The promise of excellence in education rests on the willingness of the nation to support a comprehensive programme of educational research and development to improve schools.

- Lindley J. Stiles
1.0.0 INTRODUCTION

In ancient times, when people started writing on a stone or wood, communication became portable to a limited area only. As civilisation advanced various other means of communication were also invented. The printing press, the most remarkable invention in this regard brought about a revolution in communicating to larger groups. The printed words communicated to all those who could read what had been written in the printed material on stones, wood or paper. The technological innovations added to the efficiency of the printing technology. Today, we have the most sophisticated communication technologies both print and non-print. The various means of communications used are printed texts, radio, television, video cassette, recorders, video text, computers etc.

Information Technology is affecting us as teachers, as individuals and as a society. Due to the developments in Information Technology, every field is being affected, such as education, entertainment, day to day activities, government, society etc. Today, when watching T.V. or reading a newspaper or magazine, it is impossible to miss various coverage related to Information Technology- internet, world-wide web, digital T.V., online learning, wireless communication, tele-medicine and so on. All these innovations and changes look disconnected, but still they share a common denominator, computer and Information Technology. Information revolution has taken place due to Information Technology.

(A) COMMUNICATION TECHNOLOGY

Communication plays an effective and essential role in teaching learning process. In many ways, teaching is communicating and in this sense good teachers are always good Communicators. It is also equally true for the learners. He who learns well is the one who participates well in the Communication process. Good learners are always good receives and good responders. In this way Communication must always be treated as a two way
process, in which both the source of teaching (teacher) and the beneficiary of teaching (learner) interact well for the proper realization of the teaching-learning objectives. However for this, proper interaction teacher as well as students are required to acquire the art and technique of good communication.

1.1.1 COMMUNICATION TECHNOLOGY- THE CONCEPT, ORIGIN & GROWTH

It is the transfer of information from one person or device to another is called communication, whereas Communication Technology is the act of transmission or sharing of ideas, facts and data for the individual or for collective activity by some means, media, channel in the field of education through which communication takes place is called communication technology in Education.

The word communication came from the latin word "Communicare" meaning "to share". The act of teaching and learning is also an act of sharing the content, the skills and the attitudes. Communication is a fundamental human and social process. It makes the existence of societies possible, and by its nature, distinguishes between the human and other species (Schrämm. 1973). The functioning of any society thus depends upon the quality of communication among its members (Melody, 1986). In other words, the prosperity of a society is judged by the extent its members can afford and use various modes of communication - the printed texts, radio, television, video cassette recorders, videotext, computers, etc. This is the reason why now-a-day more emphasis is being given to manufacture, storage, processing, editing, interpretation and transmission of information to one and all. With the advancement in and access to a variety of communication technologies we are moving towards an information-based society.

We should know a bit about the history of the growth of communication technologies for centuries, people developed their own ways and symbols to expand their ability to communicate as effectively and efficiently as possible under their respective circumstances. Use of signals, gestures, facial expressions, etc., were the primitive ways of communication in primitive societies. It took centuries for the first mass medium the print, to be developed and used for communication purposes.
The communication can be classified in two major dimension i.e. print & non print medium.

Print Medium:

The growth of modern communication technology begins with the invention of the printing technology - in certainly a revolution - communication. Gradually, it led to more specialised print materials - religious and political books which worked as instruments in the transformation of human beings.

Even in the age of the computers and satellite communication, the most powerful and pervasive educational technology is the printed text material (Altbach, 1987). There is little evidence so far, even in developed countries to show that the influence of printed materials as tools of education, has declined. The printed text remains a basic tool for education throughout the world. The educators still depend on the printed texts for teaching and learning.

In ancient times people used papyrus, bark, leaves, etc., for writing on. The Chinese wrote on flat pieces of bamboo or on silk fabric until an emperor, around 100 A.D., ordered his courtiers to discover a more convenient writing medium. As a result, the paper technology was developed by the Chinese. The use of the written words to serve educational purposes actually started in 105 A.D., when the Chinese made paper and ink.

In early times, the written words had to be copied by hand, which required very hard work on the part of the writers in order to get multiple copies of a written text. Because of this reason, reading materials were very expensive and were available to only a few. The need for more copies of reading materials, particularly in matters related to religion, gave birth to the reproduction of original works on a large scale. As a result, the printing process started. As early as 868, the teachings of Lord Buddha were printed by movable type in China in a book form. The Chinese experimented with wood, pottery, and tin for producing printing blocks that could be assembled to form a printed page of a book. By the 1400s, the printing technology swept over Europe, and printing machines were established as a craft. Thus, more mechanised printing started in the west. John Gutenberg of Germany, in the mid-1400s, played a major role in bringing about the mass printing of books. It was
Gutenberg who worked on the practical application of the idea of movable type. Thereafter a number of improvements were made in printing technology to increase its efficiency and effectiveness as well. Modern printing technology is the result of developments that have taken place over the past few centuries. And today, every day thousands of books are being printed throughout the world in different languages and for different purposes. As a result the printed text has become the main medium of storing and imparting knowledge. The print medium is used in various forms, such as, newspapers, magazines, journals, pamphlets, handbooks, dictionaries, atlases, encyclopedias, workbooks, etc.

Technology undergoes constant change and improvement. With the passage of time, publishing a book became easier and the products came to be of high quality. During the 1980s, the computers and laser technology were added to printing and distributing print media. The computers and other electronic devices have made it possible to store in a large quantity, of the printed text materials, and use them as and when required. Manuscripts are being composed in micro-computers utilising very efficient word processing software package. This provides the writers the freedom of preparing a manuscript in bits and pieces which can be quickly assembled in any desired sequence. Paragraphs can be shifted from one place to another, sentences can be rephrased, spellings can be checked and corrected automatically and so on. The text thus prepared can be stored magnetically on either the hard disc or a floppy. Now-a-days, more and more writers and printers use the computers from the very initial stages of preparing learning texts through editing, and printing. These new devices have improved the quality of the printed texts, have made the entire process faster and much less cumbersome.

The reading material came out in the form of newspapers (the first English newspaper—The London Gazette) in 1665.

Having briefly touched upon the growth of the printing technology in general let us now turn to the Indian scene. The first printing press was brought to India almost by accident on September 6, 1556 (Moses & Maslog, 1978). Interestingly, the press was being shipped to Ethiopia (known as Abyssinia at that time) for the Christian Missionaries there. The Jesuit priest who accompanied the press died during a brief stop over in Goa (India) and...
the press remained in India. Thus, printing was introduced in India by chance. 'Doctrina Christiana' was the first book printed in India. The second printing press in India was set up in 1578 at Punikael, a village in Thirunelveli district of Tamil Nadu. The press was set up by the Christian missionaries and was used to print religious books. The third printing press - and the first non-missionary press - was set up in 1674 in Bombay.

After more than two centuries of the arrival of the printing press, the first newspaper was printed in 1780 in India. The first newspaper, The Bengal Gazette, came out on January 29, 1780. Thereafter many presses were established and newspaper brought out. The first non-English language publication in India was the Dig Darshan, a Bengali monthly founded in 1818, followed by other newspapers magazines in some other Indian Languages. Printing in Hindi language came rather late. The first paper published in Hindi was Oodunt Martand in 1826.

Non Print Medium

Audio-Media :- The radio is a twentieth-century phenomenon. The massive growth of the radio took place between 1920s and 1940s. From the day of the discovery of the radio waves till today we have seen continued refinement of the radio technology and rapid growth of broadcasting facilities. In the beginning, radio technology progressed rather slowly, but accelerated during the World War II, and finally had very rapid growth in the recent decades. More and more people got opportunity to listen to the news and entertainment components through the radio. After the World Wars, election campaigns became potential inputs for sustained growth of the radio all over the world, particularly in the U.S.A. As a result, politicians in power took special interest in commissioning more radio stations for political propaganda. Besides political propaganda, the potential of radio for disseminating economic news also stimulated the planners to establish more and more radio stations throughout the world. By 1922, there were 564 licensed broadcasting stations in the USA alone (Thomas, 1987).

In the U.S.A., on an average, every person has two radio sets. In Japan there is one radio set for two persons. On the other hand, in India, there are six radio sets for one hundred persons. India is one of the countries with the lowest access to the radio medium.
Commercial information and entertainment potential/value of the radio medium contributed to its rapid growth. Even today the radio is being used mainly for entertainment followed by information/news. Some countries, such as, France and Hong Kong, make considerable use of the radio for entertainment (70 and 72 percent of total broadcast hours respectively) (UNESCO : 1980).

To reach and inform more and more persons, necessary improvements in the radio technology were made. These improvements brought down the size and the cost of the radio sets. As a consequence, the radio with the help of transistor technology has now become a mass medium in almost all the countries in the world. People in low income groups can buy sets these days and carry them in their pockets.

Use of the radio for educational purposes (used in a broader sense) came late. Due to easy access to a large number of persons, it was realised that the radio could be a potential medium of enhancing the knowledge of the people.

The television began to create meaningful competition for the radio. As a result, the radio started to make adjustments. A number of improvements were made to refine the radio technology, and the approach to broadcasting. Several technical developments such as multiplexing, stereophonic broadcasting, and the easy availability of transistors, boosted the growth of the radio (Hilliard 1985).

**Audio-Visual Media** :- The television came in on the heels of the radio. Discoveries pertaining to the television were made in the late nineteenth and the early twentieth centuries. After continued research the Bell Telephone Laboratories could send an experimental television programme by wire from New York to Washington in the USA in 1926-27. By 1930, a number of developments took place in the television technology, and there were 17 experimental television stations in operation in the USA.

The audio-visual technologies are rapidly expanding all over the world, especially in advanced countries. Beginning with the broadcast television, now we have the video cassettes, cable TV, computers, videotext, video disc, and so on, at our disposal. More and more sophisticated technologies, such as, talk-back facility, videophone system, facsimile, etc., are pushed into practice all over the world. Depending on their economic
conditions, levels of technological development and requirements various countries are in the race for acquiring as many audio-visual technologies as possible.

The technocrats, media experts and educators in India are keeping abreast of the fast changing communication technologies, and making efforts to put them to use wherever possible. We are not, however, sure as to what extent these technologies would be actually used to bring about the desired changes in social and educational systems. This observation is based on the studies conducted on the utilisation of the television and computers in the education system in India.

Telecommunication: India can be proud of being one of the few countries which have their own communication satellites. The satellite-based communication is geared to bring social, cultural and economic changes in the country. Therefore, the latest satellite technology is being used to combat the problems of health and family welfare, agriculture and forestry, also for weather forecasts, remote sensing, etc. To achieve the objective of using space technology for peaceful purposes, India has collaborative projects with advanced countries like USA, UK, France, and Russia.

1.1.2 FUNCTIONS OF COMMUNICATION:

Communication involves individual as well as collective activities of sharing ideas, facts, and information. This Communication performs various socio-psychological functions. Mac-Bride (1980) has given some functions of Communication in a social system.

(a) Information -
Communication refers to collective storage & dissemination of information for wider utilisation by people

(b) Socialisation -
Communication helps in dissemination of information to individuals which get opportunity to understand each other & appreciate others feelings, emotions, ideas and expectations in a social system.

(c) Motivation -
Communication fosters the individual and community activities, and motivates the
people to meet mutually agreed upon goals.

(d) Education -
Dissemination of information enhances the individual's intellectual development and helps one acquire the required skills & aptitude to become a productive member of the society.

(e) Entertainment -
The Communication helps in various activities like drama, dance, music, sports etc.

1.1. 3 DIFFERENT MEDIA OF COMMUNICATION

It is a well known fact that a teacher who can communicate well is bound to get success in the ongroup teaching-learning process. But his success is quite dependent upon the success of the learner's power of communication. In turn the success of the task or process of communication very much depends upon the appropriateness of the media of communication.

(a) Audio media -
In a communication process, both the communicator and receiver may rely on the audio media only. Meaning thereby that in a classroom situation teacher may communicate only through verbalization or lecturing and students may receive the communicated knowledge only through hearing. Communication through radio, tape recorder etc. also provide the examples of audio media.

(b) Visual media -
Class room communication may involve only visual media for the required transmission and receiving of the communication. A learner may receive information or message by reading out a written or printed statement or through the visual interpretation of graphic material (chart, diagram, graphs etc.) A student may grasp the content material through the writing on the blackboard etc. The communication through newspapers, magazines, books, etc. also provide the communication through visual media. Learning through demonstration is also carried out through visual media.
(c) Audio visual media -
In most of the occasions, the communication in the classroom or in day-to-day situation is generally carried out through a combination of audio and visual media. When a teacher writes on the blackboard, draws a diagram, displays a model or graphic, demonstrates on the demonstration table he also makes use of his skill of narration, explanation lecturing and exposition along with his visual display. No doubt, the audio-visual media proves more effective than the use of the only audio or visual media for communication.

(d) Multi sensory media -
Our senses are said to be the gateway of knowledge. Hence each of these five senses (senses of sight, hearing, smell, taste and touch) separately or in combination may work well as an effective media for the communication process. As a result if we are able to make use of different types of media and aid material involving as many senses as possible we will certainly get better results in the teaching learning communication process.

(e) Mass media :
A certain of communication media proves useful in carrying out communication with the masses. Radio television, video, cinemas, films, printed media like books, newspapers and magazines, internet communication in the form of E-mail, conferences, satellite communication and transmission etc. all come in the provision of the means and media of mass communication. The on line education and correspondence courses run by many institutions are seen to make use of the mass media in a quite formal and organized way.

(f) Multi-media :
A communication process may be termed as based on the multimedia approach when it employs a number of media by using them in a planned and organised combination for deriving maximum output in a particular communication situation. Most of the well organised programmes of the reputed open education or distance education institution like IGNOU are run through the multimedia approach adopted for the interaction with the learners. In the advanced countries like USA, UK, Australia, Canada, this approach is used in a quite effective way for carrying out a number of on-line courses.
1.1.4 PROCESS OF COMMUNICATION

Communication as a two way process involving interaction between the two or more persons (on giving and receiving ends) is carried out in a cycle illustrated below:

There are six main components or elements in general in any process of communication namely:

a. The Source of communication or Sender of the Message
b. Contents of communication or Message
c. Media or Channel of communication
d. The Receiver of the communication
e. Response Material or Feedback
f. Facilitators or Barriers of communications

(a) The Source of Communication (The communicator):

The process of Communication essentially starts with a source of communication. There must be somebody to initiate the process of communication. This source whether in the form of some object/event or person must be in a position to transmit information. Ideas, thoughts, opinions and feelings etc. known or possessed by it with the other person or persons on the receiving end of the communication. The
source of communication person or object is generally named as 'Sender' in the language of communication technology. In the teaching-learning process given inside the classroom, the teacher is to be regarded as the source of communication or sender of the massage whereas in any other communication or communication situation any source of knowledge (man or material) can be regarded as the source of communication.

(b) Contents of Communication or Message:
What is intended to be communicated or transmitted by the source of communication, i.e., sender from his own stock of knowledge, information, thoughts, opinions and feelings etc. to the other person or persons (receivers) is known as the contents of communication. These contents may be well organised and structured or unorganised and unstructured or spontaneous depending upon the nature and purpose of communication as well as the media chosen or situation prevalent at the time of communication.

(c) Media and Channel of communication:
What one wishes to communicate to others is always communicated with the help of some or the other appropriate media or channel. The media in general takes the two distinctive forms-verbal and non-verbal. In any communication process, the sender and receiver both are forced to make use of that media or channel of communication which is mutually acceptable as well as effective.

At the onset of any communication process, when one as a source of communication or sender of the message tries to convey some information or his own ideas, thoughts and feelings, he is in fact motivated to transmit it to the receiver. For its transmission, he first tries to organise the communication material in the proper shape and then searches for an appropriate media, verbal (spoken or written words) or nonverbal (gestures, sign language, body language, morse code etc.)

For conveying or transmitting the intended information, ideas or feelings through verbal or non-verbal means, he has to make use of a special transfer mechanism known
as encoding (transfer of thoughts and feelings into widely accepted, agreeable and understandable verbal or non-verbal signs and symbols).

For example, when one tries to convey his displeasure about something, he may use the distinctive language like 'I don't like this' 'don't do this' it is highly objectionable' etc. or express it through non-verbal gestures and body movements. Further for the actual physical transmission of this verbal or non-verbal symbolic expression to the receiver, he may use a variety of channels. These channels of transmission are in fact nothing but the media or means which call for the use of our senses of sight, hearing, touch, taste and smell. According to the demands of the situation and effectiveness of communication, one may plan for the use of one or the other verbal or non-verbal symbolism and sensory channel for the transmission of his communication material.

The intended encoded message travelling through one or the other sensory channel then can move to the receiver. Since it is encoded in a symbolic language, the receiver for understanding its meaning, in the way as intended by the communicator, has to resort to its decoding. Decoding thus helps the receiver in the proper interpretation of the encoded and transmitted message sent by the source of communication through one or the other sensory channels.

The receiver after receiving the message then tries to respond. He now takes initiative for opening the channel of communication with the source of communication. For transmitting his response or providing feedback he also takes the help of encoding his response in the non-verbal or verbal symbols. This encoded response is then travelled through some or the other sensory channels reaches the source of communication. The source of communication then further decodes it for getting needed feedback for maintaining the desired flow of communication between him and the receiver.

(d) The Receiver of communication:

Receiver is the person who remains at the receiving end of the communication. He is to receive the encoded intended message of the source of communication, decode
it for its proper interpretation and must reach or produce a desired response (feedback) to the source of communication. In this way, receiver like a for end pole is equally important for the flow of the current of communication between him and the communicator or sender of the message. The communication can remain operative only if he is interested and possesses required competency to decode understand and effectively respond to the communicated message.

(e) **Response Material of Feedback**

The response material or feedback may be defined as the reaction or response signals. In the encoded form transmitted back by the receiver, to the communicated message after its proper decoding, interpretation and understanding in order to maintain the flow of communication between him and the sender. The effectiveness in the flow of communication is dependent much upon the quality and effectiveness of the contents of the response. It is through feedback that one may evaluate the outcomes of his communication, i.e. what was intended to be communicated has or not reached the receiver, has there been any gap in the communication process or has there been any difficulty or misgiving in the interpretation of the message? In this way the quality of communication as a two way process may thus be properly maintained through a proper feedback from the receiver and its subsequent follow up on the part of the sender.

(f) **Facilitators or Barriers of communication**

The quality and effectiveness of the process of communication is affected favourable or adversely through the presence of some or the other intervening variables lying between the source of communication and the receiver. These variables, according to their nature helping or obstructing the path of communication, may be termed as facilitators or barriers of communication.

Whereas the presence of congenial, physical and psychological environmental conditions and facilities available for effective communication may facilitate and help in providing desirable effectiveness to the communication system, the various
types of barriers may cause difficulties and hurdles to the sender and receiver in the matter of desired flow of communication.

1.1. 5 BARRIERS OF COMMUNICATION

The effectiveness of communication also very much depends upon the presence or absence of the things and conditions, facilitating or obstructing the proper flow of communication between the source and the receiver. In fact these things or situations effectively play the role of the intervening variables in helping or hindering the process of communication by standing between the communication (independent variable or source) and the receiver (dependent variable).

The various types of Barriers of Communication are

(a) Internal Barriers of Communication:

The roots of such barriers lie in the sender and receiver of the message. These can be named as under:

(i) Poor physical health or illness.
(ii) Poor background in terms of previous learning and general knowledge about the subject of communication.
(iii) Poor mental health and improper psychological make insecurity, anxiety, depression and dissatisfaction etc.
(iv) Handicapped in understanding the symbolic expression.

• Verbalism and graphical representation etc.

(b) External Barriers of Communication:

The roots of these barriers in the environmental conditions prevailing at the time of communication. These conditions can be named as under:

(i) Noise and other similar distracters.
(ii) Polluted environment
(iii) Invisibility
(iv) Environmental and physical discomfort.
(v) Improper functioning of the communication channels involving audio-visual materials and equipment.
(vi) The non-cooperative or unhealthy rivalries and competitions among the participants in the process of communication.

(vii) Lack of proper motivation, incentives, zeal and enthusiasm needed to remain active on the part of the sender and receivers in the process of communication.

1.1.6 TYPES OF COMMUNICATION SITUATIONS

There may occur a variety of situations or environment involving two or more individuals at one or the other time. These may be classed or grouped as below:

(a) One to One Communication: This type of communication takes place between two individuals. Most of our day-to-day conversation and communication in an informal way usually occurs in this form. As examples of this type of communication, we may cite communication between wife and husband, lover and beloved, shopkeeper and customer and between any two relatives, friends, colleagues and even two strangers.

(b) Small Group Communication: This type of communication occurs in formal as well as informal ways among the members of a small group of communication we may cite communication among (i) the members of a family, (ii) students of a section or class. (iii) passengers of a bus or railway coach etc. Instead of individuals, the communication may also take place between or among the groups like communication between two families as a neighbour or units of a locality or a sector.

(c) Large Group or Public Communication: This type of communication involves a large number of people on individual or group basis. It is usually conducted in an organised or formal way. As examples we may cite the communication carried out during morning assembly, or any cocurricular activity organised in the school's open space or assembly hall; (iii) discourse of some religious preaching at some religious gathering or places of worships; (iii) public functions organised for honouring the individuals; (iv) addresses by leaders in political gatherings etc.

(d) Organisational or Institutional Communication: This type of communication is carried out within the four walls of the various organisations or institutions like factor, or industrial establishments, government officers and secretariats, police, army, hospitals, professional and other educational institutes. The style and functioning of such type of communication is quite formal, systematic, planned and organised.
(e) **Mass Communication**: The range, field and application of this type of communication is quite wide and extensive. It is carried out through different types of mechanical means, appliances and mass media like radio, television, video, cinema, films, books and literature, newspapers and magazines, E-mail, internet communication and conference, satellite communication and transmission etc. Although, here we don't have any direct face to face natural communication between the sender or receiver yet it is the only way to reach the masses with the meaningful message full of information and education with utmost economy and effectiveness. Any organisation, institution or individual can communicate its thoughts, feelings, intentions and programmes to a huge number of individuals or groups within no time with the help of the mass media. It has resulted in the globalization of the humanity. In a single moment, we can communicate to the masses residing in any corner of the world through the sophisticated means now developed for carrying out the task of mass communication. It has resulted in the development of proper means for carrying out the task of distance education and fulfilling the duties of providing required and essential information to those who ask and need it. The masses after receiving the message, information or instruction can send their responses to the source through their writing or may show the impact of the message through their actions and behaviours.

(f) **Class room Communication (Verbal and Non-Verbal)**

(i) **Verbal Communication**: Language is the key and base of any verbal communication. Each society develops one or the other forms of languages spoken or written words for communicating with each other. Accordingly we have local language, regional language, national language and international language for the required communication among ourselves. The basic units of any language are words and sentences which are governed by the rules of the grammar. The use of language can take one of the three forms, i.e., oral, written and oral plus written. In oral form of the language one can communicate his feelings, thoughts and intentions to others by speaking and listening channel. For this purpose the sender / communicator makes use of some precise and distinct sounds which when heard by the receiver are decoded for understanding the meaning of the communicated message.
(ii) **Non-verbal Communication**: Communication process can also be carried out without the use of any verbal means (written or spoken language). In many cases, such as communication with deaf and dumb, mentally retarded, the persons not knowing the language of the sender or sending a secret message in the commonly coded, symbolic expression, it may become a necessity as well as compulsion to make use of the non-verbal media is generally used for giving strength and effectiveness to the verbal communication. Some of these important modes of non-verbal communication are discussed below:


### 1.1.7 COMMUNICATION TECHNOLOGY IN EDUCATION

Educational communication concerns with the process of how the teachers and students act and interact to enhance the knowledge of the students. In educational communication, the sources are teachers/institutions, and the messages related to the curriculum (the content, the skills and the attitudes and related activities which educate inform, train, enlighten, inspire and entertain the students). The receivers are the students and various teaching strategies, such as, demonstrations, tutorials, textbooks, assignments, audio-visual components, libraries, etc., are used as media to transact the content, etc.

With the advancement in communication technologies, it is now possible to impart education throughout the world via satellites, which have the potential to communicate even live events to the students at their work-place. Thus, education has crossed many barriers of space and time. As a consequence, the methods of teaching and learning have also changed. The technologies, such as, computers, video tapes, video discs, teletext, communication satellites and tele conferences services have stepped in to improve the nature of educational communication. These technologies have made the teaching-learning process more lively and interactive. They have enhanced the pace of learning and improved the means of retention and retrieval of information also. Interestingly, Hills (986) regards the computer as man's 'fourth brain', taking its place alongside the other
As there are various channels of communication used in education these days, the main question in selecting the appropriate channel of communication is whether it clearly and accurately communicates with the students as desired by the source (the teacher or educational institution). The teachers have a variety of audio-visual media, viz., broadcast, audio/video cassettes, computers, teletext, tele-conferences etc., which can be exploited to achieve the desired objectives at a faster pace and for larger student bodies. The important point is that information should reach the students without any distortion. There are many sources of noise, which can mar the effectiveness of teaching and learning process. The interruptions (noise) in the way of communication should be removed.

The students should receive the information that is intended by the teacher. For this, they should possess the minimum prerequisite knowledge/skills to comprehend the message, undertake notes, answer the self-assessment questions and work on the assignment questions. Thus the effect of communication depends on the prior knowledge possessed by the students. In other words, the course materials should be based on the background or prerequisite knowledge of the targets students.

Feedback plays an important role in improving the quality of the course materials and achieving the desired objectives. The teacher should get information about how his materials/units, audio/video or computers CD programmes are being received and assimilated by the students. Such information will make communication more effective and will eliminate errors in decoding and the problems caused by 'noise' in the entire teaching/learning process. On the other hand, the students should also get feedback about their performance will motivate the students to draw more from the learning material.

For the purpose of clarity, the process of communication technology in education can be represented as follows:

You will notice here that the students have a dual role. They function as the receivers as well as the sources in educational communication. The teacher plays the role of a 'manager', and uses various teaching arrangements to help the students achieve their course objectives. The students interact with the learning materials and get the aimed at
meaning out of it. Therefore, in educational communication, more importance has to be given to the students. The students are not simply the passive recipients of communication, but they actively participate in the learning process.

**Figure No. 1.2**

![Diagram of Educational Communication Process]

1.1. 8 ACHIEVING EFFECTIVENESS IN THE CLASSROOM COMMUNICATION

Effective communication is the essential requirement for having an effective interaction or getting maximum advantages from the process of communication. In this way, degree of effectiveness of a communication can be judged from the amount of advantages drawn through such a communication. Now the question arises what should be done for realising the utmost effectiveness in communication. The answer is very well linked with our attempts in improving each component as element involved in the process of communication. Let us think over to bring efficiency in the nature and working of these components.

(a) **Source of Communication**: Effectiveness of a communication very much depends upon the strengths and qualities of the source of communication.

(b) **Communication Material**: The effectiveness and success of the communication process in any classroom situation very much depends upon the quality and nature of the communication material.

(c) **Communication Media or Channel**: Communication media or channel just lie in between the source and the receiver like a bridge or connecting link. What the source
of communication says or shows to the receivers, it can be done only with the help of some or the other verbal or non-verbal communication channel.

(d) **Receiver of the Communication** : Where the initiator or source of communication is the communicator, the receiver lies on the other end for actualizing the process of communication. Actually what is done through communication is always intended for the benefit of the receiver. That is why it can only be carried out effectively with his active involvement and cooperation.

(B) **INFORMATION TECHNOLOGY**

Information Technology is the interaction of man and machine which under man's control having collection, storage processing, retrieval, use and transmission of information as accurately, meaningful and effectively as possible for the purpose of enriching the knowledge as well as problem solving ability to its user. The main objective of such a system is to provide information to its user. To accomplish this data or message which must be evaluated, analysed and processed to produce meaningful and useful information. Information Technology is widely used in education along with other fields.

Information Technology may prove useful to all the personnel connected with the field of education in the following ways:

(a) **Useful for the students.** Students may get the required opportunities and training for receiving and using information for their-self-improvement. It may help them to satisfy their urges of curiosity, inventiveness, construction etc. They get acquainted with the relevant sources of information and methods of information processing etc. The training received in proper decision making and problem solving ability makes them able to bring necessary changes in their behaviour. Most of what they acquire in terms of knowledge, understanding, skill, interests, attitudes and appreciation is received through information controlled by the Information Technology. It also helps them to get self-paced auto-instruction related to the curricular and non-curricular areas of education. The precision, speed and accuracy in receiving, transforming and using information is well, I acquired through the Information Technology, as they become acquainted and trained for handing well the sophisticated electronic appliances used for information control.
(b) Useful for the teachers. Teachers get sufficient help from Information Technology in their task of teaching. Their acquaintance with the relevant source of information in the form of books, journals and other reading-material, audio-visual material and equipment and electronics and telecommunication media make them able to acquire necessary teaching material and techniques. They may also enjoy some sigh of relief if they can make their students to make use of the source of information for their self-learning. Programmed learning material, self-learning modules, teaching machines and computers may help them much in this direction. The realisation of the teaching-learning objectives may also become quite easier to them if services of Information Technology are well employed.

(c) Useful for the counsellors. The counsellors working in schools and outside the schools in the community can be greatly benefited through Information Technology. They can have proper access to the various sources of information through Information Technology. It can enable them to provide desired educational, vocational and personal guidance as well as counselling to the students along with their parents. On the other hand, with the help of the recorded electronic devices, they may be acquainted with the educational level, interests, aptitudes, attitudes and other personality characteristics of the students along with their parents. On the other hand, with the help of the recorded electronic devices, they may be acquainted with the educational level, interests, aptitudes, attitudes and other personality characteristics of the students which can further enable them to meet the guidance and counselling needs of the students.

(d) Useful for the educational administrators and planners. Information Technology may help the educational administrators and planners in the task of exercising their professional responsibilities in an appropriate way. On the one hand, it makes them well informed regarding the development in the field of education, educational administration and planning and on the other hand, they can have proper access to the planning information data regarding the functioning of the institution, working of the teachers, achievements of their students and other personnel. With such information data in their hands, they can plan their administration in a proper way. It can also help
them in chalking out the activities and work performed in the school by the students, teacher and other personnel. For the educational planners, such data bank may prove quite useful in taking decision about the courses of study, educational aims and objectives at the various stages, the evaluation strategies, the resources to be allotted to the various schools etc.

(e) Useful to the educational researchers. The students of education desirous of objects in the field of education are greatly benefited through the processes and products of Information Technology. They need quite diversified, pinpointed and reliable information and this need can be properly fulfilled through the organised sources of information controlled through Information Technology.

In this way, Information Technology may prove quite useful in helping all the personnel connected directly or indirectly with the processes and products of education. Information is the key of knowledge and learning and its proper and scientific organisation and control is bound to lead towards the effective educational effort for the proper realization of the educational goals.

1.2.0 MULTIMEDIA APPROACH IN TEACHING LEARNING

It is said that one who communicates well teaches well. Similarly the learner who responds well to the communication of ideas, is supposed to learn well. Hence it implies that key for the effectiveness of the teaching learning process lies in the strength and quality of the process of communication. There are wide varieties of techniques and media available for the communication of ideas leading to teaching-learning viz lecturing, demonstration; using hardware and software material and equipment, Programmed learning texts and packages, T.V. and Radio lessons, Computer assisted instruction, laboratory experiences and other practical work, etc.

The experiments and researches in the field of teaching-learning has established that teaching-learning process is the best organised and facilitated through the use of multi-media instead of a single or routine type of media or techniques. For example, in case a teacher while lecturing makes use of the audio-visual aids, charts and maps, writes on the blackboard, demonstrates on the demonstration table and asks his students to
respond in a theoretical as well as practical way, is surely to communicate well instead of a teacher who is simply resorting to lecturing or demonstrating. The use of educational technology in the field of teaching and learning has given birth to a new approach named multi-media approach consisting of the use of many appropriate and carefully selected devices, techniques and media in such a combination as to yield in the most effective realization of the teaching learning objectives in a best possible way. Consequently, "The term multi-media approach to teaching-learning may be referred to the use of appropriate and carefully selected varieties of learning experiences which, when presented to the learner through selected teaching strategies, will reinforce and strengthen one another in such a way that the learner will achieve predetermined objectives in an effective way." (Packiam, 1986)

In other words, in multi-media approach, the teaching-learning process is carried out through a number of media by using them in such a planned and organised combination with reference to the available teaching-learning situations as to have their utmost utilization for achieving the desired ends in a quite effective way.

The characteristics of such an approach thus can be summarized as below.

(i) Multi-media approach calls for the use of a number of media, devices and techniques for teaching-learning.

(ii) Multi-media approach is the contribution and net result of the researches and experiments going on in the subject Educational technology for improving the process and products of the act of teaching-learning.

(iii) The variety of media are carefully selected as to prove quite effective in providing desirable learning experiences to the learner for achieving the predetermined teaching-learning objectives.

(iv) These media are not used haphazardly as only to increase the size and number of media for being named as multi-media approach. Instead of it these are so selected and planned as to yield in best possible results in a most appropriate economical combination.

(v) While selecting the different media for adopting multi-media approach, it is
cared that the presence of one must increase the effect of others in the realisation of the set teaching-learning objectives with reference to a particular teaching-learning situation.

(vi) Multi-media approach asks for the judicious and planned use of the hardware and software available in the field of educational technology.

(vii) In multi-media approach the several media and techniques can be-effectively used as appropriate vehicles for the needed communication of ideas in the process of teaching-learning.

1.2.1 THE VARIOUS TYPES OF MEDIA USED IN MULTI-MEDIA APPROACH

Multi-media approach to teaching-learning now a days may call for the use of a number of modern and traditional media, classified and listed as under.

(a) Classification of Media in terms of the methods and strategies of teaching.

(i) Methods like lecture method, discussion method, Demonstration method, Question-answer method, Analytic-synthetic method, discovery method, Inductive-deductive method, Problem solving method, project method and laboratory method etc.

(ii) Strategies like group discussion, Seminars, Symposia, Conferences, Meetings, Workshops, Brainstorming, Counselling. Team teaching, Micro-teaching, Simulated teaching. Giving practical experiences etc.

(b) Classification of Media in term of Auto-Instruction.

(i) Programmed learning instruction (ii) Computer assisted instruction, (iii) Personalized system of Instruction. (iv) Instruction through teaching machines, etc.

(c) Classification of Media as a means of Mass communication and instruction.

(i) Radio and television broadcasts

(ii) Correspondence and distance Education.

(iii) The open school and university programmes.
(d) Classification of Media in terms of the use of Audio-Visual material and equipment.

(i) Graphical material like charts, pictures, snaps, flash cards, posters, diagrams, graphs and printed material etc.

(ii) Three dimensional aids like models, specimen, puppets, living and non-living real objects etc.

(iii) Projective aid material and equipment like slides, filmstrip, films, projectors, motion pictures, audio and video tapes and cassettes etc.

(iv) Radio and television lesson and educational programme, gramophone and recorded sounds, closed circuit television, satellite communicated educational programmes etc.

(e) Classification of media in terms of gaining living experience.

(i) Field trips and excursions, (ii) Dramatization, (iii) Demonstration (iv) Role-playing, (v) Visits to Museum (vi) Library reading and, (vii) practical experiences at laboratory and real life settings.

(f) Classification of Media in term of reading/Teaching Material.

(i) Text books and supplementary reading book

(ii) Work books (iii) Teacher's Guides (iv) Idea or action books,

(vi) News paper journals and magazines (vi) Laboratory and practical work Manual (vii) Self-assessment Guides etc.

1.2.2 DIFFERENT INSTRUCTIONAL SYSTEMS OF TEACHING INFORMATION TECHNOLOGY

There are so many instructional systems available for Teaching Information Technology to Secondary School Students but investigator selected only three which are as below:

1.2.3 CONVENTIONAL INSTRUCTIONAL SYSTEM (C.I.S.)

Conventional instruction system of teaching in which teacher is the centre of classroom activities of teaching- learning process. According to Good's dictionary, conventional teaching is that type of teaching, which is out growth of custom or common practice. It is the teacher, who presents the entire content to be learnt in the final form.
In this approach, the student is not required to make any independent discoveries. The usual verbal instruction of the lecture hall exemplifies conventional teaching. The terms connected with conventional approach are expository, traditional and lecture method. All these terms convey almost the same meaning.

1.2.4 AUDIO-VIDEO INSTRUCTIONAL SYSTEM (A.V.I.S.)

The Audio-Video Instructional System is a strategy which call upon the auditory and visual senses of the learned. The Audio-Video Instructional System have the wise use of our senses of hearing and sight proving magnificently helpful in making the learning more meaningful, more interesting and more effective. It is the strategy which help the teacher in effective realisation of his teaching objectives by calling upon the auditory & visual senses of his students.

Audio-Video Instructional System is an effective medium of communication for imparting educational instructions. It is very useful for educating the masses in developing countries like India where a large number of people are still illiterate. Through Audio-Video Instructional System, a standard quality of information and knowledge, in the form of educational programme, can be communicated to the people. These programmes can be recorded on Video cassettes with the communication of subject expert. Audio-Video Instructional System aims for the creation of such teaching-learning environment that may prove helpful in making students learning an independent or in groups.

1.2.5 MULTIMEDIA INSTRUCTIONAL SYSTEM (M.I.S.)

Multimedia Instructional System is the strategy which belongs to systems that integrate video, audio, text, graphics, animation. Multimedia Strategy call for the use of number of media, devices and techniques for teaching - learning for effective realisations of teaching objectives in a best possible way, for example - Computer Assisted Technology is the best technique of multimedia approach.

Multimedia instructional system ultimately aims for the creation of such teaching learning environment that may prove helpful in making students learning an independent and individualised activity. Accordingly, there is need of a significant change in the
attitude & role of the teacher. His task in the multimedia approach is not limited to the imparting of knowledge and disseminating information to the students. Consequently, there will be a shift of his role from direct communication of information to guiding students learning. He has to make his students active participants in the process of learning instead of remaining passive. The learning experiences are to be designated by him by adopting multimedia approach in such a way that the students may be able to proceed on the path of learning quite independently. Slowly & slowly they are to be lead on the path of auto-instruction and self-learning. The role of the teacher thus needs a major shift in the shape of guide, advisor and organiser in place of a more communicator, demonstrator or tutor etc.

1.2. 6 CONTENTS OF INFORMATION TECHNOLOGY SELECTED FOR STUDY

Contents of Information Technology Selected for Secondary School Students according to the syllabus mentioned in their curriculum has been divided into three units as mentioned below.

Unit-I (Information Technology-Basics)

(a) Communication Technology
1. What is Communication ?
2. What is Communication Technology ?
3. What are the various media of Communication Technology ?

(b) Information Technology
1. What is Information ?
2. What are Features of the Information ?
3. What are Different Media of Information Technology ?

(c) Computer
1. What is Computer ?
2. What is Input, Output & Data Storage Devices in computer ?
3. What is hardware & software ?
4. What is memory & various type of memories in computer ?
Unit-II (Information Technology- Uses & Applications)

(a) Uses & Applications of Computer
1. What are uses of Computer ?
2. Programming Instructions given to Computer ?

(b) Window Programme
1. What is Window Programme in Computer ?
2. What are Various Functions of Window Programme in computer ?

(c) Paint Programme
1. What is paint Programme in Computer ?
2. What are the functions of various tools in paint programme ?

Unit - III (Information Technology-MS Word)

(a) MS Word Programme
1. What is MS Word Programme in Computer ?
2. How to Start MS Word in Computer ?

(b) How to work in MS Word Programme in Computer ?
1. How to open, close the file in MS Word ?
2. How to save & Print a file in MS Word ?

(c) Other Applications in MS Word ?
1. How to Insert Text, Delete Text, Select Text, Manipulate Text ?
2. How to Check Spelling in the Document, using thesaurus ?
3. How to find Word or Text in document, find & replace word or text, alignment of text, Creating Tables, Undo & Redo the work etc. in MS Word in Computer ?

The detailed content is attached in Appendix No. IV

(C) STATEMENT OF THE PROBLEM

Today tremendous growth has taken place in all the spheres of educational activities. It is said that wisdom is the fruit of a balanced development. It is this balanced growth of individuality which should be the aim of education. For accomplishment of all round development of pupils, any good teacher uses appropriate teaching strategies like Conventional instructional material, Audio - Video instructional material & Multimedia
There are various presentation modes for teaching Information Technology at various levels namely lecture mode, demonstration mode, lecture-cum-demonstration mode, heuristic mode, project mode, laboratory mode, assignment mode, problem solving mode and historical mode, Audio-video instructional mode, multimedia instructional mode. The explosion of knowledge all over the world has brought about changes in methods of teaching of all subjects like science, arts, commerce and humanities, 'Information Technology'. Not only in India but throughout the world, innovation has become a significant feature on educational scene especially in Information Technology. The innovations explore the integrated and interdisciplinary Information Technology subjects like electronics (hardware & software), Computers, networking, Internet, e-mail, e-commerce etc. The use of electronic medium of instructions in the form of radio, television, video, telephone, closed circuit television and multimedia package has been thoroughly investigated by various researchers as mentioned above. Their studies signify the need for new and latest technology which offers a good potential for improving the quality of education. The appearance of electronic gadgets like radio, television, video and closed circuit television and computer have resulted in a sea-change in our life style. It will be quite right for us-teachers and teacher-educators to take a serious note of this change.

In the prevailing Indian conditions, there is need of those presentation modes which are easier to plan and administer within our given resources. In the present study, an endeavour has been made to study the effect of the instructional systems on the achievement of secondary students in Information Technology. The three modes chosen are Conventional Instructional System (C.I.S.), Audio - Video Instructional System (A.V.I.S) and Multimedia Instructional System (M.I.S). Studies of trend reports, various journals and abstracts and Surveys of Research (Buch 1974, 1979, 1986, 1991) reveal that very little work has been done to investigate the effect of these three Instructional Systems on achievement of secondary students in Information Technology. Hence it will be worthwhile to study the effect of these above presentation systems on the achievement of secondary students in Information Technology as the findings of the investigation may prove helpful in
the emergence of a new educational pattern, which may ultimately prove helpful in the progress of the nation. It was with this view that the present study was planned and conducted.

The problem for the present research is concerned with a comparison of the relative effectiveness of a number of communication systems in teaching "Information Technology". Three Instructional Systems - Conventional Instructional System (C.I.S.), Audio-Video Instructional System (A.V.I.S.) and Multimedia Instructional System (M.I.S.) have been taken up for study. The problem may precisely be stated as under:

A COMPARATIVE STUDY OF THE EFFECTIVENESS OF COMMUNICATION TECHNOLOGY FOR TEACHING INFORMATION TECHNOLOGY

1.3.0 DEFINITIONS OF TERMS USED

Effectiveness- It is the indicator to evaluate the standardised achievement criteria test of Secondary school students for teaching of "Information Technology" by three strategies i.e. Conventional system of instruction, Audio-Video instructional system and Multimedia instructional system and comparing them to judge the indication in the form of effectiveness.

Good (1973) in his dictionary defined effective teaching is that teaching unit which facilitates the regular as well as systematic development of learner. In the present study, the effectiveness of three instructional systems of teaching. (Audio-video instructional system, Multimedia instructional system & conventional instructional system) was studied while teaching information Technology to Secondary school students.

Achievement- Good (1973) in his dictionary defined achievement as academic knowledge defined or skills developed in the School subjects, usually designed by test scores or by marks assigned by teachers or both. In the present venture, achievement means scores of the students on the criterion test in a particular discipline i.e. information technology.

Communication Technology - It is the act of transmission or sharing of ideas, facts, data for the individual or for collective activity by some means, media, channel in the field of education through which communication takes place is called Communication
Technology in Education. The various media of Communication Technology are- Printed study material, Audio-Video Cassettes, Radio, Television, Telephone, Computer, Internet, E-mail, Fax, Video-Disc, Computer-Disc, Multimedia Tools etc. Communication Technology is a vital area of instruction. It is an instructional tool.

In the present investigation, investigator have taken three types of communication technologies as instructional tools viz-Audio-video instructional system and Multimedia instructional system & Conventional instructional system.

**Conventional Instructional System (C.I.S.)**

Conventional instruction system of teaching in which teacher is the centre of classroom activities of teaching-learning process. According to Good's dictionary, conventional teaching is that type of teaching, which is out growth of custom or common practice. It is the teacher, who presents the entire content to be learnt in the final form. In this approach, the student is not required to make any independent discoveries. The usual verbal instruction of the lecture hall exemplifies conventional teaching. The terms connected with conventional approach are expository, traditional and lecture method. All these terms convey almost the same meaning.

**Audio-Video Instructional System (A.V.I.S.)**

The Audio-Video Instructional System is a strategy which call upon the auditory and visual senses of the learned. The Audio-Video Instructional System have the wise use of our senses of hearing and sight proving magnificently helpful in making the learning more meaningful, more interesting and more effective. It is the strategy which help the teacher in effective realisation of his teaching objectives by calling upon the auditory & visual senses of his students.

Audio-Video Instructional System is an effective medium of communication for imparting educational instructions. It is very useful for educating the masses in developing countries like India where a large number of people are still illiterate. Through Audio-Video Instructional System, a standard quality of information and knowledge, in the form of educational programme, can be communicated to the people. These programmes can be recorded on Video cassettes with the communication of subject expert.
Multimedia Instructional System (M.I.S.) -

Multimedia Instructional System is the strategy which belongs to systems that integrate video, audio, text, graphics, animation. Multimedia Strategy call for the use of number of media, devices and techniques for teaching - learning for effective realisations of teaching objectives in a best possible way, for example - Computer Assisted Technology is the best technique of multimedia approach.

Multimedia instructional system ultimately aims for the creation of such teaching learning environment that may prove helpful in making students learning an independent and individualised activity. Accordingly, there is need of a significant change in the attitude & role of the teacher. His task in the multimedia approach is not limited to the imparting of knowledge and disseminating information to the students. Consequently, there will be a shift of his role from direct communication of information to guiding students learning. He has to make his students active participants in the process of learning instead of remaining passive. The learning experiences are to be designated by him by adopting multimedia approach in such a way that the students may be able to proceed on the path of learning quite independently. Slowly & slowly they are to be lead on the path of auto-instruction and self-learning. The role of the teacher thus needs a major shift in the shape of guide, advisor and organiser in place of a more communicator, demonstrator or tutor etc.

Information Technology- An information technology can be simply defined as the interacting of man and machine which, under man's control, gathers data & disseminates information. The main objective of such a system is to provide information to its user. To accomplish this, data must be evaluated, analysed and processed to produce meaningful & useful information. Information Technology is widely used in education along with other fields. In the present investigation, investigator takes the content of Information Technology teaching Secondary School curriculum in Haryana State.

1.3.1 OBJECTIVES OF THE STUDY

The Study envisages the following objectives while teaching the selected content of 'Information Technology'.
To compare the effectiveness of Audio-Video Instructional System, Multimedia Instructional System and Conventional Instructional System in terms of achievement for teaching "Information Technology".

To study the relative retention in "Information Technology" in learning through Audio-Video Instructional System, Multimedia Instructional System and Conventional Instructional System.

To study the Interaction effects in terms of achievement in teaching "Information Technology" having three instructional systems and two levels of intelligence.

To study the Interaction effects in terms of achievement in teaching "Information Technology" having three instructional systems and two levels of sex.

To study the Interaction effects in different levels of intelligence and sex factor.

To study the Interaction effects in terms of achievement in "Information Technology" having three instructional systems, two levels of intelligence and two levels of sex.

To develop Audio-video instructional system on selected content of "Information Technology".

To develop Multimedia instructional system on selected content of "Information Technology".

To develop the conventional Instructional System on selected content of "Information Technology".

To construct achievement test on selected content to study the effectiveness.

1.3.2 HYPOTHESIS

In order to realise the objectives of the study, the following hypothesis were formulated for testing.

H-1 There is no significant difference between the mean achievement scores of secondary school students in teaching "Information Technology" while receiving instructions through Audio-Video Instructional System, Multimedia Instructional System and Conventional Instructional System.

H-2 There is no significant difference in the mean achievement scores of secondary
school students in "Information Technology" in relative retention of receiving instructions through Audio-Video Instructional System, Multimedia Instructional System and Conventional Instructional System.

**H-3**  There is no significant interaction in terms of mean achievement of secondary school students while learning through Audio-Video Instructional System, Multimedia Instructional System and Conventional instructional System at high and low level of intelligence.

**H-4**  There is no significant interaction in terms of mean achievement of secondary school students learning "Information Technology" through three instructional systems and two levels of sex.

**H-5**  There is no significant interaction in two levels of intelligence and two levels of sex.

**H-6**  There is no significant interaction in terms of mean achievement having three instructional systems, two levels of intelligence and two levels of sex.

**1.3. 3 DELIMITATION OF STUDY**

The present study was delimited in the following respects:

- **Area**  - Bhiwani city.
- **Grade**  - Secondary school students.
- **Discipline**  - Information Technology
- **Sample**  - 120
- **Content**  - Only three units of "Information Technology"

**D) PROCEDURE OF THE STUDY**

The study was completed in four stages. The method adopted for the conduct of each stage is as detailed here.

**1.4.0 PRE-TEST STAGE**

Initially at the pretest stage, pre-achievement of each student of the sample in the form of their scores in Information Technology subject of IXth class, was noted from the school records. The scores of intelligence test were collected by administering "Group
test of intelligence for Children (2/70)” by Dr. R.K. Tandon. Then all the three groups were administered the achievement test prepared by the investigator himself. The scores thus obtained were recorded. This stage was called as Pre-Test stage.

1.4.1 EXPERIMENTAL TREATMENT STAGE:

Before the beginning of experimental treatment, all the three groups of students and teachers were made aware of the objectives and nature of the experiment to be conducted. This orientation helped the students to understand the instructions. The groups which were to receive instructions through Audio-video instructional system and Multimedia instructional system were explained the hardware and software in detail so as to overcome their curiosity and anxiety about the equipment in front of them.

After the administration of achievement test and taking the requisite data, experimental treatment was provided to all the three groups. Each group was taught through one presentation mode only. First group was taught through Conventional instructional system, second group was taught through Audio-video instructional system & third group was taught through Multimedia instructional system. The lessons were prepared by the investigator for Conventional instructional system. All the necessary aids including charts, models, maps and graphs etc. were also prepared for Conventional instructional system. The students of second group were taught through Audio-video instructional system, which contained all the necessary information related to the topic, supported by sound & the visual photographs. The students of third group were taught through Multimedia instructional system, which contained all the necessary information related to the topic, supported by sound & computer system for operation. There was no discussion during the lesson or at the end of lesson in Audio-video instructional system & Multimedia instructional system. Three lessons were selected from the syllabus of information technology of IXth class belonging to C.B.S.E Secondary School students for the experiment. The teachers were rotated over three presentation modes for units I, II & III.
1.4.2 FIRST POST-TEST STAGE:

After the experimental stage was over, the same achievement test was administered again to all the three groups. The scores obtained at this post-test stage were recorded.

1.4.3 SECOND POST-TEST STAGE (RETENTION TEST):

After one month of the First Post-Test, the same test was readministered to study retention in learning, the test scripts were scored. The scores thus obtained have been provided in Appendix XII. These scores were henceforth be referred to as second Post-Test scores or retention test scores.

1.4.4 SCORING:

Responses of each pupil to intelligence test, achievement test were measured using the prescribed scoring key or the key prepared for the purpose. These scores were then tabulated and statistical analysis was done for further calculations.

1.4.5 STATISTICAL ANALYSIS:

The objective of the present study warrants the use of analysis as the major technique of statistical analysis. It would allow for testing the significance of differences in more than two means and at the same time inclusion of the factors like methods, intelligence and sex factor, thus permitting the testing of the significance of interaction between the three factors. The F-ratio does not point out which ones or how many means are significantly different. In order to locate the significance of difference, further evaluation is required. Hence, F-test was followed by t-test whenever the former reached significant.

The following statistical techniques were used for the analysis and interpretation of data collected from the study.
1. Analysis of various (ANOVA)
2. F-test and t-test
3. Factorial design. (3X2X2)
The factorial design (3X2X2) of statistical analysis is given here.

### A x B x C Factorial Design
(The 3x2x2 Factorial Design)

<table>
<thead>
<tr>
<th>(B)</th>
<th>(C)</th>
<th>Teaching Methods (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intelligence (12n)=120</td>
<td>Sex</td>
<td>A₁ (4n)=40</td>
</tr>
<tr>
<td>(B)₁</td>
<td>C₁ (Boys) (3n)=30</td>
<td>A₁B₁C₁ (n)=10</td>
</tr>
<tr>
<td>High Intelligence (6n)=60</td>
<td>C₂ (Girls) (3n)=30</td>
<td>A₁B₁C₂ (n)=10</td>
</tr>
<tr>
<td>(B)₂</td>
<td>C₃ (Boys) (3n)=30</td>
<td>A₁B₂C₂ (n)=10</td>
</tr>
<tr>
<td>Low Intelligence (6n)=60</td>
<td>C₂ (Girls) (3n)=30</td>
<td>A₁B₂C₁ (n)=10</td>
</tr>
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</table>