaction between the teacher and the learners is the core of the teaching learning process.
- Teaching remains central to both learning and evaluation. There is an interrelationship between teaching objectives (ends), learning experiences (means) and evaluation (evidence of what is taught and learnt).
- Learning is what students do, teaching is what the academic staff does and that improvement in teaching can only be demonstrated if there is consequential improvement in learning.
- Although students learn because of the instruction they receive, they also learn in spite of the instruction they receive. In the process of accommodating to what is being taught students attempt to 'fit' the new experience into their past experience—into the knowledge, insights and understandings that they have accumulated previously.

- Teaching is an important part of the process of education. Its special function is to impart knowledge, develop understanding and skill.
- Teaching is a relationship which is established among three focal points in education—the teacher the student and the subject matter.
- Teaching is to be considered in terms of various steps and the different steps constituting the process are called the phases of teaching.
- An analysis is concerned with the process of breaking or separating out the elements or constituents of a substance or an idea. Therefore, an analytical description of teaching would demand the breaking or separating the different components or elements of the process of teaching.
- Classical conditioning as suggested by Pavlov and Watson involves repetition and consistency which .may be utilised for learning emotional reactions to previously neutral stimuli.
- Piaget's theory of concept learning aims at building up under-standing of common characteristics of making a class.
- In memory level presentation, drills and exercises occupy a very important role for promotion of learning.
- The teacher should link old knowledge with the new one so that the old knowledge is utilized and remains in the memory for a longer period.
- Big places teaching-learning levels on a continuum which ranges from 'thoughtless' to 'thoughtful' modes of operation. Memory level is the most 'thoughless' and the reflective level the most 'thoughtful'.
- According to Biggs, reflective level teaching should result in students emerging with an enlarged store of tested insights of a generalised character and an enhanced ability to develop and solve problems.
- According toB.S. Bloom (1968), most students can master what teachers teach them. The instructional variables can be easily manipulated so that almost all students achieve the prescribed degree of mastery.
- Mastery learning strategy was first used by JF.S. Keller (1968).
- With a view to motivative the student to learn, the course material is broken into small segments and each segment has an interesting introduction, a list of behavioural objectives, a suggested procedure for learning and a set of self-assessment exercises.
- In this learning strategy, the student *is* allowed to proceed on to the next learning segment when he passes a criterion test.
- n recent years, with mastery learning models gaining wide currency, there has been a renewed interest in the concept of criterion-referenced tests.
- The criterion-reference test has yet another advantage that of diagnosing the specific difficulties of learners and prescribing certain remedial treatments. Also, concern for criterion- referenced testing has gained importance with the emphasis on behavioural objectives (Bloom, 1964) while structuring and individualizing instructions.

7 KEY TERMS

- **Intellectual training:** It refers to mental exercise or training.
- **Sublimation:** It also means redirection but in this case emotion gets elevated and changes its form into something nobler and higher.
- **Reflective level of learning:** It is the level at which the learner can reconstruct the learnt material into classes and systems.
- **Mastery learning:** It is a teaching learning approach which asserts that under appropriate instructional conditions all students can and almost will learn most of what is taught in schools.

8 ANSWERS TO 'CHECK YOUR PROGRESS'

1. Education is regarded as a tripolar process as it involves interaction of the personality of the educator on that of the educand in a social setting which affects the modification of the behaviour of the educand.
2. According to Gandhi, education is an all-round drawing of the best in the child and man—body, mind and spirit. Education is a pouring out and not a pouring in process.
3. Jean Piaget was the first to develop the theory of cognitive development.
4. According to Crow and Crow (1973), an emotion is an effective experience that accompanies generalised inner adjustment and mental and psychological stirred up states in the individual, and that shows itself in his own behaviour.
5. Physical growth and development refers to a process which brings about bodily and physiological changes—internal as well as external—in an organism from the conception till his death.
6. Motor development may be defined as the development of strength, speed and accuracy in the use of muscular parts of the body such as arms, eyes, legs and neck muscles.
7. Teaching-learning process is a means through which the teacher, the learner, the curriculum and other variables are organised in a systematic manner to attain pre-determined goals and objectives.
8. The important aspects of teaching-learning process are:
   (i) Command, planning and organisation of the subject matter or content and activities.
   (ii) Class control and discipline (iii) Psychology of learners (iv) Evaluation
9. The objectives of teaching manifest themselves through:
   (i) The knowledge children acquire.
   (ii) The skills and abilities children attain, (iii) The interest children develop, (iv) The attitudes children manifest.

10. The three 'R's of teaching are reading, writing and arithmetic. For education rights, responsibilities, relationships and recreation are added, which makes, it seven 'R's.
11. The phases of teaching involve pre-active stage, interactive stage and post-active stage.
12. An analysis is concerned with the process of breaking or separating out the elements or constituents of a substance or an idea. Therefore, an analytical description of teaching would demand the breaking or separating the different components or elements of the process of teaching.
13. The principles of learning a round which teaching should centre are:
    1. There are individual differences in learning activities.
    2. Meaningful practice is essential in building cognitive structures.
    3. Learning is a development process.
    4. Learning becomes more effective under satisfying conditions.
    5. Goal setting facilitates learning.
    6. Transfer takes place in learning situations.
    7. Motivated forgetting helps in breaking away incorrect S.R. bonds.
    8. Greater intelligence leads to better and complex learning.
    9. Understanding is dependent upon habits and meaningful structures.
14. Reflective level teaching is a kind of problem-centred teaching. Two essential features of teaching at reflective level are: (i) Problem raising (ii) Problem solving.
15. Mastery learning is defined as a teaching learning approach which asserts that under appropriate instructional conditions, all students can and almost will learn most of what is taught in schools.
16. Criterion-referenced test determines the degree of the mastery of the study unit. It is used primarily to determine whether or not the learner is ready to advance to another study unit.

2.9 QUESTIONS AND EXERCISES

Short-Answer Questions

1. Education is a pouring out and not a pouring in process. Briefly explain.
2. What are the aspects of mental development?
3. What are the factors affecting the motor and physical development of a child?
4. State the nature of teaching-learning process.
5. What are the three variables in the structure of teaching?

Long-Answer Questions

1. Discuss the cognitive approach to education. Give your view on Piaget's theory.
2. Explain the importance of psychomotor approach in a child's education.

3. Explain why teaching learning is a three-way communication?
4. Discuss the phases of teaching.
5. Discuss are the levels of operations of the teaching-learning process.

2.10 FURTHER READING

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UNIT 3 MODELS OF TEACHING

Structure

3.0 INTRODUCTION

Educationists and psychologists have always strived to improve the teaching techniques. Various models have been developed to provide teachers with a wide range of approaches for creating an environment of interactive learning. An intelligent use of these approaches will allow teachers to understand better the students' learning needs, improvise the different learning styles, and design appropriate curriculum and educational activities. The models of teaching are, in fact, implementation of practical problems and looking for their solutions as student and teachers work together in a classroom. These are scientific and systematic approaches. Some of these models are simple to use but difficult to master while some serve broad purposes and others target particular goals. In this unit, you will learn about the nature and elements of teaching models, and Robert's Glaser's model of teaching and William Glasser's classroom meeting model. You will also learn about the use of information-processing models promoted by cognitive psychologists.

3.1 UNIT OBJECTIVES

After studying this unit, you will be able to:

- Define a teaching model
- Discuss the nature and elements of teaching models
- Describe the information-processing models

3.2 DEFINITIONS OF TEACHING MODEL

Development of models of teaching is one of the recent innovations in teaching. An important purpose of discussing models of teaching is to assist the teacher to have a wide range of approaches for creating a proper interactive environment for learning.

An intelligent use of these approaches enables the teacher to adapt him to the learning needs of the students.

A number of educationists and psychologists have proposed model- approach to teaching. Flander (1970) put his interaction analysis as a model of teaching and for this approach he categorised the statements of students and teachers into ten categories. Glaser (1962) divided instructional material in his model into four components. These are instructional objectives.

The credit for transforming the prevailing teaching theories into different models of teaching goes to Bruce Joyce and Marsha Weil (1980).

In India, the first national project on models of teaching was planned, designed and executed during 1985-86.

Teaching models have been defined in a number of ways. Some of the important definitions of a teaching model are given here to have a wider perspective of this concept.

Allen and Ryan (1969): Modelling is an individual demonstrating particular pattern which the trainee learns through imitation.

Bandura (1969): Modelling demonstrates that virtually all learn-ing phenomena resulting from direct experiences can occur on a vicarious basis through observation of other person's behaviour and its consequences for them.

B.K. Passi, L.C. Singh and D. N. Sansanwal (1991): A model of teaching consists of guidelines for designing educational activities and environments. Model of teaching is a plan that can also be utilised to shape courses of studies, to design instructional material and to guide instruction.

Joyce and Weil (1972): Teaching models are just instructional designs. They describe the process of specifying and producing environmental situations which cause the student to interact in such a way that specific change occurs in the behaviour. Teaching model is a pattern or plan, which can be used to shape a curriculum or course to select instructional materials and to guide a teacher's actions.

N.K. Jangira and Ajit Singh (1983): A model of teaching is a set of interrelated components arranged in a sequence which provides guidelines to realise a specific goal. It helps in designing instruc-tional activities and environmental facilities, carrying out of these activities and realization of the stipulated objectives.

PaulD. Eggen et al (1979): Models are prescriptive teaching strategies designed to accomplish particular instructional goals.

Weil and Joyce (1978): Amodel of teaching consists of guidelines for designing educational activities and environments. It specifies ways of teaching and learning that are intended to achieve certain kinds of goals.

Paul D. Eggen and others (1979) explain the meaning of a model in these words, 'An engineer, in considering a project, first identifies the type of structure to be built, e.g., a building, a bridge or a road. Having done this, he selects an appropriate design or blueprint to follow in building that structure. The specifications of the blueprint determine the actions the builder takes and the kind of building that will

result. The particular type of blueprint or model chosen depends on the type of structure to be built. In a similar manner a teacher considering the choice of a teaching model first identifies what is to be taught and then selects a model in accordance with that goal. The model chosen is specifically designed to achieve a particular set of objectives and will determine in large part of the actions of the teachers.'

Educators and psychologists have designed several types of teaching models which provide suitable guidelines to the teachers for modifying the behaviour of the learners. As a matter of fact some sort of models of teaching have been in existence since times immemorial. In simple language a model of teaching maybe defined as a blueprint designed in advance for providing necessary structure and direction to the teacher for realizing the stipulated objectives.

3.3 NATURE OF TEACHING MODELS

Some common identifiable characteristics of a good model, are given below:

1. **Specification of learning outcome:** All models of teaching specify what the students should perform after completing an instructional sequence.
2. **Specification of environment:** A teaching model specifies in definite terms the environmental conditions under which a student's response should be observed.
3. **Specification of criterion of performance:** Amodel of teaching specifies the criterion of performance which is expected from the students.
4. **Specification of operations:** *A* model of teaching specifies the mechanism that provides for the reaction of students and interaction with the environment.
5. **Scientific procedure:** *A* model of teaching is based on a systematic procedure to modify the behaviour of the learner. It is not a haphazard combination of facts.

Functions

1. They help in guiding the teacher to select appropriate teaching techniques, strategies and methods for effective utilisation of the teaching situation and material for realizing the objective.
2. They help in bringing about desirable changes in the behaviour of the learners.
3. They help in finding out ways and means of creating favourable environmental situations for carrying out teaching process.
4. They help in achieving desirable teacher-pupil interaction during teaching.
5. They help in the construction of a curriculum or contents of a course.
6. They help in the proper selection of instructional material for teaching the prepared course or the curriculum.
7. They help in designing appropriate educational activities.
8. They assist producers of materials to create interesting and effective materials and learning sources.

9. They stimulate the development of new educational innovations.
10. They help in the formation of a theory of teaching.
11. They help to establish teaching and learning relationship empirically.
12. They are useful to develop social efficiency, personal abilities, cognitive abilities and behavioural aspects of the students.

Effects of teaching by modelling

Bandura and Walters mention three kinds of effects in teaching by modelling. These are: (i) a modelling effect (ii) an inhibitary and disinhibitary effect and (iii) An eliciting effect.

1. **A modelling effect:** A modelling effect can be seen when a teacher demonstrates to a student how to hold a pencil or write Capital A etc., and thus, shows a new behaviour. Here a student learns new kinds of response pattern.
2. **Are inhibitary and disinhibitary effect:** An inhibitary or disinhibitary effect takes place when through modelling we let the student know that it is not possible to look at pictures of nudes, in an art book.
3. **Are eliciting effect:** The eliciting effect takes place when a teacher through modelling tries to teach students to rise when a lady enters the room, and thus, provides a cue eliciting a response neither new nor inhibited.

Modelling and other similar terms: Among those in common use are modelling, imitation, observational learning, identification, copying, vicarious learning, social facilitation, and role playing.

Gagne feels that learning through imitation seems to be more appropriate for tasks which have little cognitive structure.

Miller and Dollar also plead for learning by imitation. There is no doubt that modelling plays an important role in the development of our personality. Imitation contributes immensely to the learning of values, beliefs, attitudes and sentiments.

It is because of this that great stress is laid on the selection of right type of teachers who in turn must be very careful in selection learning experiences in the class.

Three stages of modelling: Three stages in the development of a model are:

(i) Analysis of a particular skill.

(ii) Identification of the key elements in it.

(iii) Exposition of the elements in such a way as to exemplify satisfactorily the skills under consideration.

3.3.1 Elements of a Teaching Model

A teaching model has six fundamental elements: (i) focus (ii) syntax (iii) principles of reactions (iv) the social system (v) the support system (vi) application context.

Focus: Focus is the central aspect of a teaching model. Objectives of teaching and aspects of the environment generally constitute the focus of the model.

Syntax: Syntax includes the sequence of steps involved in the organisation of the complete programme of teaching.

Principles of reactions: This element is concerned with the way a teacher should regard and respond to the activities of the students. These responses should be appropriate and selective.

Social system: It is related to the description of the following: (i) interactive roles and relationships between the teacher and the students, (ii) the kinds of norms that are observed and student behaviour which is rewarded.

Support system: The support system relates to the additional requirements other than the usual human skills or capacities of the teacher and the facilities usually available in the ordinary classroom-. These requirements refer to special skills, special knowledge of the teachers and special audio- visual material like films, self-instructional material and visit to special places.

Application context: Several types of teaching models are available. Each model attempts to describe the feasibility of its use in varying contexts—goal achievements— cognitive, conative and effective.

Sources of models of teaching

Four important sources from which all the models of teaching have been derived are given below:

1. ***Social interaction*** *sources:* The model of teaching of this category emphasises the importance of social relationship of he person and are based on the assumption that social relation is the vehicle of education.
2. ***Information processing*** *sources:* The other source of a model of teaching is the information processing capability of the learner which means the way in which people handle stimuli, organise data, sense problems and solve them. The model of this category emphasises the use of specific strategies within academic disciplines which lead to the development of creativity and general intellectual ability of learners.
3. ***Personal sources:*** Personal and emotional life of the individual and their internal organisation as it affects relationship with this environment are the sources of this category of models.
4. ***Behaviour modification*** *as* ***a source:*** The operant conditioning theory built by B.F. Skinner is the origin of this type of model which is purely a psychological model and is used in most of the teaching strategies developed in the last two decades.

Assumption

1. Each model is based on the assumption that teaching is the creation of appropriate environment and various components of the environment are interdependent.
2. Environment system consists of the content, skill, social relationships, instructional roles, activities and physical facilities. All these elements interact.

3. Various combinations of the different elements of the environment create different types of environments, and elicit different outcomes.
4. Models of teaching create environment.

Five-fold classification

Some educators classify the teaching models as under:

1. ***Historical teaching models***
   (i) Socratic teaching model—Socrates
   (ii) Classical humanistic model—Brody
   (iii) Personal Development model—Carl Rogers
2. ***Philosophical models of teaching***
   (i) Impression model—John Locke (ii) Insight model—Plato (iii) Role model—Kant
3. ***Psychologicalmodels of teaching***
   (i) Basic teaching model—Robert Glaser
   (ii) Computer based teaching model—-Lawrence Stolyrow and Davis (iii) Interaction model of teaching—Ned A. Flander (iv) Teaching model of school learning—John Carroll
4. ***Teaching model for Teacher Education.***
   (i) Toba's model of teaching
   (ii) Turner's model of teaching
   (iii) Model of variation in teacher orientation
   (iv) Life-Long Teacher Education Programme (LLTEP) Model
5. ***Modern teaching models***
   (i) Behaviour modification models, (ii) Information processing models, (iii) Personal models, (iv) Social interaction models.

Types of modern teaching models

Bruce Joyce and Marsha Weil (1985) organise these models into the following four families on the basis of their chief emphasis—the way they approach educational goals and means.

Types (Families) of Models

Behaviour Modification Models	Information Processing Models	Personal Models	Social Interaction Models

Behaviour modification models stress on changing the external behaviour of the learners and describe them in terms of visible behaviour rather than underlying behaviour. Skinner is the chief exponent of this model. (Table 3.1).

Table 3.1 *Behavioural Modification Models*

Model		*Chief Exponents*	*Goals or Missions for which most Applicable*
1	Anxiety reduction	Rinn, Wolpe	Substitution of relaxation for anxiety in social situation
2	Assertive training	Wolpe, Lazarus, Salter	Direct, spontaneous expression of feelings in social situations.
3	Direct training	Lumsolaine	Pattern of behaviour, skills
4	Managing behaviour	B.F. Skinner	Social behaviour, skills
5	Programmed	B.F. Skinner	Facts, Concepts, skills
6	Relaxation	Rinn, Wolpe	Reduction of stress
7	Self-control	B.F. Skinner	Social behaviour, skills

Information processing models refer to the way people handle stimuli from the environment, organise data, sense problems, generate concepts and solution to problems and use verbal and non-verbal symbols. Models of this type are concerned with the intellectual growth rather than the emotional or social development (Table 3.2).

Table 3.2 *Information Processing Models*

Model		*Chief Exponents*	*Goals or Missions fo r which Applicable*
1.	Advanced organiser model	David Ausubel	Designed to increase efficiency of information processing capacities to absorb related body of knowledge.
2. .	Cognitive growth	Jean Piaget, Irving Sigel, Edmund Sullivan	Designed to increase general intellectual development especially logical reasoning, but can also be applied to social and moral development.
3.	Concept attainment	Jeromer Bruner	Designed primarily to develop inductive, reasoning but also for concept development analysis
4.	Inductive thinking Inquiry	Hilda Taba, Richard, Suchman	Designed primarily for development of inductive mental processes and academic reasoning
5.	Memory	Jerry Lucas	Designed to increase capacity of memorisation
6.	Scientific inquiry	Joseph J. Schwab	Designed to teach the research system of a discipline but also expected to affect other domains

Personal development models assist the individual in the development of selfhood. Frequently, they focus on the emotional life of an individual. (Table 3.3)

Table 3.3 *Personal Models*

	Model	*Chief Exponent*	*Goals or Mission for which Most Applicable*
1..	Awareness training	Fritz Perls, William Schulz	Designed to increase one's capacity for self-exploration and self-awareness.
2.	Classroom meeting (social problem solving)	William Glaser	Designed to develop self-understanding and responsibility to oneself arid one's social group.
3.	Conceptual systems	David Hunt	Designed to increase personal complexity and flexibility.
4.	Non-directive Teaching	Carl Rogers	Designed to lay emphasis on building the capacity for personal development in terms of self awareness, understanding, autonomy and self-concept.
5.	Synetics	William Gordon	Designed for the personal development of Creativity and creative problem-solving

Social interaction models stress the relationship of the individual to other persons and to society. (Table 3.4).

Table *3.4 Social Interaction Models*

Model	*Chief Exponents*	*Goals or Missions for which most Applicable*
1. Group Investigation	1. Herbert Thelem 2. John Dewey	Designed for the development of skills for participation in democratic social process through combined emphasis on interpersonal skills and academic inquiry skills.
2. Jurisprudential	1. Donald Olive 2. James P. Shaver	Designed primarily to teach the Jurisprudential frame of reference as a way of thinking about and resolving social issues.
3. Laboratory Method	National Training Laboratory (NTL)	Designed for the development of interpersonal and social group skills and through this personal awareness and flexibility.
4. Role Playing	1. Famine Shafted 2. George shafted	Designed to induce students to inquire into personal and social values with their own behaviour and values becoming the source of inquiry.
5. Social Inquiry	1. Byren'Massialas 2. Benjamin Cox	Designed for the development of social problem-solving primarily through academic inquiry and logical reasoning.
6. Social stimulation	Sarene Boocock	Deigned to help students experience various social processes and realities and to examine their own reactions to them.

It may be noted that these models are not mutually exclusive. We find characteristics of one model apparent in some other models. Further, we find that information processing models, besides focussing on the development of intellectual skills and the acquisition of content, are also concerned with the development of

social relations. Besides, some social interaction models emphasize on personal development of the individual.

Since education is meant for the all round development of the personality of the child, no single model could be selected. We may be required to employ several models according to the requirement of the situation, that is if some information is to be given, models of the information family would be required; if creativity is to be developed in the child; the synectic model would be needed; if tho objective is to eliminate anxiety and stress, the desensitization model would be needed; and if development of social skill is the objective, the group investigation model would be required.

The selection of a model can also be done in consideration of curriculum requirements. For example, a biology teacher may need the inductive model of Hilda Taba and the concept attainment model of Brunner, while a social studies teacher who proposes to teach about values would need the role playing model of Fannie" Shaflel and George Shaftel, which motivates to inquire into personal and social values. Some situation would require an application of a combination of models. In the social studies class, the teacher may have the Inductive thinking model to help children master map skills and the group investigation model for discusing social issues.

Suggestions for the use of models in India: These models have been developed in foreign countries where the socio-economic conditions and cultural heritage are quite different from our country. So, while adopting/adapting these models we should take into consideration the following'points:

1. There is little experimental evidence to establish the superiority of one model over the other.
2. We should not consider models of teaching as panacea for all the ailings from which our system of education suffers. ...
3. Transplantation of foreign models without making necessary changes in accordance with the philosophy of life of our people will be harmful for the nation. Vigourous and continuous research is needed for their adoption in our country.
4. Classes of activity to which the models can be related to should be identified. Models can be related to three important dimensions of the educational environment—the personal, the social and the intellectual. Balance should be maintained to develop the individual harmoniously.
5. We should be very cautious in deciding the model in terms of skills and knowledge outcomes and social effects it will have on the society.

Glaser model of teaching or basic teaching model

Basic teaching model was developed by Robert Glaser in 1962. It is termed as the basic model because it tries to explain the whole teaching process by dividing it into four basic components namely, (1) instructional objectives (2) entering behaviour (3) instructional procedures (4) performance assessment. All these four basic components of the teaching process interact and influence each other as explained in the diagram. (Fig. 3.1)

1. Instructional objectives indicate the stipulated goals that a student is expected to attain after the completion of apart of instruction. These are usually based on Bloom's Taxonomy of objectives.
2. Entering behaviour implies the initial behaviour of the student before the beginning of instruction. The assessment of the entering behaviour is an important aspect of the instructional process.

3. Instructional procedures represent the teaching methods, strategies and student-teacher interaction patterns involved in teaching. Instructional procedures are guided by the nature of the instructional objectives and the entering behaviour.
4. Performance assessment involves the extent to which the stipulated objectives have been fulfilled. It involves the use of suitable evaluation techniques like tests and observation. It serves as a feedback device for each of the steps and elements of the teaching process.

As a matter of fact, all these four basic components of the teaching process interact and influence each other. One sets the base for the other by providing as a base or feedback for the successful operation of the teaching act.

Description of Glaser's model

Glaser's model may be described in terms of the fundamental elements as under:

1. ***Focus:*** It attempts to pinpoint the processes and major activities comprising the entire teaching-learning process. It also brings into light the sequence to be followed in the instructional processes.
2. ***Syntax:*** The flow of activities in this model is sequential. First of all the objectives to be followed are fixed in accordance with Bloom's Taxonomy. Then the potentiality of the learners in terms of their entry behaviour is assessed. Thereafter, in the light of the entry behaviour, instructional work is carried out for the achievement of stimulated objectives. Performance assessment is the last phase.
3. ***Principles of reactions.*** Main principles of reaction are summarised below:
   (a) *Principle of interdependence*—The student's responses are to be understood and dealt with in the light of the interaction and interdependence of the four stages, i.e., objectives, entry behaviour, instructional process and assessment.
   (b) *Principle of active involvement*—Its proper execution requires a lot of activity on the part of the teacher. At every stage the teacher is expected

to develop proper understanding of the poten-tial and difficulties ofhis students for achieving the objectives.

(c) Principle of follow up—In case the results are not in accordance with the set objectives, gaps and deficiencies have to be found out and corrective measures taken.

Social system: The success of this model depends upon the ability and competency of the teacher in terms of various skills like formulation of objectives, use of proper strategies and techniques of evaluation.

***Support** System:* The model for its success needs additional support in terms of (i) availability of adequate pre-service and in-service facilities to teachers to acquire needed competencies and skills for the use of the model (ii) availability of desirable teaching-learning environment and situations for the use of suitable teaching strategies (iii) availability of appropriate evaluation devices for the assessment of entry and terminal behaviour of the learners.

Applicability of the model: Being quite systematic and structured, this model is applicable to almost all learning- teaching situations.

Glaser's model indicates that teaching includes a wide range of decisions and practices and much of which requires little or no personal contact between the teacher and student. It implies a greater emphasis on the competency of the teacher than on his personality.

Classroom meeting model

Classroom meeting model was developed by William Glasser in 1965. It is based on the assumption that the success or failure of an individual depends more on the social factors rather than on his personal limitations. Through classroom meeting Glasser wants to see the whole school fully disciplined. All classroom meetings should result into model behaviour of the individuals. Each classroom meeting should be positive in nature and based on two basic needs namely, need for love and respect.

Description of the different elements of the model

1. *Focus:* The main aim of the model is to develop moral values and social norms among the students by providing appropriate social environment.

   Syntax: The model involves the following six phases:

   Phase 1. It is related to the creation and maintenance of a suitable climate of involvement and establishing adequate rapport with the students.

   Phase 2. It is concerned with the exposition of the problem for discussion.

   Phase 3. It involves encouraging the students to make value judgements about their behaviour.

   Phase 4. It relates to the identification of alternative courses, both by students and teachers, to find out the solution of the problem.

   Phase 5. In this phase, the teacher impresses upon the student to choose a selected path and pushes them for behaviour commitment.

Phase 6. In this phase, followup is provided and the students carry out the decisions arrived at.

2. ***Principles** of **reaction:*** The main principles are as under:
   (i) Principle of active involvement which means that the teacher should show affection, sympathy, understanding and warmth to his students, (ii) Principle of value judgement which implies that the students are made to assess their own behaviour, to accept their weak points in their interpersonal and social behaviour and find solutions for them.
3. ***Social** system:* This model is moderately structured. The students initiate the problem and cooperatively discuss and find out its solutions. The leadership remains with the teacher but the latterremains non-judgmental. The moral authority remains with the students.
4. ***Support** system:* The teacher must provide proper environment for proper group discussion. He must create a climate of openness.

Applicability of the model: The model has been developed to prepare socially desirable individuals. It attempts to nurture openness .and responsibility in students. It leads to the individual to make attempts to understand his own behaviour, seek value judgement and modify his behaviour for his self good and the good of the society.

3.4 INFORMATION-PROCESSING MODELS

Cognitive psychologists promote the use of information-processing models to describe and explain the human mental process. Educators and trainers regularlyuse this model to guide their teaching methodologies. The model likens the human thought process to the working of a computer. It considers information to flow through various internal structures present in a learner. Similar to a computer, a human mind absorbs information, organizes and stores it to be retrieved and used at a later period. Abetter understanding of how information flows, is processed, stored and retrieved through the information-processing model, allows learners' to understand more efficiently and systematically.

In a computer, information is fed through input devices such as a keyboard or scanner. It is called the sensory register in the human mind, composed of the sensory organs such as the eyes and ears through which we receive information. In a computer, the information received is processed in the central processing unit, which corresponds to the working memory or short-term memory. This information is stored in the hard disk and displayed on the screen or as a printout. Similarly, the human mind stores information for further use or it is transferred to the long-term memory, which is the human hard disk, or is discarded. The product of this information is exhibited through behavior or actions. Human beings can extract the information from the long-term me, which can be thought of as our consciousness. In certain cases, automatised skills are transferred directly from the long-term memory to the response generator, such as the skills used in operating a machine by an expert without a second thought.

According to American educational psychologist Robert Mills Gagne (1993), when we try to comprehend memories and retrieve information, simulation from the environment activates the receptors. The entire information from the surrounding is replayed to the short-term sensory store for two functions. First, it filters out insignificant information and focuses on the crucial one through selective perception. However, the importance and relevance of an incident varies from person-to-person. Hence, people may remember different things of the same incident, after reading the same book, watching the same movie or listening to the same lecture. Second, it makes sense of the various patterns of stimulation impinging on it. For example, a series of sounds of fluctuating frequencies and amplitudes is: heard as speech; different colours and intensities of light entering the eye are decoded by the short-term sensory store and we see objects.

A combination of a number of cognitive tactics, hence, forms cognitive strategies. These strategies direct human behaviours while thinking, memorizing and attending, and also to select which of the cognitive strategies and tactics is to be implemented in a particular situation. The necessity to choose strategies is termed as the need to act meta-cognitively to control your learning behaviour. A meta-cognitive learner will always self-monitor one's learning strategies. After selecting a cognitive tactic to put in use, the learner has to stand outside to monitor while evaluating whether the strategy was correct. If not found efficient, the learner has to modify or even change the strategy.

Basic assumptions

The information-processing model is based on a number of assumptions; these are:

(i) Information processing in humans resembles that in computers

(ii) The environment provides information which is processed by a series of processing systems such as attention, perception, and short-term memory.

(iii) These processing systems transform the information systematically

(iv) The aim of research is to specify the processes and structures that underlie cognitive performance

Information processing and attention

It has been observed that humans, when they selectively attend to an activity tend to ignore other stimulations, although they can be distracted by other sounds, such as calling of name or sound of a door bell. This tendency of selective attention has been an intriguing query for psychologists as they question how many things human beings can attend at the same time (attentional capacity).

One way of dealing with the question would be to consider humans as information processor who has the capacity to process only a limited amount of information at a given period without being overloaded.

Information-processing system

The information processing model, as shown above, indicates the flow of information from one stage to the next.

- Input processes are concerned with the analysis of the stimuli
- Storage processes cover everything that happens to stimuli internally in the brain and can include coding and manipulation of the stimuli
- Output processes are responsible for preparing an appropriate response to a stimulus.

Types of information processing

Information processing can be sequential or parallel, either of which maybe centralized or decentralized (distributed). The parallel distributed processing approach, propagated in the mid-1980s, became popular as connectionism. In the early 1950s, Friedrich Hayek had advocated that the brain takes spontaneous order through decentralized networks of simple units (neurons).

The connectionist network is made up different nodes, and it works by a 'priming effect', and this happens when a 'prime node activates a connected node' (Sternberg & Sternberg, 2012). But 'unlike in semantic networks, it is not a single node that has a specific meaning, but rather the knowledge is represented in a combination of differently activated nodes' (Goldstein, as cited in Sternberg, 2012).

3.4.1 Models and Theories

There are several proposed models/theories that describe the way in which we process information.

Sternberg's Triarchic Theory of Intelligence

Sternberg's intelligence theory includes three components — creative, analytical, anc practical abilities (Sternberg & Sternberg, 2012). Creativity is the talent of coming up with original ideas, and analytical ability allows a person to evaluate the positives anc negatives and whether the idea is a good one or not. Practical abilities are used tc implement the ideas and persuade others of their value (Sternberg & Sternberg, 2012)

In the middle of Sternberg's theory is cognition and with that is information processing. According to Sternberg, information processing consist of three different parts — metacomponents, performance components, and knowledge-acquisition components (Sternberg & Sternberg, 2012). These processes move from higher-order executive functions to the lower-order. Metacomponents are used for planning and evaluating problems, while performance components follow the orders of the metacomponents, and the knowledge-acquisition component learns how to solve the problems (Sternberg & Sternberg, 2012). A practical implication of this theory would be like working on an art project. First the idea takes shape, then the concept is drawn mentally or is planned, and then a sketch is done. Through this entire process, the artist will monitor the work in progress. These steps come under the metacomponent processing, and the performance component would be the actual painting. The knowledge-acquisition portion would be learning how to draw what you want to draw.

Working memory

Information processing can be defined as the sciences concerned with gathering, manipulating, storing, retrieving, and classifying recorded information. It suggests that for information to be firmly implanted in memory, it must pass through three stages of mental processing; sensory memory, short-term memory, and long-term memory.

The working memory model is one such example. This includes the central executive, phonologic loop, episodic buffer, visuospatial sketchpad, verbal information, long-term memory, and visual information (Sternberg & Sternberg, 2012). The central executive is the one to decide what requires attention and how to respond. It has three sub-sections — phonological storage, sub-vocal rehearsal, and phonological loop. These sections work together to understand words, put the information into memory, • and then hold the memory. The result is verbal information storage.

Visuospatial sketchpad is the next sub-section which stores visual images. The storage capacity is brief but leads to understanding of visual stimuli. Finally, there is an episodic buffer. This section collects information and puts it in long-term memory. It also takes information from the phonological loop and visuospatial sketchpad, combining-them with long-term memory to make a unitary episodic representation (Sternberg & Sternberg, 2012). For these to work, the sensory register takes in via the five senses: visual, auditory, tactile, olfactory, and taste. These are present since birth and are able to handle simultaneous processing (e.g., food—taste it, smell it, see it). The benefits of learning become visible once there is a developed process of pattern recognition.

In general, learning benefits occur when there is a developed process of pattern recognition. The sensory register has an expanded capacity and its behavioral response is short (1-3 seconds). In this model, sensory store and short-term memory or working memory has limited capacity. Sensory store holds limited amounts of information for very limited time duration. (Sternberg & Sternberg, 2012).

Short-term memory holds information for slightly longer period, but still has limited capacity. According to Linden (2007), 'The capacity of short-term memory (STM) had initially been estimated at seven plus or minus two items' (Miller 1956), which fits the observation from neuropsychological testing that the average digit span of healthy adults is about seven (Cowan and others 2005). However, these number of items can only be retained if they are formed into groups, using perceptual or conceptual associations between individual stimuli. Its duration is of 5-20 seconds before it is out of the subject's mind. This can be experienced when a new name is introduced to us. Here images and information based on reasoning are stored but is forgotten if not repeated. Long-term memory, however, has unlimited capacity (Sternberg & Sternberg, 2012) with indefinite duration. At times it becomes inaccessible as it stores a lot of information till that particular time. This is when people say they forget or partially remembers in information.

3.5 SUMMARY

In this unit, you have learnt that:

- Development of models of teaching is one of the recent innovations in teaching.
- A number of educationists and psychologists have proposed model- approach to teaching.
- The credit for transforming prevailing teaching theories into different models of teaching goes to Bruce Joyce and Marsha Weil (1980).
- Educators and psychologists have designed several types of teaching models which provide suitable guidelines to the teachers for modifying the behaviour of the learners.
- Bandura and Walters mention three kinds of effects in teaching by modelling. These are: (i) a modelling effect (ii) an inhibitary and disinhibitary effect and (iii) an eliciting effect.
- Among those in common use are 'modelling', 'imitation', 'observational learning', 'identification', 'copying', 'vicarious learning', 'social facilitation', and'role playing.'
- A teaching model has six fundamental models: (i) focus (ii) syntax (iii) principles of reactions (iv) the social system (v) the support system (vi) Application context.
- Social interaction models stress the relationship of the individual to other persons and to society.
- Since education is meant for the all round development of the personality of the child, no single model could be selected.
- The selection of a model can also be done in consideration of curriculum requirements.
- Basic Teaching Model was developed by Robert Glaser in 1962.
- As a matter of fact, all these four basic components of the teaching process interact and influence each other.

- The success of this model depends upon the ability and competency of the teacher in terms of various skills like formulation of objectives, use of proper strategies, techniques of evaluation etc.
- Classroom Meeting Model was developed by William Glasser in 1965. It is based on the assumption that the success or failure of an individual depends more on the social factors rather than on his personal limitations.
- The model has been developed to prepare socially desirable individuals.
- Cognitive psychologists promote the use of information-processing models to describe and explain the human mental process.
- Similar to a computer, a human mind absorbs information, organizes and stores it to be retrieved and used at a later period.
- According to American educational psychologist Robert Mills Gagne (1993), when we try to comprehend memories and retrieve information, simulation from the environment activates the receptors.
- A combination of a number of cognitive tactics, hence, forms cognitive strategies.
- It has been observed that humans, when they selectively attend to an activity tend to ignore other stimulations, although they can be distracted by other sounds, such as calling of name or sound of a door bell.
- Sternberg's intelligence theory includes three components — creative, analytical, and practical abilities.
- Information processing can be defined as the sciences concerned with gathering, manipulating, storing, retrieving, and classifying recorded information. It suggests that for information to be firmly implanted in memory, it must pass through three stages of mental processing; sensory memory, short-term memory, and long-term memory.
- In general, learning benefits occur when there is a developed process of pattern recognition.
- Short-term memory holds information for slightly longer period, but still has limited capacity.

KEY TERMS

- **Performance assessment:** Performance assessment involves the extent to which the stipulated objectives have been fulfilled.
- **Behaviour modification models:** They stress on changing the external behaviour of the learners and describe them in terms of visible behaviour rather than underlying behaviour.
- **Information processing models:** They refer to the way people handle stimuli from the environment, organise data, sense problems, generate concepts and solution to problems and use verbal and non-verbal symbols.

7 ANSWERS TO 'CHECK YOUR PROGRESS'

1. Accroding to Jangira and Singh, a model of teaching is a set of inter-related components arranged in a sequence which provides guidelines to realise a specific goal. It helps in designing instructional activities and environmental facilities, carrying out of these activities and realization of the stipulated objectives.
2. Paul D. Eggen explains, as an engineer, in considering a project, first identifies the type of structure to be built, e.g., a building, a bridge or a road. Having done this, he selects an appropriate design or blueprint to follow in building that structure. The specifications of the blueprint determine the actions of the builder takes and the kind of building that will result. The particular type of blueprint or model chosen depends on the type of structure to be built. In a similar manner a teacher considering the choice of a teaching model first identifies what is to be taught and then selects a model in accordance with that goal. The model chosen is specifically designed to achieve a particular set of objectives and will determine in large part of the actions of the teachers.
3. Some common identifiable characteristics of a good model, are given below:
    1. Specification of learning outcome. All models of teaching specify what the students should perform after completing an instructional sequence.
    2. Specification of environment. A teaching niodel specifies in definite' terms the environmental conditions under which a student's response should be observed.
    3. Specification of criterion of performance. A model of teaching specifies the criterion of performance which is expected from the students.
    4. Specification of operations. A model of teaching specifies the mechanism that provides for the reaction of students and interaction with the environment.
    5. Scientific procedure. A model of teaching is based on a systematic procedure to modify the behaviour of the learner. It is not a haphazard combination of facts.
4. Bandura and Walters mention three kinds of effects in teaching by modelling. These are: (i) A modelling effect (ii) An inhibitary and disinhibitary effect and (iii) An eliciting effect.
5. A teaching model has six fundamental elements: (i) focus (ii) syntax (iii) principles of reactions (iv) social system (v) support system (vi) application context.
6. Information-processing models refer to the way people handle stimuli from the environment, organise data, sense problems, generate concepts and solution to problems and use verbal and nonverbal symbols.
7. The information-processing model likens the human thought process to the working of a computer. It considers information to flow through various internal structures present in a learner.

8. The information-processing model is based on a number of assumptions; two of them are:

   (i) Information processing in humans resembles that in computers (ii) The environment provides information which is processed by a series of processing systems such as attention, perception, and short-term memory.

9. According to Sternberg, information processing consist of three different parts — metacomponents, performance components, and knowledge-acquisition components.

3.8 OUESTIONS AND EXERCISES

Short-Answer Questions

1. What do you understand by teaching models?
2. What are the functions of teaching models?
3. What are the five-fold classifications of teaching models?
4. What is information-processing system?

Long-Answer Questions

1. Explain the different types of modern teaching models.
2. Discuss Glaser's model of teaching. How is it different from the classroom meeting model of William Glasser?
3. Why is Bruce Joyce and Marsha Weil credited for transforming the teaching theories. Discuss.
4. Discuss the various theories of information-processing models.

3.9 FURTHER READING

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UNIT 4 PROCESS OF COMMUNICATION AND INSTRUCTION

Structure

4.0 INTRODUCTION

In the modem world of science and technology where man is moving towards more and more advancement, we cannot deny the fact that our education system is also being affected. However, the success of education cannot be achieved merely by replacing human beings with technologies. It needs a right blend of both labour and scientific inventions. We have to utilize the existing resources to improve the way we communicate with each other. To make the process of teaching-learning more effective, communication, as the most important tool, should be used in a proper way. The teacher should communicate facts, skills, ideas and attitude. However, it has been found that there are some principles of communication which may help in improving the relationship between teachers and students. Communication is a powerful means of bringing about social change. The revolution in media has helped in accelerating the pace of social change during the last few decades. Teaching will only be effective if its outcome is positive. As we know all students are not the same, additional material should be available to help each one of them. Skinner developed one such implement known as 'teaching machine'. It is very helpful in the activity of memorization.

In this unit, you will learn about the process of communication in a classroom, the modalities of tracking, and the differences between teaching and instructions

4.1 UNIT OBJECTIVES

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

- Define communication and instruction
- Explain communication cycle

- Discuss the concept of teaching along with its different phases
- Identify the constituent parts of a teaching machine
- Discuss the role of teaching machine in improving the process of teaching

4.2 CONCEPT OF COMMUNICATION

Man is a social animal and his ability to communicate is the prime factor that distinguishes him from other animals. Apart from basic necessities, one needs to be equipped with good communication skills. We always want to share our thoughts, feelings, ideas and beliefs with people around us. We can exchange information through words, gestures, signs and symbols, expressions, and tone etc. One can also make use of technical media like telegraphy, radio, television, and computer, etc., for interaction. This interaction is called communication. The word communication is derived from the Latin word '*communicare'* which means to share, is the process of transmitting information and understanding. Communication is a complex and ongoing process. It is a process of exchanging verbal and non-verbal messages. The way we communicate is a learned style. We grow up watching our parents and other people communicate with each other. As adults, we can learn improved ways of communication by observing others who communicate effectively, learning new skills and practising those skills. The ability to effectively communicate at work, home and in life is probably one of the most important sets of skills a person needs. In the process of teaching-learning, communication plays a very important role. If a teacher is a good communicator, only then will he/she be able to interact with students, properly to make them understand his/her ideas or thoughts. Any idea or thought which is not shared is of no use. Hence, communication is a must as it involves transmission of message by a sender and its proper understanding by the receiver.

Definitions of communication

Some of the important definitions of the process of communication are as follows:

- Newman and Summer defined communication as an exchange of facts, ideas, opinions or emotions between two or more persons.
- According to Hoben, 'Communication is the verbal interchange of thoughts or ideas.'
- According to Anderson, 'Communication is the process, by which we understand others and in turn, endeavour to be understood by them. It is dynamic, constantly changing and shifting in response to the total situation.'
- According to Shannon and Weaver, 'Communication involves all the procedures by which one mind may affect another. This involves not only written and oral speech, but also music, pictorial arts, theatre, ballet, and in fact all human behaviour.'
- According to Merrihus, 'Communication is a process of mutual exchange of thoughts, ideas, facts and emotions.'
- According to John Dewey, 'communication is a process of sharing experiences till it becomes a common possession'.

Characteristics

Communication has some basic characteristics, which are discussed as follows:

- **Purposeful:** Communication always involves a purpose. Whenever an idea or thought arises in the mind of a sender, he wants to communicate it. This mean there is always some purpose behind it. The purpose of communication is to impact attitudes and behaviour of those involved.
- **Universal:** Communication is the only way through which human beings can share information. Thus, communication is a universal process as it occurs almost everywhere.
- **Interactive:** Interaction is primary characteristic of communication in which two or more persons or groups interact with each other. It may results in social interaction. Thus, it is a two-way dynamic flow of information.
- **Imperfect:** A perfect communication is never possible in reality because what a person thinks can never be exactly understood by the receiver. This is because every individual is different from the other and perfect synchronization of minds is never possible.
- **Dependent:** Communication is performed with the help of some media. Communication is now carried out through various channels or modes, ranging from sophisticated communication media and technology, to non-verbal signals. So, it is dependent on some media through which message from one person could be sent to another.
- **Complex:** Communication is a complex process which involves various steps. A number of barriers can hinder this process at both ends (sender and receiver).
- **Contextual:** Communication always takes place within a context. The context of communication has at least four dimensions: (i) physical^ (ii) social, (iii) psychological (iv) temporal. These dimensions interact and influence, and are influenced by one another.

Importance of communication

As we have already discussed, communication is nothing but transmission and understanding of message from sender to receiver. It is a very important aspect of human life because it is only through communication that human beings can interact with each other as individuals and as independent groups. It is an essential and basic process in all fields of life. Communication skills can be used virtually in every field. Effective communication is important because it allows people to lead more satisfying lives. Some other reasons which explain why communication is important are as follows:

- **Transmission of information:** Communication is must to transfer information between individuals and places. Any message which is not communicated is of no use.
- **Displaying ideas/emotions:** Whether it is in written or oral form, we always express ourselves by communicating with others. Without communication, we are not able to express our feeling or ideas. Hence, communication is important to transmit emotions/ideas.

- **Education:** The whole process of education involves imparting of knowledge to students by the teacher. However, this knowledge is imparted by various media which depend on communication. Education without communication is impossible.
- **In relationships:** Communication plays a vital role in building relationships between people. It facilitates dialogue, exchange of expression and emotions which result in relationships. The type of communication decides the relation. It could be personal or professional.
- **Entertainment:** To break away from the daily schedule of life full of stress, entertainment is a crucial part of everyone's life. Nowadays, every source of entertainment like movies, music, television shows, games, theatre or even anecdotes narrated by people involve communication.
- **Achievement** of **goals:** The ability and the importance of communication become much more crucial when we are on a mission, or need to achieve a goal. Without a means to communicate, an organization will become isolated. The ability to effectively communicate is very important to achieve the set goals.
- **Cultural promotion:** Communication offers a prospect to promote and preserve culture and traditions. It helps people in fulfilling their desire to be creative.
- **Integration:** It is with the help of communication that many people in a large number of countries all over the world, gain awareness related to each other's customs and tend to admire each other's lifestyle and culture. It progresses the activity of being integrated and tolerant with respect to each other.
- **Discussion:** The processes of debating and discussing elucidate various perspectives on matters that are of interest to people. With the help of communication, the reasons for difference in opinions and imparting of new ideas to others can be pinpointed.

Communication cycle

the process of communication consists of a message being sent and received (Figure 4.1). The effectiveness of communication can be estimated by the similarity between the message sent and the one received.

Thus, it is a two-way process in which information is sent by one person and received by the other. It is a continuous process in which different steps are followed for proper understanding and effective communication. The process of communication can be explained with the help of a communication cycle, which involves the following:

- **Sender** of **the** message: Initiation of the process of communication is done by a sender or communicator who conceptualizes the idea that is to be transmitted. A sender is a person who initiates communication by making use of language or symbols to convey the message. The views, advancement, ability, mindset, capability and awareness of the sender have a great impact on the message. It is also very important to choose correct symbols, depending on the audience and the environment. It is essential to select appropriate spoken and written symbols to ensure that the message is interpreted correctly by the receiver.

Message: The process of communication begins with finalization of the message to be conveyed. Message is a key idea, thought, opinion, feeling, knowledge of information, which sender wants to communicate. A message is sent by the source and received by the destination. It is encoded in a way that can be understood by both the sender and the receiver. A message can be written or oral. It maybe well-organized and structured, or unorganizedtiirid unstructured depending upon the nature of the communication. Anythihg%hich conveys thoughts or feelings can be considered a message, for example, a painter communicates through his paintings, a writer communicates with the help of his writings, a person with speech or learing problem communicates through symbols or movement of fingers, an actor can convey his message through expressions. All these examples can be considered messages.

Channels of communication: In order to convey what the information means to the receiver, the sender uses the process of encoding. In encoding, information is translated into a format which can be understood by the receiver. Information is either oral, written or visual. The medium or means which a sender employs to convey his message is known as 'channel of communication'. Through this channel, the sender is connected to the receiver. The majority of channels transfer information in either verbal or written format. However at present, visual

channels are gaining popularity due to expansion of technology. Some common official channels of communication are: letter, memorandum, e-mail, telephone, fax, telegram or television. Every channel has its own advantages and disadvantages. It is important to select a suitable channel for communicating effectively and for correct interpretation of the message by the receiver. For instance, written channels are more effective when the receiver of the message is a small group of people. Similarly, the effectiveness of oral channels is more when the receivers require quick feedback. Some situations require use of both written and verbal modes of communication. Thus, sender has to select right kind of channel (Figure 4.3) for the message to reach the right receiver.

Receiver of the message: Once the appropriate channel is selected, the decoding stage of the message begins. The process of interpretation of the information that is transferred is known as 'decoding'. Decoding is done by the receiver. The receiver interprets information that the sender sends. The receiver translates the message in order to make the symbols meaningful. A number of factors govern the extent to which a message is interpreted by the decoder. Some of these factors are: the receiver's knowledge, his sensitivity to the message, and the degree of dependence of the encoder on the decoder. Successful communication takes place when the receiver correctly interprets the sender's message.

Feedback: The most important part of the communication process is the feedback. On the basis of this component, the sender analyses how effective the message is. If there is no feedback, the sender would not be able to make sure that the message has been interpreted by the receiver. There would be no way of knowing if meaning had been shared. Once the message is received by the receiver, he sends a response to the sender. The signal might probably be a spoken comment, a written message, a smile, or any other similar activity. Hence, one can assume that feedback may be in the form of words, or in the form of smiles, and sighs.

4.2.1 Principle Modes

At the time of communicating, it is very important to consider some of the general principles of communication. These principles are the same for all human beings, no matter what ethnicity or culture they may be part of. These principles help to overcome all barriers of communication and make the process more successful. Thus, it is important to consider some of the general principles of communication to make the process more effective. Following are some important principles which should be kept in mind, during the process of communication:

(i) Principle of mastery on language: Verbal communication is the most widely used form of communication. It uses language to express thoughts and ideas. Mastery of language is vital for effective communication. The sender or source of communication should use the language which is easy for the receiver to understand. In a classroom, the teacher should be fluent in the language which the students understand; only then it will be possible for him to convey the message to students. Individuals without this mastery are prone to be misunderstood and their efforts to communicate their ideas may not be successful. Sometimes, a teacher is very good in his subject, but it is of no use if he is not able to communicate the knowledge to his students. Therefore, both the teacher and the students should have a good command on the language used to transfer knowledge in a classroom.

(ii) **Principle of motivation:** The level of interest of both the source of communication and the receiver should be interested throughout the process of communication. Lack of motivation, interest and zeal on part of the sender or the receiver may adversely influence the progress of communication. A teacher cannot teach the students until they are interested in the topic being taught. Hence, he needs to motivate the students for proper communication. The higher the level of motivation, the better the communication.

(iii) **Principle of sharing and interaction:** During communication it is important to be sensitive to the others and be aware of how the receiver is interpreting the message. The success of communication lies in sharing and mutual interaction between the sender and the receiver. A teacher should always involve the students while teaching to increase interaction and effectiveness of the teaching-learning process. Sharing of ideas and interaction between teacher and students is necessary to develop a relationship based on understanding and mutual experiences.

(iv) **Principle of active listening:** Listening is an important aspect of communication and this role is played by the receiver of the message. To become an effective communicator, it is very important to listen to the other person. If the sender is not a good listener, it would be very difficult to understand what someone is trying to say. A lot of misunderstanding and misinterpretation can occur if there is lack of proper listening. Active listening ensures that the sender's message is received both effectively and efficiently A lot of misunderstanding and misinterpretation may be caused by not listening to the other person. A listener must be able to make sense out of what he hears, only then it will be called active listening. Although listening is not communication in itself, it is still an integral part of communication.

(v) **Principle of suitability of communication contents:** The content which is to be communicated should have a definite purpose, cohesiveness and usefulness for the receiver. The content should be suitable and appropriate for both the sender and the receiver. The sender should be familiarized with the content to be communicated. On the receiver's end, the content should be suitable enough to be grasped so that he can respond properly.

(vi) **Principle of usiiig appropriate channel:** Selection of the wrong communication channel can cause communication obstacles and inadequate feedback. Effective communication relies on selecting an appropriate communication channel for sending the message. While selecting the

communication medium, one should keep in mind the purpose of the message. More than one communication channel should be selected in order to reinforce information. For example, in a classroom it is always suggested to use various teaching aids, which may help students in better understanding of the topic being taught.

(vii) **Principle of conductive environment:** A conducive environment is a very vital constituent for facilitating effective communication. The communication process should be protected from noise, disturbance, poor pronunciation, improper ventilation, etc., because in the presence of all these factors, communication may not be successful. Hence, to enhance the effectiveness of communication, a conductive atmosphere is necessary.

(viii) **Principle of competency:** Competency is required at both the sender's and receiver's end in terms of communicating and receiving the desired information. Both of them should possess the communication skills which help the sender in sending the message and the receiver in the receiving the message effectively. In a classroom, the teacher must be equipped with sufficient knowledge and skills to transfer information to the pupils.

(ix) **Principle of appropriate body language:** Appropriate body language also plays a very important role in the communication process. One of the most influential modes of communication in day-to-day interaction is our body language, which includes eye contact, gestures, body stance and facial expressions. Individuals with improper body language are prone to be misunderstood and do not succeed in communicating their ideas. In a classroom, the teacher uses ample body language, but if it does not match with the words conveyed, the students may get confused and that will result in poor communication.

(x) **Principle of appropriate feedback:** Appropriate feedback from receiving end conveys that the message of the sender has been received and interpreted correctly. The feedback can also work in reverse order from the source to the receiver's end. If a teacher gets proper feedback from the students, it will help him understand whether the communication is effective or not. In the same way, when students get feedback of their performance from the teacher, they get motivated and that results in better communication. In the absence of proper feedback, communication would be incomplete and improper.

(xi) **Principle of using example:** The addition of examples always make the message more interesting. For instance, various visual slides or other material related to the topic can result in better communication, especially, in the classroom where the teacher has to deliver a lecture. He may use a number of routine real-life examples so that his pupils understand the lesson better.

(xii) **Principle of friendly nature:** Friendly attitude of sender can also help in receiving the message in a better way. Fear and threat of a senior or a more qualified person may make the receiver conscious and he may not interpret the message properly. For example, if a teacher is too strict, the students will not try to clear their doubts for fear of being punished. On the other hand, if the teacher is friendly, students feel comfortable in asking questions and even giving feedback.

4.2.2 Barriers

Barriers to communication have made the process complex, difficult and frustrating. Communication is effective if it flows freely through an appropriate medium between the sender and the receiver. Free flow means uninterrupted transmission of information Or message, correct comprehension of the message by the receiver, and relevant and appropriate feedback from him. Problems with any one of the components of communication can become a barrier to communication. Barriers to communications range from simple distracting noises to complex psychological factors. These barriers may cause simple communication gaps or total failure of communication. Some major barriers of communication are as follows:

(i) **Lack of common language:** Language uses oral or written symbols to transmit messages from one person to another. If the sender and the receiver of a message do not belong to the same language group, then this deficiency will pose as an obstacle to the process Of communication. The sender and the receiver will not be able to communicate with each other if they do not know a common language. Communication will not be possible between a boy who can only speak in English and another boy who can only speak in French.

(ii) **Semantic barrier:** It is possible for one word to have many different meanings. It is not necessary for the meaning that is ascribed to a word by the communicator to be the same as that ascribed by the receiver to the same word. One word can have different meaning for different people at different points of time. Hence, it is possible that the sender and the receiver, most of the time, ascribe different meanings to the same word. Occasionally, they might possibly make use of dissimilar words to communicate the same meaning.

(iii) **Poor listening:** Poor listening skills are one of the chief problems when communicating. If people are attentive in listening to the message, a lot of misunderstanding can be reduced. A large number of people do not pay value-added attention to the message because of a variety of disturbances, feelings, enthusiasm, absence of interest, unwarranted assertiveness and roving concentration. This usually leads to misunderstanding and conflict.

(iv) **Poor vocabulary:** Low level of vocabulary is an obstacle to the communicator in conveying the message in its exact form. It makes the message more complicated and reduces its effectiveness. If the recipient cannot figure out the words, he will not be able to comprehend the sentences.

(v) **Noise:** A lot of noise also affects communication. Noise is usually, but not always, in the form of sounds. It can be visual, audiovisual, written, physical or psychological. Noise, in a physical form denotes the loud noise made by machines or speaker or other such things. Noise occurs when a student arrives late for a class and his arrival becomes a source of distraction for others in that class. Bad handwriting and incorrect typing leads to written noise. Psychological noise refers to mental trouble and turmoil, inattentiveness and indifference.

(vi) **Time:** Time factor may also hinder the process of communication. For example, a phone call at midnight may irritate the receiver and he person may not listen to the communicator. Thus, his communication becomes ineffective. The best of communication may prove to be ineffective if it does not take place at the right time.

(vii) **Distance:** The distance between one who communicates the message and one who receives it may be a strong obstacle to communication. This can be due to absence of technical equipment such as telephone, and telefax and for linking them. An unfavourable system of seating in the classroom can give rise to a type of communication gap, which can be eradicated by making adjustments in the distance.

(viii) **Attitudes and values:** People interpret message on the basis of their attitudes and values. If a message is adverse for the receiver, it will not be able to persuade him easily. Thus, personal attitudes, values and opinions are transformed into obstacles, in the process of effective communication. Negative attitude of a teacher or a student may affect communication in the classroom.

(ix) **Emotional barrier:** Emotions refer to the way we feel about the world around us. Constructive emotions like happiness, adoration or liking make the flow of communication smooth. However, negative emotions like fear, distrust, anger,-anxiety and hatred, work as powerful hindrances to efficient' means of communicating.

(x) **Different perceptions:** Different perceptions of different people have their own limitations. According to Francis Bacon, 'Man prefers to believe what he prefers to be true.' Our reality is created by us with the help of selective perception. This conceals specific things that are present and reveals other more specific things, in addition to those which are already present. Every person's experience and his way of interpreting things are never the same since every person has perception his own. A communication barrier emerges, when the same object or concept is interpreted differently by two or more people.

(xi) **Wrong channel:** At times, simple rules for selection of a channel cause more problems than they solve. In selection of a channel, the sender needs to be sensitive to things like complexity of message, consequences of a misunderstanding, knowledge, skills and abilities of the receiver and timely response on receiving the message.

(xii) **Poor retention:** There is a limit to the functioning of human memory. Everything that is said cannot be always retained. The retention is even lower if the receiver is not interested or attentive. This causes a breakdown in the process of communication.

(xiii) **Closed mindedness: It** is not at all easy to communicate with a person with intense prejudice. Such person is not ready to receive any message on a subject about which he believes that he knows everything. His mind is closed to new ideas, facts and proposals. Hence, he completely rejects the information and recommendations of the communicator, even before he knows the real facts.

(xiv) **Physical distractions:** Physical distractions are physical things that interrupt communication. For example, uncomfortable seating arrangement makes it difficult for a learner to concentrate on the communication.

(xv) **Lack of proper feedback:** Without feedback, communication is oneway. Feedback in terms of proper motivation, incentives, zeal and enthusiasm is needed on the part of the sender and the receiver. If, in a classroom the teacher is not getting feedback of his teaching, he may never achieve the actual goal of teaching.

(xvi) **Too much information:** Excess of information also acts as communication barrier. A lot of information faces many drawbacks and different respondents react differently to filter the information and receive only what they need. Hence for effective communication, the amount of information can be reduced.

4.2.3 Classroom Communication

There is nothing in this world that would be achievable without the process of communication. There are different modes of communication, depending on the environment or situation and also on the number of people involved. Let us discuss all of these one by one:

1. **Mode of communication:** A person can communicate with the help of both language and expression. If there is use of language it is called verbal communication. However, communication that takes place without language, with the help of expression only is known as non-verbal communication.

(i) ***Verbal communication:*** Language is an important factor and base of any verbal communication. Communication which makes use of oral or written form of language is termed as verbal communication. We have different types of languages like regional, national and international, for communication. In a classroom, the teacher mostly communicates verbally and writes words or sentence on the blackboard. Verbal communication with students is through questioning, lecturing, guiding, explaining or demonstrating. In this way, we. can say that verbal communication combines both written and oral forms, which results in effective communication. For effective verbal communication, the following things should be kept in mind:

(a) The language must be clear and proper.

(b) It is important for the message to be short and to the point, but absolute in every way.

(c) The communicator must have a good vocabulary.

(d) The message must be appealing not only to the mind but also to the spirit of the listener.

Advantages of verbal communication

(a) Verbal communication provides immediate feedback, which helps the communicator in knowing the receiver's response. It also helps him to change his message in such a way that it becomes easy for the receiver.

(b) The sender can provide easy clarification of things, which have not been understood by the receiver.

(c) Verbal messages can be transmitted in a very less time, as compared to any other form of communication.

(d) Vocal directions and instructions are successful in taking control of the state of affairs to make sure that the objectives are fulfilled.

(e) Oral communication is a convenient and reliable media for communicating in committees, conferences and meetings, where a number of people come together for discussion.

Disadvantages of verbal communication

(a) Oral communication can be of very high-quality and useful if the conversationalist is a fine speaker.

(b) The verbal message may reach the receiver in a distorted form. This unclear message could be the reason of his misapprehension and misconception of it.

(c) Due to lack of proper recalling, people may find it problematic to remember the key ideas of realistic facts which are conveyed orally.

(d) Meetings can be costly in terms of time and money.

(ii) ***Non-verbal communication:*** *There* are many ways used by people to communicate, other than verbal communication. Messages that are conveyed through body language, facial expression or code language, without taking help of verbal or written language are known as non-verbal communication. In some cases (with people who are not able to speak and listen (dumb and deaf), mentally challenged persons or who do not know the language of the sender) use of non-verbal communication becomes a compulsion. This type of communication is very often used along with verbal communication to make it more effective. Non-verbal communication can be of following types:

(a) *Body language:* Feelings, thoughts or ideas can be conveyed with the help of body language. Various postures and movements of body can convey various messages. Different people in different profession makes use of body language and convey the feelings like happiness, fear, anxieties, jealous, love and sympathy. A dancer while performing can convey feelings with the help of various postures. Similarly, a teacher can show love for the students, lawyers can very well use various postures to evoke the answers from their clients and so on.

(b) *Facial expression:* It is rightly said that face is a mirror for one's emotions. Intentions of a person can be very easily studied by his facial expressions. When a person is angry or happy, it can be clearly observed through the facial expression. These expressions are similar and universal. For non-verbal communication, these are most suitable and effective.

(c) *Language of eye:* Language of eyes can be declared as another important form of non-verbal communication. It is very simple and easy to understand the language of eyes. Widening or narrowing of pupils and movement of eyelids convey messages to the receiver.

(d) *Symbolic code language:* In news bulletin for the deaf and dumb on television, special code language is used. This is easily understood by them. Even in our day-to-day activities, we use various symbols, or codes to convey messages. Detectives use code language to pass on secret information.

2. **On the basis of the number of people:** Communication eatftake place between two or more individuals. Hence, based on the number of individuals involved, we can divide communication into following:

(i) ***One-to-one comm unication***: It occurs between two individuals. A friend talking to other, a teacher talking to a student or talks between a father and a son are some examples of one-to-one communication. It can be both formal and informal type.

(ii) ***Small-group communication:*** This type of communication occurs among more than two individuals. Communication between families, neighbours and friends are examples of this type of communication.

(iii) ***Public communication'.*** This type of communication is mostly formal and involves a number of people. Morning assemblies in schools or preaching at religious places are examples of this type of communication.

(iv) ***Organizational communication:*** This type of communication occurs within the boundaries of an organization or institution, for instance, communication in hospital, army, or any educational institute, (v) ***Mass communication:*** This type of communication is broad and it involves ways to communicate with masses. It is carried out through different types of mechanical means, appliances and mass media such as television, radio, books, and videos. Individuals living in any part of the world can be involved in mass communication.

3. **Communication on the basis of environment:** Communication can take place in a variety of situations or environment. Depending upon the environment, wemay divide communication into two types:

(i) ***Formal*** *communication:* When communication takes place in a well-set environment with proper rules and regulations to achieve predetermined objectives, it is called formal communication. In events that require public speaking, mass communication, and official communication formal communication is used. Here, language is used more precisely and there is a higher focus on grammar, (ii) ***Informal com m unication****:* When communication is not pre-planned and it is free of rules and regulations with minimum formalities, it is known as informal communication. In this type of communication, focus on the structure of language and grammar is very less. There is also lesser focus on non-verbal behaviour like attire, way of walking, and stance. Any type of communication between a group of friends outside the school or college can be taken as an example of informal communication.

4. **Communication on the basis of its direction of flow in an organization:**

On the basis of this criteria, there are the following two types of communication: (i) ***Upward communication:*** In this type of communication, message is initiated by subordinates and is received by superiors. In an organization, people in the top management use this type of communication to be aware of the needs, requirements, problems and complaints of employees. It also helps them in sound decision-making, based on the information received from employees. This type of communication provides an opportunity to employees to communicate their issues to the top management, Upward communication takes place in meetings, counselling, correspondence, and reports, (ii) ***Downward communication:*** This type of communication is initiated by people at higher positions in an organization. For the success of an

organization, effective downward communication is very important. The communication of management with employees is necessary for organizing, coordinating and directing the operations of an organization. Downward communication flows through speeches, instructions, meetings, telephones, letters, pamphlets, etc.

Every type of communication is unique and it makes everyone special and unique. Various types of communication enable us to enhance our communication skills, verbal or non-verbal.

4.3 MODALITIES OF TEACHING

Teaching is considered as a social phenomenon. Teaching is an art in which a teacher influences his students and motivates them for learning. Students learn and develop according to the ideals set before them by teachers. Teaching is nothing but an organized set of activities, as a result of which pre-determined objectives are achieved. The success of teaching process depends upon the sincerity and hard work of teachers. Communication plays a big role in teaching as the whole process of teaching involves various forms of communication. Teaching should not be confused with conditioning, training, instruction and indoctrination. However, all these may help in the process of teaching. Teaching is more complex, wide and comprehensive in comparison to all these four terms. A teacher should have a number of skills. Let us discuss the whole process of teaching and some steps, which are performed by teacher.

A few popular definitions of teaching are as follows:

- In the words ofBrubacher (1939): 'Teaching is an arrangement and manipulation of a situation, in which there are gaps or obstructions which an individual will seek to overcome.'
- According to Morrison (1934): 'Teaching is an intimate contact between a more mature personality and a less mature one, which is designed to further the education of the latter.'
- According to Smith (1961): 'Teaching is a system ofactions intended to reduce learning.'
- According to Clark (1970): 'Teaching refers to activities that are designed and performed to produce change in student behaviour.'

Assumptions of teaching

Some assumptions of teaching are as follows:

(i) The teacher is a professional who is capable of making rationale, humane and creative decisions,
(ii) The primary purpose of teaching is to facilitate student learning.
(iii) Student learning can be measured only through observations that reveal changes in behaviours,
(iv) The act of teaching is a complex process that is influenced by a field of forces, of which teachers can be aware only in part and which they can only partially control.

(v) Teaching is an activity that can be described and analysed.

(vi) Teachers should teach objectively and enable students to evaluate their teachings.

Characteristics of teaching

According to the definitions and assumptions of teaching, the characteristics of teaching can be interpreted in the following ways:

(i) Teaching is an interactive process between a teacher and a learner. It is not a one-sided affair as bothjhe learner and the teacher have to be fully active during this process.

(ii) Teaching is not an independent activity as it cannot happen in vacuum. It takes place in some social setup where the teacher aims at modifying the behaviour of an individual or group.

(iii) Teaching is both formal and informal. Both the ways, it help in achieving desired goals.

(iv) The process of teaching is carried out to achieve some specific aims and objectives.

(v) Teaching is a cooperative activity and a teacher should involve students in different classroom activities such as organization, management, discussion, recitation and evaluation.

(vi) Teaching is dominated by the process of communication. Good communication skills make teaching interesting and lively.

(vii) Teaching is not only about motivating students to learn, but also enabling them to learn in a manner that is relevant, meaningful and memorable.

(viii) The main aim of teaching is to provide guidance to learners, according to their capabilities.

(ix) The purpose of good teaching is to develop independence of thought, self-reliance and confidence among students.

(x) Teaching is a tri-polar process and its three poles are: teaching objectives, learning experiences and behaviour modifications.

(xi) Effective teaching provides feedback for both students and teachers.

(xii) Teaching is remedial and the teacher must solve the problems of students.

(xiii) Teaching is an observable, measurable and modifiable process. A teacher's behaviour can be observed and measured with the help of various supervisory techniques and their analysis.

(xiv) Teaching is a well-planned activity and teachers plan the objectives, methods of teaching and evaluation techniques in advance.

(xv) Teaching is a democratic process as it provides the learner with an opportunity to present his view.

Variables of teaching

Various types of variables are involved in the process of teaching. The teaching process takes place as a result of the activity of these variables as shown in Figure 4.4.

There are mainly three variables in the process of teaching. These are discussed below:

(i) Independent variables: In any process, the variable which is manipulated or the variable whose impact is observed on another variable is called 'independent variable'. In the teaching process, the teacher plays the role of an independent variable. He plans and organizes all activities of the classroom, and thus controls the process of teaching. The teacher is free to perform his teaching activities in order to bring about desirable outcomes from the learners. Hence, the teacher is more independent as compared to students. He has to diagnose the potential of the students and formulate educational objectives, accordingly. Thus, a teacher is a very important variable in the attainment of the goals of education.

(ii) **Dependent variables:** hi any process, the variable on which the effect of an independent variable is studied is called a 'dependent variable'. In the teaching-learning process, learners or students are dependent variables as they depend upon the teacher. It is the student who is subjected to changes and development through the effort of the teacher. The student has to act according to the planning and organization of the teacher. Hence, the student is included in the category of dependent variables.

(iii) Intervening variables: A variable which falls in between independent and dependent variables and may influence dependent variables is called an 'intervening variable'. Intervening variables are also very important in the process of teaching as they help in smooth functioning of independent and dependent variables, for the realization of teaching objectives. In the process of teaching—learning, contents, methods of teaching, teaching environment, management of instructional material, learner's background, student's interest,. attitude, and aptitude are some of the intervening variables. These variables are responsible for bringing about desirable interaction between the teacher and the students by producing proper teaching environment, teaching material and facilities, and creating appropriate learning conditions or situations.

Functions of variables

N.R. Swarup Saxena and S.C. Oberoi, in their book, *Technology of Teaching*, have given following functions of variables of teaching:

(i) Diagnostic function

The diagnostic function is the first aspect of teaching. In this aspect, the teacher decides about the pupils' entering behaviour and teaching objectives. Hence, the teacher considers only two things under the diagnostic function: (a) the pupil and (b) the content. The teacher, first of all, determines previous knowledge or basic behaviour

of the pupil. He then arranges the elements of the content to be taught in a sequence, by analysing them logically. In this way, the diagnostic function is the foundation of the remedial aspect of teaching. This function is performed in accordance with the pre-active phase. In this function, the teacher takes decisions after considering the following variables:

(a) Analysis of teaching problem: The first variable of diagnostic aspect is analysis of the teaching problem. Hence, the teacher should decide about the basic behaviour of pupils, related to the content, with far-sightedness and depth. It is also to be decided whether that content is according to their capacity or not. In other words, the teacher should take the decision concerning pupils and content so that the desired objectives maybe attained. This decision proves fruitful for the remedial aspect or the interactive phase of teaching.

(b) Determining the entering behaviour of students: The second variable of the diagnostic aspect is to clearly determine the basic behaviour of students. After this, the teacher should present the new knowledge to the pupils. Its advantage is that after presenting the new knowledge, the information of changes in the behaviour of pupils will be easy to acquire. Hence, for determining the basic behaviour of pupils, the teacher should prepare and use evaluative questions, keeping in view the contents, which should be reliable and valid.

(c) Individual differences: The third variable of the diagnostic aspect is the consideration of individual differences of pupils. The principle of individual differences means that every pupil has different interests, attitudes, capacities, abilities and needs. Hence, keeping in view the capability differences of pupils, the teacher should perform the task of teaching.

'(d) Task analysis: Task analysis is the fourth variable of the diagnostic aspect. The teacher should analyse learning activities related to the content. The success or failure of a lesson also depends on the task analysis.

(e) Analysis of content on the basics of types of learning: The last variable of the diagnostic aspect is analysis of the content, with regard to the type of learning. For this, the teacher should know the nature of learning. The should also know the tactics and principles to be used in various situations so that teaching becomes easy, clear, effective, understandable and scientific.

(ii) Remedial phase

In the remedial phase, an effort is made to bring desired changes in the behaviour of pupils. Hence, the teacher should make decisions regarding the use of teaching methods, strategies, tactics and mutual relationships between various variables, keeping in view individual differences of pupils. Assistance must be sought from action research in order to solve various problems which arise during the teaching. In this way, the teacher should manage the teaching variables in such a way that maximum teaching objectives are attained by deciding teaching techniques and tactics. This aspect has the following two sections:

(a) Selection of teaching strategies and tactics: The first section-of teaching strategies and tactics is their selection. It should be remembered that the success of teaching and learning depends upon appropriate selection and use of teaching

strategies and tactics. Hence, the teacher should perform this important function in accordance with his ability and experience.

(b) Arrangement of feedback devices: The second important section of the remedial phase is the arrangement of feedback devices. Here, it is essential to state that feedback is the soul of successful teaching. Its reason is that feedback provides reinforcement to the pupil, who in turn, provides motivation and encouragement for learning. Hence, at the time of teaching, the teacher should provide necessary feedback for motivating and encouraging the pupils.

(iii) Evaluative phase

Evaluation is the third important variable of teaching. In this phase, the diagnostic aspect is evaluated. It should be remembered that the criterion of this evaluation is achievement of objectives. If the objectives are achieved, the remedy by the teacher is correct, otherwise it is defective. In other words, if the teaching objectives are not achieved, the teacher should not blame the pupil for his failure. He should change the variables of the diagnostic aspect so that the objectives maybe achieved. Concerning this, it should be remembered that this aspect is in accordance with the post-active phase. This aspect has the following important parts:

(a) Construction of criterion test: The first part of the evaluation aspect is construction of the criterion test, which provides clear information regarding the changes brought in the behaviour of pupils by remedial teaching. The main characteristic of the criterion test is its objectivity. In other words, this test is reliable and valid. Hence, the teacher should construct the criterion test with great care.

(b) Evaluation of behavioural changes: The second part of the evaluation aspect is the evaluation of pupils' behavioural changes. The teacher should perform this function on the basis of criterion test.

(c) Diagnosis: The last part of the evaluation aspect is diagnosis. Diagnosis means to know the extent of success teaching by evaluation. If it is not successful, then decide upon the type of modification that should be brought about. If the teaching objectives have not been achieved as a result of their use; then planning, organization, leading and controlling of the teaching process should be repeated.

Phases of teaching

Teaching is a complex task and systematic planning is required to make this task successful and easy. This planning has to be done in a sequence of steps. These different steps are called phases of teaching. Different phases of teaching have different types of activities. There are three main phases of the process of teaching. These are as follows:

(i) Pre-active phase

This phase is also called the planning phase of teaching. As the name suggests, this phase is mainly concerned with the preparation for teaching. It involves all those activities mat a teacher does before actually entering the classroom. The following activities can be included in this phase:

(a) **Fixing of goals:** For any type of teaching, first of all, the teacher decides goals, aims and objectives. After fixing the goals, the teacher decides on specific instructional objectives in the form of clearly defined behavioural terms. He also decides the level of sophistication or abstraction concerning the goals. While deciding on the objectives, the teacher also keeps in mind the characteristics and needs of the society.

(b) Deciding the subject: After deciding the objectives, the teacher has to decide on the subject for students. While deciding the subject matter, he teacher needs
' to consider the curriculum, behaviour of learners, their needs and motivation.

(c) Sequencing the elements of content for presentation: After deciding on the subject matter, the teacher has to arrange elements of the subject matter from logical and psychological viewpoint, so that this sequencing of the subject matter may prove helpful in the transfer of knowledge.

(d) Decision-making about teaching strategies: After arranging the subject matter, the teacher has to decide the methods and techniques to be employed. The content may be imparted through lectures, group discussions or self-instructional material. The teacher will select teaching strategies, keeping in mind the subject matter and the mental level of the pupils.

(e) Deployment of teaching strategies: Now the teacher has to decide as to what strategies will be used, and how and when they will be used in the classroom. The teacher shall also decide when and how questions should be asked.

(ii) Interactive phase

This is the second phase of teaching where the actual teaching-learning takes place. Whatever has been planned or decided at the planning stage is implemented at this stage. Here, the teacher and students are actually participating in the teaching-learning process. This phase includes all activities, behaviours or things done between the time the teacher enters the classroom and the time when lesson or subject content has been delivered by him. The interactive phase involves following activities:

(a) Perception: Appropriate perception on the part of the teacher as well as the students is a very essential element in the process of teaching. When the teacher enters the class, first she he tries to perceive the classroom's climate. Such perception helps in knowing about the pupils who can prove helpful and those who can create problems for him. The teacher tries to weigh herself himself and his/her abilities with respect to the class group. In the same way, students also perceive the personality, behaviour and capability of the teacher in order to seek desirable interaction in the classroom.

(b) Diagnosis of the learners: It is essential for the teacher to diagnose his/her abilities and behaviour and that of the students she "he is going to teach. The diagnosis may be done by asking questions. The students also through verbal or non-verbal interaction get the opportunity to assess and diagnose the abilities, aptitude, interest and performance of their own responses. Thus, everyone in the classroom situation tries to see within her/his own self.

(c) Reaction or achievement: This is the period of actual interaction between the teacher and the students. This step involves the following activities:

- **Selection of stimuli:** The stimuli in the action or activity of teaching can be verbal as well as non-verbal.
- **Presentation of stimuli:** After selecting the proper stimuli, the teacher should now present that stimulus before the pupils.
- **Feedback and reinforcement:** Feedback and reinforcement are two of the most pivotal concepts in learning. Feedback involves providing learners with information about their responses, whereas reinforcement affects the tendency to make a specific response again.
- **Deployment of teaching strategies:** The strategies of reinforcing the students, of controlling their verbal and non-verbal behaviour, and of imparting subject matter systematically and effectively to the learner continues for most of the time while a teacher is teaching.

(iii) Post-active phase

The post-active phase of teaching is the simplest of all phases. It is nothing but the evaluation of operations involved in teaching. This phase comprises attempts made by teachers for determining the effectiveness of their teaching, and effectiveness of lessons taught by them. Practically, the data that is collected and examined is a combination of observation of classroom activities and outcome of students' written work. This phase involves the following operations:

(a) ***Defining the exact dimensions of teaching:*** The teacher compares the expected and the actual behavioural changes in course of her/his teaching, at the end of her/his session. The extent or quality of accomplishment of stipulated objectives helps the teacher to understand the effectiveness of teaching. It also helps in taking decisions about future improvement. Methods and strategies used by a teacher are said to be effective only if the teaching objectives have been achieved.

(b) ***Selecting appropriate testing devices and techniques:*** The teacher chooses appropriate testing techniques and evaluation tools to measure the various dimensions of behaviour. Thus, he notices the changes brought about by her/ his teaching. The tests may be of many types, e.g., paper-pencil test, standardized tests, objective type tests, and teacher-made tests, etc. It helps the teacher to teach things better in the future and also the students to learn things better.

(c) ***Changing strategies in terms of evidences gathered:*** On the basis of assessment, a teacher comes to know about his performance. If the objectives have not been achieved, the teacher may find out the factors responsible for failure and also find the remedial techniques to be applied so that the objectives can be achieved.

Teaching machine

The pressure of the increasing population is affecting schools and teachers such that there is a higher demand of quality education and individual attention. To deal with the situation, various educationists are busy in finding the best solution for solving the problem of teaching. One of these solutions is a teaching machine, also called *programmed teaching. Teaching machine* is a mechanical or electronic device for self-teaching. Teaching machine is a device which is automatic in nature and is controlled by the user. It helps in presenting the information to the leaner and is also able to get her/his response. Teaching machine acts like teacher, as the name suggested,

and, hence, after response from the learner it provides feedback about the correctness of the learner's response. The teaching machine presents the learner with a sequence of questions, problems, or instructions. The learner responds to each item, typically by pressing one of the several buttons provided to her/him. Teaching machines have been used in school systems and job-training programmes.

In classrooms, it is very difficult for a teacher to deal with individual differences as there are both slow and fast learners. Fast learners find the teacher slow, if she/he is teaching according to the speed of slow learners. Similarly, slow learners find the teacher too fast, if she/he is teaching according to the speed of fast learners. Teaching machine can solve the problem of individual differences as each student can learn according to his own rate. These machines are unique instructional aids because students remain active as they have to read, watch and respond, according to the content being taught. A teaching machine presents information in a carefully planned manner; generally in small steps that can be mastered easily. Mistakes are revealed immediately giving time for improvement. Subject matter presented in this way is called a programme, or programmed material.

We can, thus, define teaching machines as follows: 'Amechanical, electrical or other automatic device designed to teach students by presenting information in a planned sequence, questions based on the given information and providing an immediate response to his or her answer.'

American psychologist Ludy T. Benjamin defined teaching machine as follows: 'A teaching machine is an automatic or self-controlling device that (a) presents a unit of information, (b) provides some means for the learner to respond to information, and (c) provides feedback about the correctness of the learner's response.' This definition clears the concept of teaching machines. To understand more about teaching machines we have to go through its origin and evolution.

History of development of teaching machine

Experimentation in mechanized teaching began in the 19th century. Several kinds of devices were in use at the time of World War II. In the mid-1950s, psychologist B.F. Skinner devised programmed materials that led to the development of several kinds of teaching machines. By early 1980s, most of these machines had been replaced by computers. The use of computers for self-teaching is known as Computer-Assisted Instruction, or CAI.

However, the development of teaching machine began with the educational devices of the 19th century, through initial teaching machines of Sidney L. Pressey in the 1920s to the machine invented by B.F. Skinner in 1950s. However, pioneer work is considered to be done by Pressey and, thus, he is known as father of teaching machines. Pressey's machine was strongly influenced by Thorndike and his laws. In 1924, Pressey made a basic teaching machine appropriate for rote-and-drill learning. In 1926, he published the first paper by using a teaching machine, for use in schools and society. Pressey showed learning was facilitated by automated-instruction by providing immediate reinforcement, individual adjustment of pace and active responses. He had done impressive work in the world of education by providing information in a sequence and by immediate feedback, with active participation of

learner. However, at that time the world of education was not ready for this change as the study of human learning was dominated by teacher-oriented and theory-based learning.

As time passed, the use of such machines was emphasized by many educationists as well as psychologists. In 1950s, B.F. Skinner, a famous psychologist and a professor at Harvard University, invented the actual teaching machine. He came up with a boxlike mechanical device that fed questions to students, rewarding correct answers with fresh academic material. Wrong answers simply repeated the old question. Skinner said, 'the student quickly learns to be right'. A number of teaching machines were developed after the work of Pressey and Skinner, which had tremendous effect on the process of learning. By the mid 1960s, it was possible to identify different types of teaching machines like the linear machine, which had content in a particular sequence. Another type of teaching machine was the adaptive machine in which each learner develops mastery of the content, depending upon its capability.

Thus, we can say that origin of teaching machine had a psychological basis. A number of teaching machines are in use nowadays. These are used by the teachers to assess the student's knowledge. They are very helpful for the teacher to increase the knowledge of individual differences and also to apprise them about the strong and weak points of their students. Teaching machines are specially used for small children as they are very successful in drilling practices.

Characteristics of teaching machine

The characteristics of teaching machine are as follows:

(i) A teaching machine not only presents information to the students but also elicit information from them.

(ii) It keeps record of student's response. This estimates how much they have learnt.

(iii) Teaching machine informs the people about their progress by showing correct and incorrect responses. This restricts cheating.

(iv) Teaching machine helps in solving the problems of teaching.

(v) Teaching machine controls the behaviour of students.

Constituent of teaching machines

Teaching machines are used to teach students in such a way that they are induced to engage in new forms of behaviour. It is not only a matter of teaching them what to do but also how to do it. There are different types of teaching machines, but following are the main components that are present in every type of teaching machine:

(i) **Content:** It forms the most important part of a teaching machine. Content is the information stored in a teaching machine, which is to be transferred to the learner in a particular manner. Content is organized on the principles of psychology. All necessary information regarding related subject or topics is included and divided into frames, which are arranged in a particular sequence.

(ii) **Medium of transformation:** The content prepared for a teaching machine is present in thetform of programmed text, radio/TV programme or in the form of computer sofware. To transmit this information to students, a proper channel is required. This is known as the 'medium of transformation'. This medium

could be printed words, audiovisual programme, computers or other likely devices. These mediums allow the students to learn at their own pace, as they proceed from frame to frame. They can take as much time as required, according to their learning/responding ability. Thus, mastery of content can be achieved by each and every student.

(iii) **Responding:** In each frame, there are some given questions in multiple choice format or others, depending on the type of teaching machine. Thus, after going through the content, students have to answer those questions and then only they are able to move to the next frame. Thus, response from a student tells us about what she/he has learnt with the help of a teaching machine.

(iv) **Feedback:** After response from students, correct feedback is given to them so that they are able to know what they have actually learnt. If the response is correct, they are moved to the next frame, but if the response is incorrect they are given the necessary information and made to read the content, after which they can move ahead. It is very important for students to know about their progress as it is considered a very important component of the teaching machine.

Types of teaching machines

Teaching machines can be of various types, but all of them work on the same principle. Some teaching machines are extremely simple and easy to prepare and handle, while some are complex and not easy to prepare. So we may broadly categorize them into the following types:

(i) **Simple teaching machines:** In simple teaching machines, a test sheet or a book has content and questions, along with answers. For example, after the necessary information, questions are given in the form of fill in the blanks and answers are given on some other page.

(ii) **Complex teaching machines:** In complex teaching machine, help of electronic devices like computers are taken. Here, frames are arranged in sequence and questions are of multiple choice types. The next question appears only when the user answers the previous one correctly. Otherwise, he is prompted to answer the same question again till he does it correctly.

Advantages of teaching machines

There are many advantages of using teaching machines. Some of them are as follows:

(i) **Individual differences:** Teaching machines allow individual learners to proceed at their own pace and also give them the opportunity to review their work.

(ii) **Immediate feedback:** They provide immediate feedback to learners.

(iii) **Self instruction:** If teacher is not present, teaching machines can serve the purpose and help students to continue with the learning process.

(iv) **Command on the subject:** They give the learner more control on the subject, as he/she can learn a lot from correct or incorrect answers.

(v) **Interactive:** Teaching machines normally interact directly and individually with each student and they never lose patience with students, even after a number of mistakes made by them.

(vi) Active participation: Teaching machines involve a lot of participation from learners, as a result of which they remain active, unlike traditional teaching.

(vii) **Not time bound:** Teaching machines can be used any time because they never get tired.

(viii) **Diagnosis of problem:** While using teaching machines, a learner get the correct answer immediately after responding to the question, so errors can be easily diagnosed.

(ix) **Motivation:** Immediate feedback helps students to know whether they are right or wrong, and if right they are motivated to continue successfully.

(x) **No cheating:** Copying and cheating is discouraged in this programme. Since students perform on their own, answers are not shown to them directly.

(xi) **For drilling:** It is very useful for the subjects where drills is required. Teaching machines are very useful for younger students who learn mostly through drills.

(xii) **Helpful for teachers:** Teaching machines saves the teacher from a lot of drudgery resulted from drilling and routine teaching. This helps them to utilize their energy and time saved by the machine for better and more creative type of activities and teaching.

Disadvantages of teaching machines

(i) Time consuming: It is very time consuming to prepare a teaching machine.

(iii) **Costly:** Teaching machines are very expensive. Hence, developing countries like India cannot afford to use mem in their educational and training institutions, at reasonable scales.

(iii) **Difficult:** It is difficult to develop programmes for the machine.

(iv) **Not self-sufficient:** There are many things which students can learn only with the help of a teacher, so only teaching machines are not sufficient for learners.

(v) **Maintenance:** Maintenance of these machines is both difficult and costly.

(vi) **Boring:** If a lot of errors occur in answering the questions, students may get bored or demotivated. Moreover, readymade structure of programme often fails to create curiosity or stimulate the thinking ability of a learner.

(vii) **Lack of flexibility:** There is loss of human touch and lively interaction in the learning process organized by means of teaching machine. This leads to lack of flexibility and interest in the system and fails to promote effective learning.

4.3.1 Differences between Teaching and Instructions

Instructions are interaction between the teacher and the pupil, but it still has the ability to divert the pupils towards objectives. It is basically involves giving instructions as to what to do and how to do. The instructions should be followed strictly to reach the desired task or accomplish a task. The main difference between teaching and instruction is that the teaching includes instruction but the instruction does not include teaching. Hence, the teaching is instruction but the instruction is not teaching. In spite of this, all the three cognitive, affective and psychomotor aspects of the pupils can be developed

by teaching, while by instructions only cognitive aspect can be developed. Hence, no instruction can replace the teaching. In short, instruction is that process which diverts the pupils towards the objectives of cognitive aspects.

Also, instruction is primarily concerned with the development of knowledge and understanding in the pupil about a thing, system or process. Imparting of knowledge and understand ing merely represents one of the several objectives which we want to achieve through teaching. Teaching is concerned with all the domains of pupil's behaviour, i.e., cognitive, conative and affective. Instruction is a part of teaching.

The distinction between teaching and instruction may be seen from another angle. The face to face interaction of the teacher and taught found in teaching is not so much essential in the process of instruction. In instruct ion, a teacher may be rep laced by the programmed material, computer teaching machine, radio and television etc. A teacher cannot be replaced by these aids. Of course, in teaching a teacher makes use of them. Thus instruction is one of the several modes of teaching. In education, teaching and instructions go hand-in-hand.

4.3.2 Conditioning and Training

Who, Whom, Why, Where, What, How and When of Teaching

A review of the definitions given above reveals that to play the role competently in teaching, a teacher is expected to understand the significance of the following:

1. Who is to teach. The teacher is to teach and herself/he must understand himself throughly — his/her strengths and weaknesses and strive to present a reasonably good model before the students.
2. Whom to teach. The child is tube taught. Therefore, a teacher should understand him thoroughly-his abilities, aptitudes, attitudes, manners and temperaments and accordingly cater to the individual differences of students.
3. Why to teach. The teacher should always keep in view that the aim of education is to develop harmonious personalities, who are culturally retined, emotionally stable, ethically sound, mentally alert, morally upright, physically strong, socially efficient and spiritually enlightened. The teacher should not forget even for a moment that the traditional 3 R's have been replaced by 7 R's, that is, reading, writing, arithmetic (representing various disciplines), rights, responsibilities, relationships and recreation.
4. Where to teach. The teacher ought not to visualise the school to be merely a place of imparting information but a place where women and men of tomorrow are trained to take their place as enlightened citizens in the society and contribute-to national development.
5. What to teach. The teacher must have mastery over the subject she teaches.
6. How to teach. The teacher must'use new teaching-learning technology to make her teaching effective and inspirational.
7. When to teach. Appropriate steps need to be taken by the teacher to develop motivation of the student in the entire work.

4.4 SUMMARY

In this unit, you have learnt that:

- Communication is a complex and ongoing process involving exchange of verbal and non-verbal messages.
- Newman and Summer defined communication as an exchange of facts, ideas, opinions or emotions between two or more persons.
- Communication has some basic characteristics, such as, purposeful, universal, interactive, imperfect, dependent, complex, and contextual.
- Communication skills can be used virtually in every field. Effective communication is important because it allows people to lead more satisfying lives.
- The process of communication consists of a message being sent and received. The effectiveness of communication can be estimated by the similarity between the message sent and the one received.
- The process of communication begins with finalization of the message to be conveyed.
- Once the appropriate channel is selected, the decoding stage of the message begins.
- On the basis of the feedback, the sender analyses how effective the message is. If there is no feedback, the sender would not be able to make sure that the message has been interpreted by the receiver.
- Competency is required at both the sender's and receiver's end in terms of communicating and receiving the desired information.
- Barriers to communication have made the process complex, difficult and frustrating.
- Barriers to communications range from simple distracting noises to complex psychological factors.
- People interpret message on the basis of their attitudes and values. If a message is adverse for the receiver, it will not be able to persuade him easily.
- Communication can take place between two or more individuals.
- The type of communication which is broad and involves ways to communicate with masses is called mass communication.
- Every type of communication is unique and it makes everyone special and unique.
- Teaching is more complex, wide and comprehensive in comparison to all these four terms. It should not be confused with conditioning, training, instruction and indoctrination.
- In any process, the variable which is manipulated or the variable whose impact is observed on another variable is called 'independent variable'. In the process of teaching, the teacher plays the role of an independent variable.

4.5 KEY TERMS

- Message: It is a key idea, thought, opinion, feeling, knowledge or information, which sender wants to communicate.
- **Sender:** A sender is a person who initiates communication by making use of language or symbols to convey the message.
- **Encoding:** In order to convey what the information means to the receiver, the sender uses the process of encoding.
- **Decoding: It** is the process a receiver interprets the information that comes from the sender.

4.6 ANSWERS TO 'CHECK YOUR PROGRESS'

1. According to Merrihus, 'Communication is a process of mutual exchange of thoughts, ideas, facts and emotions.'
2. Encoding is a process of translating an information into a format which can be understood by the receiver.
3. According to the principle of mastry of language verbal communication through use of language is the most effective ways of communication. A sender or source of communication should use the language which is easy for the receiver to understand. In a classroom, the teacher should be fluent in the language which the students understand; only then it will be possible to convey the message to students.
4. Some major barriers of communication are lack of common language, semantic barrier, poor listening, poor vocabulary, noise, time, distance, emotional barriers and attitude and values.
5. Upward communication happens when the message is initiated by subordinates and is received by superiors.
6. Verbal and non-verbal communication between students and teacher in the class is called classroom communications.
7. Of the many assumptions of teaching, it is expected to:
   (i) facilitate student learning (ii) the act of teaching is a complex process that is influenced by a field of forces, of which teachers can be aware only in part and which they can only partially control.
8. The variables of teaching are (i) independent variables (ii) dependent variables (iii) intervening variables
9. The first aspect of teaching is diagnostic function wherein the teacher decides about the pupils' entering behaviour and teaching objectives. The teacher considers
   . only two things under the diagnostic function: (a) the pupil and (b) the content.
10. Teaching machine is a device which is automatic in nature and is controlled by the user. It helps in presenting the information to the leaner and is also able to get his response. Teaching machine acts like teacher, as the name suggested, and hence after response from the learner it provides feedback about the correctness of the learner's response.

4.7 QUESTIONS AND EXERCISES

Short-Answer Questions

1. What do you understand by the concept of communication? What are its characteristics?
2. Briefly discuss the functions of variables in teaching?
3. What are the differences between instruction and teaching?
4. How can barriers in communication affect the teaching-learning process?
5. Discuss the modalities of teaching. Also explain the functions of varibles.

Long-Answer Questions

1. Explain the cycle of communication.
2. Discuss the phases of teaching.
3. Why is good classroom communication important. Give your views.
4. Discuss the effectiveness of teaching machine.

4.8 FURTHER READING

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