

Unit-5

INSTRUCTIONAL MEDIA

5.1 Introduction

Instructional media encompasses all the materials and physical means an instructor might use to implement instruction and facilitate students achievement of instructional objectives. Instructional media carry messages with an instructional purpose. The design of the message and the quality of teacher – learner interactions, not the medium, are what influences learning effectiveness. No one medium is capable of presenting all the required learning stimuli, so use a multimedia approach.

5.2 Classification of Instructional Media

Instructional Media are seen by educators as aids rather than substitutions for the teacher. Teachers spend a disproportionate amount of their time in routine chores – in collecting and assigning books, materials and in grading that could be partly obviated if aids could be so constructed as to free them to concentrate on the central job of promoting understanding, intellectual curiosity, and creative activity in the learner.

Instructional Media can be classified using their important characteristics. We will use four characteristics for this purpose:

- stimulation provided to sense organs
- learner's control over media
- type of experience they provide, and their reach

Classification of Media according to Sense they stimulate

The below lists media in a traditional classification i.e., according to the senses they stimulate and the message code they transmit. It may be noted that new emerging media stimulate more than one sense; they stimulate not just the ear or eye but both and sometimes touch. These media function in a more interactive way.

a) Audio media – focuses on sense of hearing

b) Visual media – involves sense of seeing

c) Audio – Visual – focuses on hearing and seeing

d) Multimedia – stimulates multiple sense (multisensory) which include hearing, seeing, touch, smell and taste.

Classification of Media

Audio

- Voice (any human sender of the message)
- Gramophone records
- Audio tapes, to be used in a tape recorder or language laboratory
- Stereo records / tapes
- Radio
- Telephonic conversation

Visual (verbal) print or duplicated

- Text books, supplementary books
- Reference books, encyclopaedia, etc.
- Magazines, newspapers, etc.
- Documents, clippings from published material
- Duplicated written material

Visual (non – projected, two – dimensional)

- Messages / pictures on roll – up board
- Flat picture, cut – outs
- Posters, charts, graphs, etc.
- Cartoons, comics, etc.

Visual (non – projected, three dimensional)

- Models, mock- ups, display materials
- Diagrams
- Globes or maps (three – dimensional)
- Specimens (animate or inanimate)
- Puppets

Visual (projected -still)

- Slides
- Filmstrips
- Overhead transparencies
- Micro image system; micro film, micro card.

Audio – visual (projected – motion)

- Film
- Television
- Close – circuit television
- Video cassettes

Multimedia packages (for more than one sense)

slide + tape

- Slide + tape + work book
- Radio + Slide or posters (radio vision)
- Film + Posters + work book (print materials)
- Television + workbook (print materials)
- Any of the above + introductory and summarizing talk by the teacher / leader of the group.

New emerging media (all of these are multisensory)

- Teleconferencing (Group discussion through telephones)
- Cable television (localized television where feedback is possible)
- Television / communication satellites
- Computer networking
- Video discs
- Mini computers / microcomputers / word processors

2. Classification of Media according to the Learner’s Control over them

Media can be used to classify them is the extent to which they can be controlled by the learner. While using a textbook or an audio tape for learning, the learner can use them at his / her own pace, he / she may go back and read the paragraph or listen to the part of the programme again and again. So, these may be called learner – controlled media.

Now think of a television programme. The messages are transmitted according to the pace of the sender and it may not be appropriate for an individual learner. Mass media like radio or TV offer no control to the learner.

Thus, various media can be placed on a continuum ranging from no control by the user to high control by the user. (Below table)

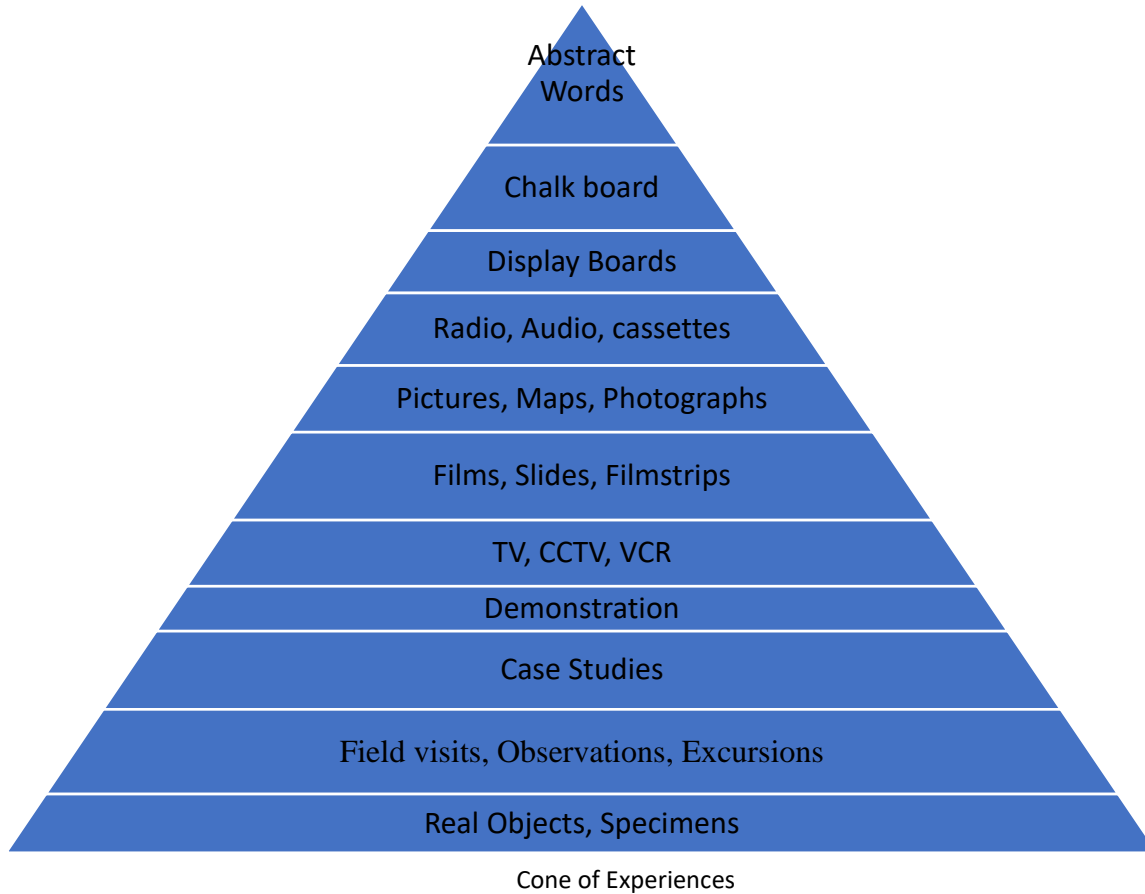
1	2	3	4
No control			High control
(TV, Radio) Media	Projected Media	Non – projected	(Computer, Tape recorder)

All new emerging media are designed to provide more and more control to the learner over the learning process.

3. Classification of Media according to the Type of Experience they provide

Media can be classified on the basis of the type of experience they provide. The cone of experience has a broad base of direct purposeful experience which can be provided mostly through instructional media consisting of real objects, specimens and methods such as field visits, observation, experimentation, etc. As we move away from the base towards abstraction (verbal message only), we come across many instructional media which provide indirect or vicarious experiences. They differ in their degree of abstraction. Case studies, video and TV programmes provide more life – related experiences whereas radio or audio tapes tend to provide only verbal experiences.

Pedagogy of Mathematics



4. Classification of Media according to their Reach

Media can also be classified to the size of the group of learners (or an individual learner) for whom they are intended and used.

A computer – assisted instructional (CAI) programme, for example, is prepared for individualized learning. It takes into account the difficulties which may be encountered by the individual learner (who is learning on his/her own without any help from the teacher or peers) in his/her learning and it aims at providing help to solve/overcome these difficulties.

Non – projected aids or graphic aids, such as charts, maps or models are used for a small group of learners. They are not quite useful to teach a class of 70 – 80 students.

Projected aids, such as slides or filmstrips can reach a larger group of their quality of enlargement. Media, such as TV, radio or newspapers (print) reach millions of people at a time. Hence, they are called mass media.

5.3 Use of Mass Media in Classroom instruction

5.3.1 Mass Media

Mass Media is an important means of making mathematics teaching and learning more effective and interesting. A teacher of mathematics needs to explore the full potential of these for more effective mathematics teaching.

Mass Media as agency or instrument through which ideas, attitudes, impressions or images are simultaneously communicated to a large number of people. Such media forms include not only the print and electronic forms such as newspaper, magazines, radio, television, etc. Mass Media are a popular non – formal agency of education. Although the mass media have been widely utilized in adult education, development activities.

John Dewey stated that education could not be limited within teacher and taught without social environment. So mass media is one such potent force in social environment in education. Through modern electronic techniques and technologies, mass media prove that education is, really comprehensive not confined within four walls of the classroom.

5.3.2 The Role of some important Mass Media in Mathematics Education

1. Radio

Radio has been playing a vital role in the field of education and Radio has established due credit in the field of education. Almost all the important centers of A.I.R. broadcast programmes on mathematics education. These programmes are either related to general aspects of mathematics education or regular classes on topics for high school and higher secondary school mathematics. The important discussions and speeches concerning principles and laws of mathematics, life history and contribution of mathematics, the application at mathematics in practical life are broadcast. Highly Experienced teachers, teacher educators, mathematicians and research persons take part in such programmes. The Radio as a means of communication takes their voices to the millions of students and teachers listening to their programmes.

A teacher of mathematics can make the best use of such programmes by making himself and his students aware of the programmes and listening to such programmes. As far as possible, the teacher should try to integrate the radio programme with regular classroom instruction. The teacher can put up a list of programmes to be broadcast every week, on the classroom notice board so that the students keep track of the programmes. The students may be asked to take notes on the programmes and the teacher can follow it up with a discussion on the following day.

2. Television

Television has the greater advantages as it not only conveys the messages through sound, but also depicts the content with relevant pictures, figures and scenes. The teacher can supplement his regular teaching by making use of the relevant educational programmes telecast by Doordarshan in English and in regional languages. The list of programmes are published in advance in leading newspapers and the teacher can make use of this list as a guide to select the programmes should be based on the students' level of achievement and capacity to understand before the students view the programmes, they should be properly motivated, should be told what to look for, how to view the programme and how to pick up the key points. After viewing the programme the teacher can discuss with the students about the important points and ask questions for clarification and summarisation. Though this is an interesting aid for teaching, the major disadvantage is that if the students are not able to follow any part of the programme, there is no way of replying. It for viewing it once again or interacting with the expert for clarification. This can be overcome if the teacher records the programme and views, it along with the students, interacting and clarifying s and when it is required.

In television the programmes on mathematical speeches, Mathematics classes for competitive exam, History of mathematics and pictures about mathematicians, and also it has shown the places about related to mathematics.

Eg: Bank, Post-office, share market etc.

The teacher of mathematics should try to take advantage of such learning opportunities by making himself and his students fully conversant with such programmes

3. News paper

Newspaper is an economical, effective and exciting teaching aid. It provides supplemental, supportive teaching materials. Using the newspaper bridges the gap between classroom learning and real-world living, helps foster global awareness and understanding of local issues, creates informed citizens, offers examples of conflict and resolution and fosters reading thinking and writing skills. In addition, using newspapers in class can encourage positive students' attitudes toward reading, improve mathematics skills, motivate students to talk with their peers and parents about what they read and help students learn how to solve real-life problems.

Newspapers may be used an effective aid for teaching and learning of mathematics. They help in correlating teaching of mathematics with day-to-day happenings of life. The statistics given in the newspaper in the form of weather charts, the prices of various commodities, budgets of stage and central government, interest rates of various private and government agencies stock and shares etc. All provide good means for making the teaching of mathematics interesting

useful and purposeful. The cutting of the newspapers may thus be employed to help the students in learning the practical application of mathematics in day-to-day life.

5.3.3 Importance of Mass Media

1. Mass Media provide information to the mass within a less time.
2. It takes a wide coverage of information regarding anything that is happening in any corner of the world.
3. It brings the entire world to the individual or to the classroom. Children spend hours together sitting in front of the television and can visualize, hear and acquire knowledge about the world.
4. These media easily reach groups, allow repeated use, give more reality, influence attitudes, show cause and effect relationships and ultimately motivate the audience.
5. It sends information to remote places and helps in distant learning.
6. It helps in modification of attitudes, inculcation of desirable values and acquaintance with cultural heritage.
7. Mass media acts as an agency of social change.
8. Mass media are useful for reinforcing group dynamics and interpersonal communication.
9. Mass media as means of communication make ideas clear to children and help them to acquire correct knowledge. They help in simplifying and in giving vividness to explanation.
10. Mass Media make the instruction concrete and stimulate interest and excite curiosity in things.

5.3.4 Using Mass Media

The teacher should make all necessary arrangements for using the mass media very effectively. He / She should select the mass media according to the age level of the students. He must know some general principles of using the mass media.

1. Organization:

Mass Media should be organized as integral part of the educational programmes. They should not be separated from other curricular activities.

2. Selection:

Mass Media should be properly selected and coordinated by the teacher. An experienced and trained teacher can select the mass media according to the needs of the students.

3. Planning:

Mass Media should be available according to the need of the instructional programme. The teachers should possess skill in the use of mass media. They should have special training in their preparation. So, they should be properly planned.

4. Experience:

Mass Media should be related to pupil's experience.

5. Preparation:

There should be adequate preparation on the part of pupils. The teacher should prepare himself before using it. He / She should know what the mass media teach and where they fit into his plan of teaching. Adequate preparation should be followed by proper presentation and an adequate follow – up.

6. Evaluation:

Mass Media should be evaluated at regular intervals in regards to their use, effect on learning and their functions.

5.3.5 Advantages of Mass Media

- It educates individuals. People get to know regarding health problems, environmental protection, and more via television and radio programmes.
- In a very short period of time, citizens get the latest information. Distance does not constitute an obstacle. Via the newspapers, individuals get information every day and this makes everyone updated on the current events.
- People have to bring their secret talents. In the media, their skills like acting, comedy and singing are demonstrated.
- The awareness in children is growing. From quiz programmes, animal programmes, and so on, children will understand.
- Radio is useful as individuals obtain brief news and can reach it via a cell phone and many more.

5.3.6 Disadvantages of Mass Media

- It contributes to individualism. On the website and watching tv, people waste too much time.
- As a consequence, it is affected by social interactions with friends, relatives and neighbours.
- It can be tough to restrict children's access to certain stuff.

- Papers are geographically limited.
- The Internet opens up the possibilities of fraud, theft and hacking as a type of entertainment.

5.4 New Emerging Media

The emergence of online technology, the production, distribution and consumption process of information has been changed. Printed and Audio –visual resources have shifted their importance to the online editions. Each and every media houses in India now have their own websites. Especially the electronic communication with the internet driven technology has brought lots of innovations. The new forms of media have created opportunity for interactions between the teachers and students. These new forms of media are known as Emerging Media.

5.4.1 Meaning and Definition

In common parlance by “emerging” we mean “upcoming”. So “emerging media” we mean by upcoming media used to access information. It is very difficult to define exactly what the emerging media meant by. As media is evolving in nature so also its various forms. World Wide Web, Internet and digital technology have influenced both print and electronic media.

Neuman (1991) has defined the concept of emerging media more than a decade ago. He argued that what we define as emerging media will a) alter the influence of distance, b) increase the volume and speed of communications, c) enable interactive communications and d) permit the merging of media forms.

Thus, we can define emerging media as “media used to share and exchange information with the use of emergent digital technologies having the feature of interactivity, on – demand and faster speed’. Thus, emerging media not only contain new medium of communication but should also have the faster speed of delivery of information. New media definitions remain fluid and are evolving, with some definitions of new media focusing exclusively upon computer technologies and digital content production whilst others stress the cultural forms and contexts in which technologies are used (Dewdney & Ride, 2006).

5.4.2 Uses in Teaching Mathematics

New Emerging Media is essential that teachers and students have regular access to technologies that support and advance mathematical sense making, reasoning, problem solving, and communication. In mathematics education, content specific technologies include computer algebra systems; dynamic geometry environments; interactive applets; handheld computation, data collection, and analysis devices; and computer-based applications. These technologies support students in exploring and identifying mathematical concepts and relationships. All

Schools and mathematics programs should provide students and teachers with access to instructional technology – including classroom hardware, handheld and lab-based devices with mathematical software and applications, and web – based devices with mathematical software and applications, and web-based resources together with adequate training to ensure its effective use. Programs in teacher education and professional development must continually update practitioners’ knowledge of technology and its application to support learning.

5.5 Teleconferencing

Teleconferencing means the conferencing made possible among the participants even by staying at a large distance from each other. Since, face to face interaction (FTF) interaction is the traditional standard for holding conferences (or interactive group communication). However, holding of such conferences becomes a tiresome or a long task when the people involved in these conferences are located at a very far distance. The time, money and energy spent in bringing people together for these conferences create various problems. The alternative lies in the changing to teleconferencing leaving behind the traditional face to face method of conferencing.

Therefore, teleconferencing can be defined as an interactive group communication or a real time interaction between two or more people in two or more locations through an electronic medium.

Teleconferencing was introduced for the first time in 1960s with American Telephone and Telegraph’s picture. Teleconferencing brings people together under one roof even though they are separated by thousands of miles for the exchange of information and opinion.

5.5.1 Types of Teleconferencing Used in Mathematics Education

Today, Teleconferencing has vast use with the great advances made in the field of communication through modern software and hardware technologies.

1. Audio Conferencing Technologies

These technologies can be further classified depending on medium used as audio and audio graphic as shown in the following.

Audio Conferencing

It is basically natural extension of the person-to-person telephone call done for enabling communication and conversion among more than two persons at a time. Distance learning can be conducted by audio conference. In fact, it is one of the most underutilized, yet cost effective methods available to education. Instructors should receive training on how to best utilize audio conferences to augment other forms of distance learning.

Audio graphics

Uses narrowband telecommunications channels to transmit visual information such as graphics, alpha – numeric, documents, and video pictures as an adjunct to voice communication. Other terms are desk – top computer conferencing and enhanced audio. Devices include electronic tablets / boards, freeze – frame video terminals, integrated graphics systems (as part of personal computers), Fax, remote – access microfiche and slide projectors, optical graphic scanners, and voice / data terminals. Audio graphics can be used for meetings and distance learning.

2. Video conferencing

Combines audio and video to provide voice communications and video images. Can be one – way video / two – way audio. It can display anything that can be captured by a TV camera. The advantage is the capability to display moving images. In two – way audio / video systems, a common application is to show people which create a social presence that resembles face – to – face meetings and classes and enables participants to see the facial expressions and physical demeanor of participants at remote sites. Graphics are used to enhance understanding. There are three basic systems: freeze frame, compressed, and full – motion video.

Video conferencing is an effective way to use one teacher who teaches to a number of sites. It is very cost effective for classes which may have a small number of students enrolled at each site. In many cases, video conferencing enables the institution or a group of institutions to provide courses which would be cancelled due to low enrollment or which could not be supported otherwise because of the cost of providing an instructor in an unusual subject area. Rural areas benefit particularly from classes provided through video conferencing when they work with a larger metropolitan institution that has full – time faculty. Through teleconferencing, institutions are able to serve all students equitably. This learning was carried out using the Zoom platform, Google Meet, etc.

National Council of Teachers of Mathematics (NCTM) in a book entitled ‘Principles and standards for school Mathematics’ states about video conferencing that the five mathematical abilities that student should have 1) Mathematical communication; 2) mathematical reasoning; 3) Solving mathematical problems; 4) mathematical connection; 5) mathematical representation. Video conferencing has an effect on the mathematical problem-solving abilities of students. With the help of video conferencing, online learning feels more alive, interactive and active.

3. Computer conferencing

Uses telephone lines to connect two or more computers and modems. Anything that can be done on a computer can be sent over the lines. It can be synchronous or asynchronous. An example of an asynchronous mode is electronic mail. Using electronic mail (E – mail), memos, reports, updates, newsletters can be sent to anyone on the local area network (LAN) or wide area network (WAN). Items generated on computer which are normally printed and then sent by facsimile can be sent by E-Mail.

Computer conferencing is an emerging area for distance education. Some institutions offer credit programs completely by computer. Students receive texts and workbooks via mail. Through common files assigned to a class which each student can assess, teachers upload syllabi, lectures, grades and remarks. Students download these files, compose their assignment and remarks off – line, then upload them to the common files.

Computer conference can be structured so that each student must interact with peers in solving mathematics problems. Because this interaction is tangible and visible, the learning may be even more “active” than it is non – computer cooperative learning situations. It can be an avenue for students to experience success. The response time for questions is provided and the student isn’t intimidated by others who are faster. This developing confidence in the ability to do mathematics will make the experiences more enjoyable rather than something to be feared.

Learning Mathematics through Computer conference example Maths Bingo, Puzzle, Treasure Hunt.

5.5.2 Advantages of Teleconferencing

The educational benefit of teleconferencing is enlisted in points, which are as follows:

It saves time, money and energy of the participants by allowing them to participate in the conference from their own places, instead of travelling to a long distance.

It helps the students and teachers in getting up to date to information and experiences related to their topics and areas of interest by communicating with the people and sources of authenticity.

It provides good sources of communication in the form of exchange of ideas and knowledge, sharing of experiences, execution of common projects, doing surveys and investigations, writing of a report, working in team, etc. for a number of students or institutions scattered in a worldwide.

It reduces the wastage of time and other resources that usually occurs in fulfilling social formalities during the face-to-face traditional conferencing. Here, the contacts are shorter and purpose is oriented primarily.

The members can participate more freely and equally with their adequate preparation as compared to the traditional face to face conferencing.

The advanced technology available through audio – plus teleconferencing, video conferencing supported by computer technology helps the learners and teachers in gaining useful experiences in the form of audio – instructions and auto – training that works according to their learning pace or learning speed, availability of time and diversities in the interests, specially through e – mail transaction and web – conferencing.

Teleconferencing has made it possible a unique collaboration and cooperation among different subject experts, teachers and students of different capabilities and interests for fulfilling their thirst of knowledge and sharing their contribution in the field of education. The barrier of distances and timings have been eliminated through on – line chatting and video display of the information available on websites, for the useful interaction among the people who want to acquire knowledge or discuss something related to information.

5.5.3 Disadvantages of Teleconferencing

- Teleconferencing has certain inherent limitations, due to which it is not in frequent use in education. Some of these are as follows:
- Teleconferencing requires a huge and very efficient telephonic, radio and television network throughout the country.
- The chances of technical breakdown are quite high.
- The telephone charges are very high, which all the educational institutions cannot afford.
- Teleconferencing is a costly technique of instruction. It requires sophisticated technology and expert human power.
- Teleconferencing is a mode of group communication, so the willingness of each participant is an essential requirement, but this is generally lacking especially among distance learners.
- It takes time to organize.

5.6 Communication Satellite

A communications satellite is a wireless communication device in Earth's orbit that uses a transponder to send and receive data from Earth. It is primarily used to redirect communication data from one Earth – based communication station to another station. Typically, a communications satellite works when it receives data from terrestrial stations in the form of electromagnetic waves. The data is usually sent via large satellite dishes. Based on the intended destination, the communications satellite redirects the waves to the corresponding station.

The communication satellite was Echo 1 launched in 1960. Relay 1 and Telstar 1, both launched in 1962, were the first active communication satellites. INSAT – 4A was India's first communication satellite.

Communications satellites are vital for remote areas that do not have access to traditional landlines for telephone or Internet services.

5.6.1 Satellite Instructional Television Experiment (SITE)

SITE was the largest communication experiment in the use of satellite in support of developmental programmes in modern times. SITE covered four different language regions but children of other regions also watched these programmes on school days. Though the programmes were meant for children, other also viewed the programmes within the school. These were not based on school syllabi but intended to provide general enrichment. Governments of each state receiving SITE programmes were responsible for electrifying the school, which housed the television receiver.

An important highlight for SITE was teacher training through multimedia. Nearly, 50,000 teachers were exposed to this training in two installments. Experts planned the lessons. SITE experiment drew attention of the world. Two international teams, one sponsored by United Nations and other by Common wealth Broadcasting Association toured the SITE areas and gave favorable reactions.

5.6.2 INSAT

The Indian National Satellite system is one of the largest communication satellite systems in the Asia Pacific Region. It is the multipurpose and Geo- stationary communication system. It is launched by ISRO. Commissioned in 1983. INSAT is being used for education and development. Institution such as NCERT, UGC, IGNOU produce educational TV programmes for broadcast on the national channel through INSAT.

The major objectives of INSAT were:

- To produce and transmit varied programmes designed to awaken, inform, enlighten, educate, entertain and enrich all sections of the people in different parts of the country.
- To promote alternative approaches to education for children, youth and adults.
- To stimulate interest and involvement of people in economic development.

5.6.3 EDUSAT

With the success of the INSAT – based educational services, a need was felt to launch a satellite dedicated for educational service and ISRO conceived the EDUSAT project. EDUSAT is the first exclusive satellite for serving the educational sector. It is known as GSAT-3. Its first operational flight took place on 20th September 2004 from the Satish Dhawan Space center Sriharikottah. EDUSAT had manifold objectives – to supplement the curriculum-based teaching, imparting effective teacher training, providing access to quality resource persons and new technologies, thus finally resulting in taking education to every nook and corner to India. EDUSAT provided connectivity to schools, colleges and higher levels of education and also supported non – formal education including development communication. It was the first dedicated “Educational Satellite” that provides the country with satellite – based – two –way communication to the classroom for delivering educational materials.



For Example, one program allows students to send video questions to any teacher in any teacher in any connected classroom, anywhere in India, using a streaming video card over the EDUSAT satellite. The teacher then responds to these questions through EDUSAT. The satellite also will be used in teacher training.

5.6.4 Objectives of EDUSAT

- Providing support to formal and non – formal education
- Teachers understanding program
- Increasing access to quality resource persons
- Enhancing community participation
- Taking education to remotest corner of the country.

5.6.5 Uses of EDUSAT

- Conventional Radio and Television broadcasting
- Interactive Radio and Television
- Exchange of data
- Teleconferencing both one way and two way, Audio conferencing & computer conferencing
- Web based education

5.6.6 Characteristics of Communication Satellites

The characteristics of all communication satellites are similar. These are:

Power: A live satellite does not require conventional power to maintain its position in space, except tiny amounts of energy necessary to correct its position occasionally. The power for receiving and transmitting signals comes from the solar batteries built into the satellite. These batteries are recharged. Solar panels, which convert sunlight into electrical energy, are used for the functioning of the satellite system.

Large coverage: Satellite-based communication is independent of distances and serves the rural and urban, central and far-flung areas simultaneously. It can cater to very widely dispersed populations at a time. This characteristic of the satellite is particularly useful for education at a distance. Space scientists claim that three satellites in the geo-synchronous altitude orbit can provide communication services to the entire earth on a full time basis, except for the Polar Regions, which are not visible from this orbit (Nicholson, 1976).

Multi-purpose uses: Satellites can be used simultaneously for the radio, telephone, television and data traffic. Multi-purpose satellites offer a wide variety of combinations. Besides

serving communication purposes, the satellites are also used for remote sensing, such as is required in soil surveys, flood (assessment of area under water, etc.), forestry (tree resources, tree diseases, etc.), oceanography, etc.

Cost: The initial investment in the development and launching of a satellite is very high, especially for the third world countries. A multipurpose satellite such as INSAT needed a huge financial allocation in its fabrication and launching. But when INSAT-IB was launched and became operational, all demands for communication were met without adding new investment. On the other hand, the terrestrial system, including the microwave, needed additional infrastructure to meet the increasing information needs of a country. Expanding telecommunication infrastructure to provide communication services to different parts of the country is not always an economically rational thing to do. Because telecommunication for educational purposes cannot produce sufficient revenue to cover capital and operational costs, the costs in this case should be counted in terms of social and economic benefits, such as roads, water supply systems, schools, etc.

Planning: The implementation of satellite-based communication requires advance planning. It needs more lead time than terrestrial communication does. Therefore, the use of satellites should be linked to the overall socioeconomic and educational development of the country. Since it (satellite-based communication) is closely linked with the educational development and economic growth of the country, it should have a base in long term planning.

National and area specific communication: Satellite-based communication has the capability to cater to both the national and the area specific needs of a country. It can be regionalized as well which can provide area-specific service.

Life of a satellite: The use of solar panels/cells describes the life of a satellite. The electrical energy output from a solar cell will decrease with age: after 8 to 10 years, the electrical output from a solar cell will decrease by about 20 per cent. The communication satellite is generally replaced after about 10 to 12 years of continuous service. For example the life span of Indian satellite- INSAT-1A and IB was seven years. Launched in August, 1983, INSAT-IB completed over 108 months of operational service in August, 1992.

5.6.7 Advantages of Communication Satellite

- The communication satellite services are very helpful for the people staying in a remote area.
- It is used for mobile as well as wireless communication applications find at independent of location.
- It is enhanced the business and education sector due to the silent advantages of a satellite communication system.
- Television and radio signals are the most important part of the communication system.

- Data communication can be done with the help of satellite communication.
- It is very helpful for the department of defence.
- It covers wide area of the earth hence entire country or region can be covered with just one satellite.
- It is being so portable and is very easy to install and also have user – friendly.

5.6.8 Disadvantages of Communication Satellite

- The satellite has a life which is about 12 – 15 years. Due to this fact, another launch has to be planned before it becomes un – operational.
- Satellite manufacturing requires more time. Moreover, satellite design and development require a higher cost.
- Satellite once launched requires to be monitored and controlled on regular periods so that it remains in the orbit.
- The redundant component is used in the network design. This ensures more cost in the installation phase.

5.7 Computer Networking

Computer Network is an interconnection between computers or we can say computer network is group of computers linked to each other which enables one computer to communicate with another computer. It acts as basis of communication in Information Technology. It is system of connected computing devices and shares information and resources between them. The devices in network are connected by communication links and share data by data communication system.

An example of computer network includes let us think about classroom and in class, two friends are there with their own laptops, but communication between two processes is established even if the two laptops are physically separated means they are in computer network.

5.7.1 Types of Computer Networking

There are five main types of computer Networks:

1. LAN (Local Area Network)

Systems connected in a small network like in a building or a small office. It is inexpensive. Two or more personal computers can be connected through wires or cables acting as nodes. Transfer of data is fast and highly scores.

2. PAN (Personal Area Network)

The smallest computer networks. Devices may be connected through Bluetooth or other infrared enables devices. It has a connectivity range of up to 10 meters. It covers an area of up to 30 feet. Personal devices belonging to a single person can be connected to each other using PAN.

3. MAN (Metropolitan Area Network)

A network that can be connected within a city, for example, cable TV connection. It has a higher range. This type of network can be used to connect citizens with the various organizations.

4. WAN (Wide Area Network)

A network which covers over a country or a large range of people. Telephonic lines are also connected through WAN. Internet is the biggest WAN in the world. Mostly used by Government organizations to manage data and information.

5. VPN (Virtual Private Network)

A Network which is constructed by using public wires to connect to a private network. There are a number of systems which enable you to create networks using the internet as a medium for transporting data.

5.7.2 Advantages of Computer Networking

1. Ease of accessibility

Modern computer networks are easy to explore. So, even if you are a kid or a person new to technology, you'll find it easy to connect.

2. Flexibility

It means that different people will be able to explore different things as per their requirements. For this purpose, computer networks provide you a wide array of choice to share a particular piece of information. For example, e – mail or messaging apps like whatsapp. So, there is flexibility for different users.

3. Convenient resources sharing

The main aim of a computer network is to enable sharing of resources among its users. You can use resources such as printers, scanners and photocopy machines that can be shared across multiple users. This resource sharing is important for big companies as they can use one single common network for connecting with their employees.

4. Connectivity

Computer networks improve connectivity irrespective of a person's location. In these testing times, we can see live examples as we use video call apps or Google documents to connect with our friends and colleagues.

5. Security

Computer networks provide security through authorization. Authorization is done via user id and password. So, it ensures that when we log in, we are only able to do it when there is a perfect match between our details and the details stored in the database.

6. Great storage capacity

Organization has an abundance of data that needs to be stored. For that purpose, they are required to store them in a central server. A central server is a remote server that is accessible to each and every employee. So, if in case one loses the data, others have it.

7. Reduced cost

Cost is one of the crucial factors that one needs to consider while evaluating the pros and cons of a particular technology. In networking, a central server is used that enables companies to store files in one place and thus reducing file storage expenses.

5.7.3 Disadvantages of Computer networks

1. Lack of robustness

Computer networks rely on the main server called the central server. If the central server malfunctions or there is an issue in the central server, then the entire network would stop functioning. So, this is a major disadvantage due to dependency on a single server.

2. Spread of Computer Virus

As computers in a network are interconnected, there is a high probability that if one of the computers is affected by the virus, others too can get affected. This spread can actually damage the entire system. Also, if the central server gets corrupted, then it's quite dangerous as the network depends on the central server.

3. Independence issues

The entire networking system is based on a centralized server, so it lacks independence. So, individual users lack the freedom to use the computer as per their wish.

4. Lack of productivity

Since a network has a lot of advantages and applications, it is certain that it results in simultaneous use of many services that cause distraction. Thus, due to employees focusing on a myriad of tasks, productivity issues are quite common.

5.8 Word Processor

A word processor is a type of software application used for composing, editing, formatting and printing documents. Word processors have a variety of uses and applications within the business environment, at home and in educational contexts. It is an important tool to document something that to write about some information on the topic. It is a great alternative to pen and paper.

One example of a Word Processor is Microsoft Word, but other word processing applications are also widely used. Examples include: Microsoft work word processor, open office writer, Word Perfect and Google Drive Document.

In addition to typing text, the word processor allows you to add content such as pictures, tables, and charts to your documents as well as decorative items including borders and clipart. The editing and formatting capabilities of the word processor demonstrate the applications true power. Text can be inserted, edited, moved, copied or deleted within your document and the appearance of the text can be modified in numerous ways. Most word processor also give you're the ability to check your spelling and grammar and many have built in dictionaries and other tools to assist you in your writing.

5.8.1 Features of Word Processor

Insert text: Allows you to insert text anywhere in the document.

Delete text: Allows you to erase characters, words, lines or pages.

Cut and paste: Allows you to remove a section of text form one place in a document and insert (paste) it somewhere else.

Copy: Allows you to duplicate a section of text.

Page size and margins: Allows you to define various page sizes and margins, and the word processor will automatically readjust the text so that it fits.

Search and replace: Allows you to direct the word processor to search for a particular word or phrase.

Word wrap: Automatically moves to the next line when you have filled one line with text, and it will readjust text if you change the margins.

Print: Allows you to send a document to a printer to get a hard copy.

File management: Provides file management capabilities that allow you to create, delete, move and search for files.

Font specification: Allows you to change fonts within a document. For example, you can specify bold, italics and underlining. Most word processors also let you change the font size and even the typeface.

Windows: Allows you to edit two or more documents at the same time. Each document appears in a separate window. This is particularly valuable when working on a large project that consists of several different files.

Spell checking: Identifies words that don't appear in a standard dictionary.

Footnotes and cross – references: Automate the numbering and placement of footnotes and enables you to easily cross – reference other sections of the document.

Automated lists: Automatically creates bulleted or number lists, including multi –level outlines.

Graphics: Allows you to implant illustrations, graphs, and possibly even videos into a document. Some word processors let you create the illustrations within the word processors let you create the illustrations within the word processor; others let you insert an illustration produced by a different program.

Internet features: Allows you to implant web links into their documents and format their documents for the web. Some also link to web services that can help users create their documents.

5.8.2 Word Processor using in Mathematics Education

Word Processor can be used to write mathematics journals in which students make entries such as explaining and justifying problem solutions relating their understanding of a concept or preparing a mathematics project report.

5.8.3 Advantages of Word Processor

- Time Saving - people can generally type words faster than they can write using a pen. This means they take less time to create a document when typing.
- Clarity - Word processors have fonts that help make the document clear or easy to read as compared to different handwriting.
- Synchronization - people in two different locations can create a document through synchronization. This means both can edit and add content almost simultaneously.
- Spell checking - word processors have automatic spell-checking features that help in error elimination. They also allow for grammar correction in certain instances.

5.8.3 Disadvantages of Word Processor

- Expensive - not everyone can afford a computer which is essential in using word processors
- Need for powered computer – when there is a power blackout, word processors cannot be used since computers require power to function.
- Too many options – some word processors have too many options which make them difficult to use for those who do not have experience.

5.9 Blended Learning

Blended learning is a planned combination of online learning and face-to-face instruction using variety of learning resources. It is a flexible learning strategy that integrates innovative and technological advances of online learning with interaction and participation of traditional face-to-face classroom learning. Blended learning as a way of meeting the challenges of tailoring learning and development to the needs of individuals by integrating the innovative and technological advances offered in the best of traditional learning.

Blended learning strategies vary according to the discipline, the year level, student characteristics and learning outcomes, and have a student-centered approach to the learning design. Blended learning can promote learner s access and flexibility, increase the level of active learning, and achieve better student experiences and outcomes.

For teachers, blended learning can improve teaching and class management practices. A blend might include:

- Face-to-face and online learning activities and formats
- Traditional classes with different modalities, such as regular, weekend, evening, part time, semester
- Use of technology interfaces like social media, wikis and various web sources
- Group work, Simulation, debate, Online Assignments, Practical etc.
- Both usual classroom human factors and digital learning resources of the web
- Psychological concerns are addressed in the face-to-face interaction and technological

Concerns are addressed in the online learning

So, incorporating all these aspects in the learning environment, “Blended learning should be viewed as a pedagogical approach that combines the effectiveness and socialization opportunities of the classroom with the technologically enhanced active learning possibilities of the online environment, rather than a ratio of delivery modalities. In other words, blended learning should be approached not merely as a temporal construct, but rather as a fundamental redesign of the instructional model with the following characteristics:

- A shift from lecture- to student-centered instruction in which students become active and interactive learners (this shift should apply to the entire course, including face-to-face contact sessions).
- Increases in interaction between student-instructor, student-student, student-content, and student-outside resources
- Integrated formative and summative assessment mechanisms for students and instructor.

5.9.1 Components of Blended Learning

There are five components of blended learning. They are:

- Live events
- Self-paced learning
- Collaboration
- Assessment
- Performance support

Live events

Synchronous, teacher-initiated learning environment in which all learners participate at die same time. Teacher may use lecture, demonstration, discussion or computer-based instruction to all the students in live. For many learners, nothing can replace the ability to tap the expertise of a live teacher. It can be in real classroom or can be in virtual learning environment.

Self-paced learning

Learning experiences that the learner completes individually at his own pace and on his time, such as recorded live events, Internet-based or CD-ROM-based: it implies on demand learning at a pace is managed or controlled by the learner.

Collaboration

It implies a more dynamic communication and interaction among many learners that brings about knowledge sharing. Collaborative learning has more advantages which are not available from traditional instruction because a group can accomplish meaningful learning and solve problems better than any individual. It can be extended from discussion in the live classroom to synchronous communications in chat room or in open discussion forums and asynchronous communication by e- mail and threaded discussion.

Assessment

It is both live and online measure of learners' knowledge to determine prior knowledge as well as to measure learning transfer.

Performance support

These are the reference materials that enhance learning, retention and transfer. It may be printable references, downloaded multimedia learning objects, documentation etc.

5.9.2 Blended Learning Approach in Teaching Mathematics

In mathematics Education, many mathematicians acknowledge the value and importance of Blended Learning approach in teaching mathematics, taking advantage of the different mathematical software that can be used in teaching. We use MATLAB to teach mathematical concepts.

5.9.3 Advantages of Blended Learning

- Blended Learning that uses apps, games, or measurable programs to teach concepts allows students to engage the material at their own pace.
- It can promote deeper learning, reduce stress, and increase student satisfaction.
- Teacher can become more engaged with their students.
- Blended learning presents an increased opportunity for students to connect with their professors and teachers.
- Students have ability to track their progress.

5.9.4 Disadvantages of Blended Learning

- On the one hand, there are still gaps between young people and adults, which still make it difficult for all teachers to access blended learning experiences.
- The other great limitation is the social and economic gap that determines, in many cases, that certain areas and groups do not have access to the necessary technological equipment and are once again excluded from higher-level educational offers.
- In some cases, community technology centers can solve these problems, but we certainly must work to overcome these types of marginalization.
- Strategies have not been developed to maintain student motivation and make them feel integrated into a group.
- The very large offer of courses can also be considered as a weak point of e-learning, given the inequality of quality between them. This generates doubts and uncertainty in the user, and results in them preferring to enroll in a conventional course.
- Many of the degrees obtained through this learning system are not officially recognized.

5.10 Flipped Learning

Flipped Learning is a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter.

The flipped classroom is a pedagogical model in which the typical lecture and homework elements of a course are reversed. Short video lectures are viewed by students at home before the class session, while in-class time is devoted to exercises, projects, or discussions. The flipped classroom describes a reversal of traditional teaching where students gain first exposure to new material outside of class, usually via reading or lecture videos, and then class time is used to do the harder work of assimilating that knowledge through strategies such as problem solving.

5.10.1 Flipped Learning in Teaching Mathematics

Flipped learning approaches in mathematics learning, it could be essential for students to acquire knowledge in a confident and adaptable environment actively. Teacher had created all the videos, added the questions, uploaded. After develop the presentation to introduce the flipped classroom to students.

The following resources for Flipped Learning in Mathematics are,

- You tube: Video Lessons.
- 3Blue 1Brown: Voice guides you through neat mathematical topics with excellent animations.
- Khan Academy: Blackboards with lots of colours are using to provide short instructional videos.

5.10.2 Four Pillars in Flipped Learning

1. Flexible Environment

Flipped Learning allows for a variety of learning modes; educators often physically rearrange their learning spaces to accommodate a lesson or unit, to support either group work or independent study. They create flexible spaces in which students choose when and where they learn. Furthermore, educators who flip their classes are flexible in their expectations of student timelines for learning and in their assessments of student learning.

2. Learning Culture

In the traditional teacher-centered model, the teacher is the primary source of information. By contrast, the Flipped Learning model deliberately shifts instruction to a learner-centered approach, where in-class time is dedicated to exploring topics in greater depth and creating rich learning opportunities. As a result, students are actively involved in knowledge construction as they participate in and evaluate their learning in a manner that is personally meaningful.

3. Intentional Content

Flipped Learning Educators continually think about how they can use the Flipped Learning model to help students develop conceptual understanding, as well as procedural fluency. They determine what they need to teach and what materials students should explore on their own. Educators use Intentional Content to maximize classroom time in order to adopt methods of student-centered, active learning strategies, depending on grade level and subject matter.

4. Professional Educator

The role of a Professional Educator is even more important, and often more demanding, in a Flipped Classroom than in a traditional one. During class time, they continually observe their students, providing them with feedback relevant in the moment, and assessing their work. Professional Educators are reflective in their practice, connect with each other to improve their instruction, accept constructive criticism, and tolerate controlled chaos in their classrooms. While Professional Educators take on less visibly prominent roles in a flipped classroom, they remain the essential ingredient that enables Flipped Learning to occur.

5.10.3 Advantages of Flipped Learning

- Encourages students to utilize digital content to explore knowledge beyond textbooks.
- Improves personalized learning and teaching methods.
- Gives rise to student centered teaching
- Improves visualization and understanding capacity.
- Smoothens student – teacher and student – student collaboration and interaction.
- Enables students to learn at their own time and pace.
- Provides a good platform for students to ask questions
- Online tutorials and lectures supply basic and essential knowledge and allow students to review the topics and again as many times as possible.

5.10.4 Disadvantages of Flipped Learning

- Many argue that flipped board divides students digitally.
- The technology required (computers, smart gadgets, internet, etc.) are not accessible to many individuals.
- Flipped classrooms that utilize videos to deliver instruction sometimes suffer technical challenges / difficulties.
- Increases the time spent by students on computer screens.
- The additional time spent by students at home preparing for topics is highly debated.
- Threatens the traditional classroom teaching method.

5.11 Artificial Intelligence: (AI)

The computers of 1990s are said to be Fifth Generation Computers and are going to use the concept of Artificial Intelligence (AI). Their speed is extremely high. An AI computer can think, talk and take decision like human being of consulting its huge knowledge data base. This generation is expected to function on the concept of “Parallel Processing” as against the “serial processing done” by today’s computers. These will act as “reservoirs of human knowledge” and act diligently at par with human intelligence.

It is when machines engage in high – level pattern matching and learning in the process. It is the cognitive science and the history of its evolution suggests that it has grown out of the knowledge derived from disciplines such as Science, Mathematics, Philosophy, Sociology, Computing and others.

“Artificial Intelligence is not magic; it’s just Mathematics”. Artificial Intelligence and Mathematics are the two branches of the same tree. Artificial Intelligence can help the students learn better and faster when paired with high – quality learning materials and instruction. In some cases, such as automated easy scoring, teachers and students do not directly experience the benefits of the tools.

5.11.1 Artificial Intelligence uses in Education

Artificial Intelligence has recently attracted attention for its potential in improving various fields, in teachers and students have a wide range of tools available, ranging from Google searches, in which alternate search terms are instantly suggested, citation generators, plagiarism checkers. An astounding amount of information generated instantly, far more advanced from thirty years ago and society’s reliance on card catalogues, calculators and books.

The main branches of Mathematics involved in Artificial Intelligence are:

- Linear Functions
- Linear Graphs
- Linear Algebra
- Probability
- Statist

5.11.2 Advantages of Artificial Intelligence

- It defines a more powerful and more useful computers It introduces a new and improved interface for human interaction.
- It introduces a new technique to solve new problems.
- It handles the information better than humans.
- It is very helpful for the conversion of information into knowledge.
- It improves work efficiency so reduce the duration of time to accomplish a task in comparison to humans.

5.11.3 Disadvantages of Artificial Intelligence

- The implementation cost of AI is very high.
- The difficulties with software development for AI implementation are that the development of software is slow and expensive. Few efficient programmers are available to develop software to implement artificial intelligence.
- Another concern regarding the widespread use of this technology pertains specifically to education students who do not learn how machines work will find themselves at a significant disadvantage if their field relies heavily on computer science skills going forward because they would lack the necessary knowledge.

5.12 Augmented Reality

- Augmented reality has quickly become one of the most popular trends among software and hardware developers. There are two terms which are very common in this generation such as VR and AR.
- VR refers to virtual Reality which deals with simulated or virtual world. It ignores the real world around us completely. Once the person wears the VR device, he / she feels that they have moved physically though they have not moved actually.
- AR refers to Augmented Reality which is combination of actual reality, virtual reality and real world surroundings. As the name suggests AR adds or augments additional stuff to the real world around us. It makes surrounding world more interactive which can also be manipulated digitally.
- AR is used in various domains for wide variety of applications. The common sectors where it is used are education, Gaming industry, Engineering, Medical, military etc.The above figure is Augmented reality concept. Augmented reality system consists of sensors, user input devices, CPU and display / output devices. Example of AR device is Microsoft HoloLens.

5.12.1 Augmented Reality in Education

Augmented reality (AR) technology is introduced to support educators in their teaching-learning process especially when classes are conducted fully online. Feedback was being obtained from educators and students regarding the AR interface, understanding through visualization and inspiration in learning.

Using augmented reality apps like Quiver, Elements 4D, and Aurasma, you can engage students with learning materials that spring to life in three-dimensional overlays.

Quiver: Students go beyond the pictures in their textbooks to interact with three - dimensional figures.

Elements 4D: Elementary, Middle, and High school students.

Blipper: Completely transform a child's reading experience by pushing him or her to think more deeply and explore a topic in a new way.

Aurasama: Users can upload trigger images of their choice and add videos to make their very own augmented reality experience.

5.12.2 Augmented Reality in Teaching Mathematics

Augmented Version allows us to generate 3D objects and mathematical functions. Mathematics apps, if used appropriately as part of classroom program, add variety and can enhance mathematical thinking & understanding. Augmented reality explores the development of spatial intelligence in relation to mathematical learning, our classroom experience revolves around the open resource application, Geogebra AR, for mobile devices which helps students learn analysis, geometry, algebra and calculus. This mathematical application is specially designed for educational purposes. It is promoting mathematical self-learning. It is effective for teaching learning of mathematics and improving the understanding of abstract concepts and enabling their correlation through meaningful and effective learning experience

5.12.2 Advantages of augmented reality

Access to learning materials. Educational institutions often lack up-to-date teaching materials; many students have to study outdated information or search for information on their own at home. In an AR application, you can download the latest data and display it in an interactive format.

Access to virtual equipment. In cases where it is necessary to explore specific equipment and learn how to use it, an augmented reality application can present the required 3D model and helpful explanations. This adds practical value to the traditional learning materials.

Higher student engagement. Students study the material more deeply through immersion, which makes it feel more real and relevant. This is a substantial change of pace and an exciting experience for many.

Faster learning. A new way of presenting information helps reduce the overall learning time. Subsequently, there is more time for practice and in-depth examination of niche topics.

Safer practice. In such cases as anatomy lessons, students no longer need to dissect real animals; this can be accurately simulated through software. Students get the same level of practice without harming anything or working with dangerous tools.

5.12.3 Disadvantages of augmented reality

- It is expensive to develop the AR technology-based projects and to maintain it. Moreover, production of AR based devices is costly.
- Lack of privacy is a concern in AR based applications
- In AR, people are missing out an important moment.
- Low performance level is a concern which needs to be addressed during testing process.

Some educators do not embrace modern technologies, or even know how to use them. This can be a problem when the teacher is obligated to show how the device works and help students in case of difficulties.

5.13 Conclusion

Instructional Media have provided to help in classifying concepts, stimulating group and individual activities, developing a collective critical awareness, changing attitudes, imposing a new structure or organization on certain subjects and encouraging originality and creativeness. Therefore, teachers have to be properly motivated and made interested in the use of such materials. And they have also to be trained and oriented in the adequate use and maintenance of the materials.

As we know, good teachers are not born, they are made. Training in the methods, techniques, use of various means and media help a teacher to be good and efficient. All illustrative materials will be “aids” to his / her teaching. His / Her educational outputs will be optimized through judicious uses of modern methods, techniques and mass media.