1

CONCEPT OF INFORMATION, COMMUNICATION AND EDUCATIONAL TECHONOLGY

Unit Structure :

1.0 OBJECTIVES

After reading this unit you will be able to :

- State the meaning of information technology, communication technology and instructional technology.
- Define the term Educational Techonology
- Explain the concept of Educational Technology
- Justiy the need & Significance of ICT in Education
- Explain the historical perspective of Educational Technology.
- State the emerging trends in Educational Technology.
- Analyses the relation among ET., IT. CT. etc.
- Differentiate among T, IT, CT etc.

1.1 INTRODUCTION

Globalization and technological change processes that have accelerated in tandem over the past years have created a new global economy "Powered by technology, fueled by information and driven by knowledge." The emergence of this new global economy has serious implications for the nature and purpose of educational

institutions. As you know the half life of information continues to shrink and access to information continues to grow exponentially, schools can not remain mere venues for the transmission of a prescribed set of information from teacher to student over a fixed period of time. Rather Schools must promote "Learning to Lear" i.e. the acquisiton of knowledge and skills that make possible continous learning over the lifetime. "The illiterate of the 21st century" according to futurist Alvin Toffler, "Will not be those who can not read and write, but those who can not learn, Unlearn & relearn", Concerns over educational relevance and quality co-exist with the imperative of expending educational opperunities to those made most vulnerable by globalization - developing countries in general, low income groups, girls and women and low skilled workers in particulars. Global changes also put pressure on all groups to constantly acquire and apply new skills. The international Labour organization defines the requirements for education and training in the new global economy simply as a "Basic education for all," "Core work skills for all" and "Lifelong learning for all."

In this connection, Information and communication technologies (ICTS) which include radio and television, and the Internet - have been touted as potentially and powerful enabling tools for educational change and reform. When used appropriately, different ICTS are said to help expand access to education, Strengthen the relevance of education to the increasingly digital workplace, and raise educational quality by, among others, helping make teaching and learning into an engaging, active process connected to reallife.

However, the effective integration of ICTS into the educational system is a complex, om ultifaceted process that involves not just technology, indeed, given enough initial capital, getting the technology is the easiest part - but also curriculum and pedagogy, Institutional readiness, teacher competencies and longterm financing, among others.

In this module we will get an overal idea about the concept of ICTS. We will also dicuss the need & significance of ICTS in Education with specific reference to historical perspective and emerging trends.

1.2 CONCEPT OF INFORMATION TECHNOLOGY :

Today's world is a world of information explosion. This information explosion is taking place in such a fast speed that even a literate person is feeling as if he or she is illiterate being not able to cope up with such an information explosion. Here the question arises how is one to cope up with it? The answer is, information technology (IT) that can help in coping with the information

explosion. So, we can say that "Information Technology is nothing but coping up with explosion of Information."

Information technology (IT) is the acquisition, processing, storage and dissemination of vocal, pictorial, textual and numerical information by a micro-electronics - based combination of computing and telecommunication. The term in its modern sense first appeared in a 1958 article published in the Harvard Bussiness Review, in which authors Leavitt and whisler commented that "the new technology does not yet have a single established name. we shall call it information technology."

It spans a wide variety of areas that include but are not limited to things such as processes, computer software, computer hardware, Programming Languages and data constructs. In short, anything that renders data, information or perceived knowledge in any visual format whatsoever, via any multimedia distribution mechanism, is considered part of the domains space known as Information Technology.

Meaning of Information Techology (IT) :

Information Technology consists of two words Information and Technology. If you know the two words you can understand the word information technology together.

The term "Information" refers to "any communication or representation of knowledge such as facts, data or opinions in any medium or for, including textual, numerical, graphic Cartographic, narrative or audiovisual forms."

"Technology is the practical form of scientific knowledge or the science of application of knowledge to practical."

"Information Technology is any equipment or interconnected system or sub system of equipments that is used in the acquistion, storage manipulation, management transmission or reception of data or information."

Definition of Information Technology:

"Information Technology is a scientific, technological and engineerning discipline and management technique used in handing the information, it's application and association with social, economical and cultural matters."

- UNSECO

"Information technology is a systemic study of artifacts that can be used to give form to facts inorder to provide meaning for decision making, and artifacts that can be used for organization, processing, communication and application of information"

- Darnton and Giacoletto

From the above discussion we can conclude that information technology refers to the information processing of the software application on operating systems or hardware applications that includes computers, videos, telephones and related equipments of telecommunications, tapes, CDs etc.

Characteristics of Information Technology :

Information Technology has the following Characteristics :

* Acquistion, Storage, manipulation, management, transmission or reception of data or information.
* Real time access to information.
* Easy availability of updated data
* Connecting Geographically dispersed regions
* Wider range of communication media.

Check your progess : 1

1. Define Information Technology
2. What is Information Technoogy? Explain its' Charateristics.

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1.2.1 Concept of Communication Technology

Communication Technology is also comprised of two words like "Communication & Technology". We have already discussed that technology is the science of the application of knowledge to practical purposes. You also know that information means any communication or representation of knowledge in any form. Now we will know what communication is?

"Communication" is an integral part of human existence. It is communication that decides the very identity of human beings Modern society is turning into an information society and communication is the exchange of information. It is the process & transfering information form a Sender to a receiver with the use of a medium in which the communication information is understood by both sender and receiver.

"Communication Technology" implies the knowledge, skills and understanding needed to exchange information verbally or non-

verbally. It is processing of information interms of accessing information, decoding information and sending it via a medium and changer to the receivers. Medium or channel can be written or oral or gesture form of information through speech, action or any electronic machine.

"Communication Technology is the electronic systems used for communication between indeividuals or groups. It faciliates communication between individuals or groups. Who are not physically present at the same location. Systems such as telephone, telex, Fax, radio, T.V. and Video are included, as well as more recent computer based technologies, including electronic data interchange and e-mail."

In short, communication technolgoy is the activity of designing and constructing and maintaining communication systems.

1.2.2 Concept of Instructional Technology

J. K. Galbriath in his book a the new Industrial state has given two main characteristics of every technology.

They are:
- Systematic application of scientific knowledge to the practical tasks and
- the division of the practical tasks into sections and Subsections.

Any Subject who meets these two norms of the characteristics is called instructional Technology. Instructional technology, today is widely accepted as the application of systems approach in the systemic design of a learning system and as a method or approach combined with the appropriate and necessary media and material to bring about improvement in teaching - learning - evaluation process.

Instructional Technology is neithers technology in education nor technology of education but both and all pervasive which pervades the whole teaching learning or engineering put it should be taken as a sum total of all such aspects, which go a long way in shaping the personality of the learner in a meaningful context.

Definition of Instructional Technology :
Instructional technology is just what it sounds lie, using computers, CD Roms, interactive media, modems, satellites, teleconferencing and other technological means to support learning.

Instructional technology has several different aspects. It includes the following.

- the process of designig instruction.
- the application of learning theories and
- styles to designing instruction
- the selection of materials and tools to design and implement a design.
- the evaluation of designs.
- the effective use of team work and
- the use of technology in support of the development and delivey of instruction.

According to the Association fo Educational Communications and Technoogy (AECT)

"Instructional Technology is often reffered to as a part of educational technology but the use of these terms has changed over the years. While instructional Technology covers the processes and systems of learning and instruction, educational techology includes other systems used in the process of developing human capabilities"

Nature of Instructional Techonology :
- It's basis is science
- It studies the effect of science and technology upon education.
- It is a contiuous, dynamic, progressive & effect producing method.
- It developes new concepts like programmed learning, microteching, Simulated teaching, video tape, projector and computer etc.
- It accepts school as a system.
- It can not solve each an every problem of education. It can be used succesfully in teaching and instructional system only.
- It can not replace the teacher

Characteristics of Instructional Technology :
- It is helpful in achieving cognitive objectives.
- It can meet the shortage of effective teachers
- With it's help, the purose can learn according to his needs and speed.
- It can control the individual differences.
- Analysis of contents in depth is carried out in this technology.

Check your Process - II
1. What is communication Technology?
2. What do you mean by instructional technology?
3. Differentiat between Information technology & instructional technology.

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1.3 CONCEPT OF EDUCATIONAL TECHNOLOGY

Meaning of "Educational Technology"

Words are of little interest in themselves but they do indicate changes in thinking. Once the climate of opinion is right, one may arrive at the word "Educational Technology" by different routes. One route starts from audio-visual aids! At first sight, it would appear that teaching machines could go under this heading; but those who work with teaching machines emphasise the importance of programmes rather than machinery. Hence the heading has to become audio-visual aids and programmed instruction, an odd pairing since some forms of programmed instructions use only the printed page. The new term "educational technology" suggests itself and it may be used to refer to a little beyond the use of equipments and techniques that are associated with equipments. On the other route, starting from programmed instruction, a wider conception of educational technology tends to be reached. It is difficult to keep programmed instruction within narrow bounds. Programmed instruction begins to look as though it is a part of something larger and this is educational or instructional technology. Programmed instruction emphasises that the aims of teaching should be analysed, the methods of accomplishing them made explicit and the effects assessed as precisely as possible. These basic ideas are applicable to the systems of instruction that do not necessarily include the use of teaching machines.

The term "technology", as Ofiesh (1964) observes, implies the application of science to art. When we apply the science of learning and communication to teaching, we evolve a technology, i.e., the technology of instruction. In modern education, we can witness the impact of two forces; one, of physical sciences and electronics and the other, of behavioural sciences, operating on the

process of instruction. Both these forces have contributed to the evolution and growth of educational technology. Fig. 1.2 makes the concept clear.

The interaction of physical sciences with education provides us with traditional aids, tools and hardwares such as paper, ink, books, radios, lin-guaphones, films, etc. and more sophisticated modern hardware like electronic computers, space satellites, language laboratories etc.
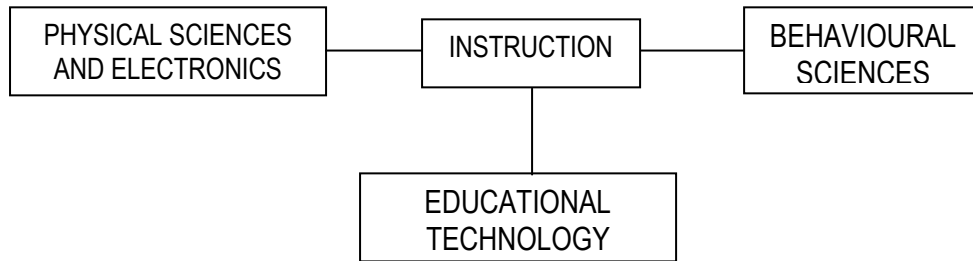
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┌────────────────────┐     ┌─────────────┐     ┌──────────────┐
│ PHYSICAL SCIENCES  │─────│ INSTRUCTION │─────│ BEHAVIOURAL  │
│  AND ELECTRONICS   │     │             │     │   SCIENCES   │
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                           │ EDUCATIONAL │
                           │ TECHNOLOGY  │
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Fig. 1.2

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┌────────────────┐     ┌─────────────┐     ┌──────────────┐
│   EDUCATION    │─────│ INTERACTION │─────│   PHYSICAL   │
│                │     │             │     │   SCIENCES   │
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              ┌───────────────┴────────────────┐
              │  TRADITIONAL AND MODERN         │
              │  ELECTRONIC GADGETS             │
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              │  EDUCATIONAL TECHNOLOGY         │
              └────────────────────────────────┘
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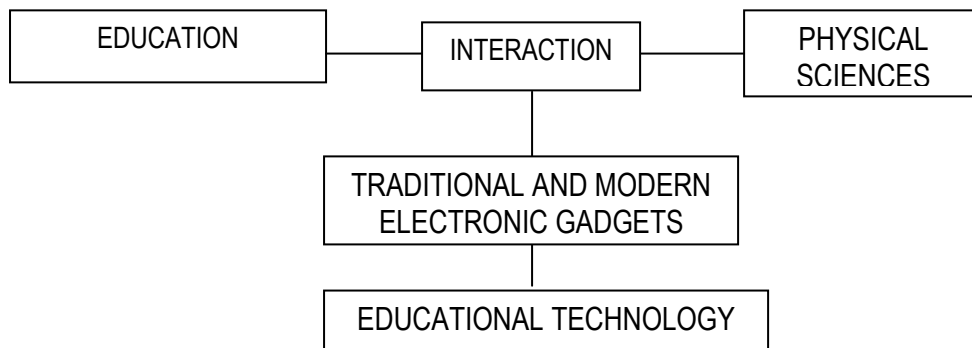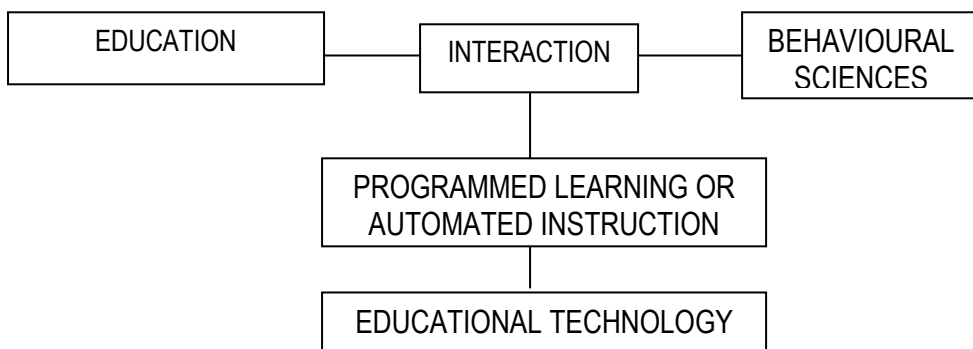
Fig. 1.3

The interaction of behavioural sciences with education has generated a new concept and new technique of programmed learning or automated instruction.

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┌────────────────┐     ┌─────────────┐     ┌──────────────┐
│   EDUCATION    │─────│ INTERACTION │─────│ BEHAVIOURAL  │
│                │     │             │     │   SCIENCES   │
└────────────────┘     └──────┬──────┘     └──────────────┘
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              ┌───────────────┴────────────────┐
              │  PROGRAMMED LEARNING OR         │
              │  AUTOMATED INSTRUCTION          │
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              ┌───────────────┴────────────────┐
              │  EDUCATIONAL TECHNOLOGY         │
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Programmed Learning and Educational Technology:

Educational technology can be regarded, as the application of systematic knowledge about learning and instruction to teaching and training with the aim of improving their quality and efficiency. For this reason, a wide range of presentation, control and feedback devices may be employed such as teaching machines, stimulators and computers. It should, however, be emphasised that techniques such as critical path analysis, curriculum development methods and task analysis are essential components as well as the hardware system. In fact, as long as programmed learning co-ordinates these techniques, it is woven into the fabric of educational technology.

The point is that it is not merely a system of presentation, a particular technique or a set of principles; it is a methodology for discovering an efficient means of organising learning situatiens to attain specified objectives.

Looked at from another point of view, the job of the programmer can be regarded as that of providing appropriate opportunities for the pupils to learn. It is his task to discover what these may be and to arrange the environment of learning, as far as he is able to optimise these opportunities. He will, for example, have to determine in some cases whether simulation is as useful as the real thing in some learning situations.

Programmed learning, though wide in scope, is only a part of the broader concept of educational technology which must include many areas such as the problem of innovation, resources of learning, standardisation and compatibility of system components, the training of personnel, educational productivity and the design of educational plant.

If educational technology possesses any value at all, it is vital that the teachers in training shall be introduced to its philosophy and techniques.

In fact, there are two meanings attached to the definition of the term •'educational technology." One meaning refers to the detailed application of psychology of learning to practical teaching problems. The second meaning refers to the application of engineering principles in the development of electro-mechanical equipments of such devices—pictures, tape-recorders, computers etc.

These two meanings of educational technology interact in the design and use of equipment to provide control over the learning situation, a rich array of stimulus materials (e.g., films) and interaction between responses of the learner and the presentation of instructional material.

However, the correct meaning of the term "educational technology" has been differentiated by Lumsdaine by using two different symbols: ET-1, ET-2. 'ET-1' refers to the application of technology to instrumentation useful to the process of teaching. This meaning in its essence is a hardware approach. It stresses the need to develop and use audio-visual aids for teaching. Due to this concept, the process of leaching is mechanised through production and use of teaching aids.

ET-2 means the application of scientific principles to instruction and hence the emphasis is on objectives and performances. It is the software aspect. All programmed learning materials and teaching machines come under this.

Educational technology is thus the application of scientific knowledge about learning and conditions of learning to improve the effectiveness of teaching and learning.

Nature of Educational Technology

So far no one is universally agreed upon the definition of the term "educational technology." For most people the term brings to mind such electronic gadgetry as film projectors, tape recorders, television sets and micro-computers used as teaching tools. Other people add such nonelectrical instructional materials as books, photographs and charts. Still others subscribe to a definition that includes not only items used in teaching but also equipments used in educational administration—keeping students' records on the micro film, communicating between schools by radio, correcting entrance examination papers with the aid of a computer and the like.

In effect, educational technology can mean different things to different people. Even those who have specialised in this field have failed to arrive at a proper definition. However, in an attempt to satisfy everyone, the Association for Educational Communications and Technology in the United States have come to the following definition: "Educational technology is a complex integrated process involving people, procedures, ideas, devices and organisation for analysing problems and devising, implementing, evaluating and managing solutions to those problems involved in all aspects of learning."

Extensive use of educational technology requires a left of change on the part of the teacher. This is because some technologies are not accepted or only partly accepted because they require too many adjustments of traditional methods of instruction or administration. Frequently, teachers avoid attempting a new instructional technique because it requires too much from them'in energy, time, patience or skill to become adept in its Use. Altering old leaching habits in order to master new ones entails not only the

expenditure of energy but also the risk of a teacher looking foolish by committing embarrassing errors when attempting new techniques in the classroom. In addition, teachers who have traditionally perceived themselves as classroom's chief performers — lecturing, conducting recitations, leading class discussion — can feel demoted to a less prestigious educational role when they are asked to have reading materials, radio, television or computers to deliver the content of lessons.

Thus the amount of change required in the existing habits and the fear of failure or of decreased prestige can affect the teachers' willingness to accept a new technology. Electronic equipment may frighten teachers with its apparent complexity. At least a part of this fear comes from the expectation that something may go wrong during the lesson, making the teacher appear inept or unable to control the teaching situation. To utilise educational television (ETV), many teachers think that much training equipment and general reevaluation of teaching goals and activities would be required. However, such fears are baseless.

The evolution of technology has in fact ushered in a kind of revolution in our occupational, social and educational world. But it seems a little awkward to observe that whereas the contribution of some kind of technology is visibly felt in respect of the operation of our hospitals, factories, farms and offices, our classrooms have remained a unique example of backwardness by remaining insensitive to the technological inputs and their influences. The reasons for this are not far to seek. Our teacher and via him/her the processes of educational resource generation have not properly assimilated or understood the importance and relevance of technology for the classroom. Also the overall ecology of the formal educational system is responsible to a considerable extent for this state of affairs.

Earlier educators used to advocate the use of audio-visual aids in the process of teaching in addition to supplementary aids such as pictures, charts, maps, models and various audio-aids. Gradually, the emphasis shifted to the employment of costly gadgets such as video and computers and now the multi-media approach.

In brief, it may then be said that the entire principle of educational technology lies in the :
(1) Useof a broad range of resources;
(2) Emphasis on individualised learning; and
(3) Emphasis on systems approach to education.

Scope of Educational Technology
By taking into consideration the usefulness of educational technology in all branches of education, one dare not deny the

vastness of its scope. It modifies the learner's environment through the various techniques of presentation, arrangement of learning activities and organisation of physical surroundings.

The very purpose of educational technology is to facilitate and improve the quality of human learning. It is concerned with achieving the goals—of maintaining internal discipline, adapting to its environment etc. For solving the varied problems of education successfully, educational technology consisting of various media of mass communication, suitable child learning processes, and modern testing and evaluation techniques are essential. Especially in developing countries like India, it has to be mastered and utilised by educationists if they are to keep pace with each other and catch up with the developed nations. As such both quantitative expansion and qualitative improvement of education can be facilitated and accelerated with the help of educational technology.

Today, technology of education is being developed with the aim not only of making education more widely available, but also of improving the quality of education which is already available.

Educational technology is conceptualised audio-visual aids. What can it achieve most? Only to improve the quality of message and if it is taken in the form of problem-oriented technique, then its main concern will be the production of teaching-learning material. But both these meanings make the scope limited because educational technology is also concerned with the management and organisation of man and material both, so that they achieve the specific objectives of planning and implementation.

Educational technology is concerned with providing appropriately designed learning situations, which hold in view the objectives of teaching. It modifies the learner's environment through the varied techniques of presentation, arrangement of learning activities and organisation of social and physical surroundings. The purpose of educational technology is to improve the quality of human learning.
The uniqueness of educational technology is characterised as:

(1) Use of a broad range of resources fo: learning;
(2) Emphasis on individualised learning; and
(3) Use of systems approach. The effectiveness of educational technology depends on:

(1) Ability to achieve goals;
(2) To maintain itself internally; and
(3) To adapt to its environment.

Educational technology is concerned with the disciplined and systematic approach to education and training. It is a sort of

investment in national development. Employment structures can be neatly geared to make the best need of development. The entire educational system is educational technology adapting itself to the changing environmental conditions. Thus ihe scope of educational technology has become very vast.

Technology includes:
(1) Preparing pupils for learning experience;
(2) Reinforcing their values while pupils are sharing the ex-
       perience;
(3) Relating the experience with the lesson and thus stimulating
       further learning.

However, the factors responsible for the progress of educational technology also cannot be overlooked. The factors causing ihe progress of educational technology are:
(1) Student flood due to population explosion;
(2) Acute resource scarcities;
(3) Rising costs;
(4) Unsuilability of output.

Hence there must be a focus on relationships of things between the various levels and internal working parts between the educational system and the environment.

There is a heavy stress on innovation to achieve the needed improvements and adjustments. This requires modernisation in educational management, modernisation of teachers, of learning processes, strengthening of educational finance and emphasis on non-formal education.

If educational technology will not cater to individualised learning, then there will be no individual development and social progress.

1.4 INFORMATION AND COMMUNICATION TECHNOLOGY IN EDUCATION

"Globalization and technological changes have created a new global economy powered by technology, fueled by information and driven by knowledge."

The emergence of this new global economy has serious implications for the nature and purpose of educational institutions. As the access to information continues to grow rapidly, schools cannot be contented with the limited knowledge to be transmitted in a fixed period of time. They have to become compatible to the ever expanding knowledge and also be equipped with the technology to deal with this knowledge.

Information and communication technologies (ICTs) — which include radio and television, as well as newer digital technologies such as computers and the Internet — have been proven as potentially powerful tools for educational change and reform. When used appropriately, different ICTs can help expand access to education, strengthen the relevance of education to the increasingly digital workplace, and raise educational quality by helping make teaching and learning into an active process connected to real life.

DEFINITIONS

"ICT stand for information and communication technologies and is defined, as a "diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information."

"ICT implies the technology which consists of electronic devices and associated human interactive materials that enable the user to employ them for a wide range of teaching - learning processes in addition to personal use."

These technologies include computers, the Internet, broadcasting technologies (radio and television), and telephony.

"ICT is that technology which uses the information to meet human need or purposes including processing and exchanging."

"Information and communications technology (ICT) in education is the processing of information and its communications facilities and features that variously support teaching, learning and a range of activities in education."

All these definitions combine Communication technology and Information technology that have thin line between them but cannot do away without each other. When these technologies are applied n the field of education, it is termed as ICT in education. The term too can be used as the connotation to the term Educational; technology because it also uses any hardware and software approaches that can enhance yield better learning outcomes. In the era of Computer technology the term ICT mainly focuses on the infrastructure, devices and sources of computer technology and thus it is imperative to discuss about the use of ICT in education by focusing mainly on Computer based technology.

CHARACTERISTICS OF ICT IN EDUCATION

ICT in education is any hardware and software technology that contribute in the educational information processing. In the context of present era, ICT mainly comprises of Computer technology with its hardware, like, Personal computer machine, infrastructure required for setting up Internet facility and also

software like, CD ROM including various programme packages, E-learning strategies etc.

ICT in education is any Information Technology that focuses on the acquisition, storage, manipulation, management, transmission or reception of data required for the educational purpose. For example, the information about students' records, their admissions, updates of their auricular and co-curricular activities.

ICT in education is any technology that deals with the exchange of information or in other'words communication in the teaching learning process. Uses of Electronic learning technology like, Teleconferencing, power point presentations, CD ROM are Communication Technology which is the part of ICT.

ICT in education is any educational technology that is applied in the educational process. It encompasses Hardware approach like use of machines and materials, Software approach like use of methodologies and strategies of teaching learning and Systems approach that uses the management technology that deals with the systematic organization of the hardware and the software. Different software packages for the use in different department of education; e.g. library software, administration software, software related to managing the entire teaching learning process.

ICT in education is the support material in the hands of the human resource involved in the educational process in order to enhance the quality of education.

ICT in education comprises of the application of science of On-line, Offlinelearning with the help of the computer technology.

USES IN EDUCATION

ICT is being utilized in every part of life. Due to the increasing importance of the computer, students-the future citizens cannot afford to keep themselves aloof from this potential medium.
In education, use of ICT has become imperative to improve the efficiency and effectiveness at all levels and in both formal and non-formal settings. Education even at school stage has to provide computer instruction. Profound technical knowledge and positive attitude towards this technology are the essential prerequisites for the successful citizens of the coming decades.

It can be used for the following purposes :
• To broadcast material, online facility or CD-ROM can be used as sources of information in different subjects;
• To facilitate communication for pupils with special needs;

- To use electronic toys to develop spatial awareness and psycho-motor control;
- To use the Online resource like, email, Chat, discussion forum to support collaborative writing and sharing of information.
- To facilitate video-conferencing or other form of Tele conferencing to involve wide range of students from distant Geographic areas.
- For Blended learning by combining conventional classroom learning with E-leaming learning systems
- To process administrative and assessment data.
- To exchange and share ideas -among teachers for the professional growth.
- To carry out internet-based research to enhance , educational process

ADVANTAGES OF THE USE OF ICT IN EDUCATION:

ICT encompasses all those gadgets that deal with the processing of information for better and effective communication. In education, communication process takes place between teachers, students, management and administrative personnel which requires plenty of data to be stored for retrieval as and when required, to be disseminated or transmitted in the desired format. The hardware and software like OHP, Television, Radio, Computers and related software are used in the educational process. However ICT today is mostly focused on the use of Computer technology for processing the data. In this context, advantages of ICT in education can be listed down as follows :

- **Quick access to information :**

    Information can be accessed in seconds by connecting to the internet and surfing through Web pages.

- **Easy availability of updated data:**

    Sitting at home or at any comfortable place the desired information can be accessed easily. This helps the students to learn the updated content. Teachers too can keep themselves abreast of the latest teaching learning strategies and related technologies.

- **Connecting Geographically dispersed regions:**

    With the advancement of ICT, education does not remain restricted within four walls of the educational institutions. Students from different parts of the world can learn together by using online, offline resources. This would result in the enriching learning experience. Such collaborative learning can result in developing...
- divergent thinking ability in students,
- Global perspectives
- respect for varied nature of human life and acculturation.
- Facilitation of learning

ICT has contributed in shifting the focus on learning than teaching. ICT helps students to explore knowledge to learn the content through self study. Teacher can help the students by ensuring the right direction towards effective learning. Situational learning, Programmed learning, many Online learning courses are some of the example of self learning strategies that are being utilized with the help of ICT.

• **Catering to the Individual differences:**

ICT can contribute in catering to individual needs of the students as per their capabilities and interest. Crowded class rooms have always been a challenge for the teacher to consider the needs of every student in the class.

• **Wider range of communication media:**

With the advent of ICT, different means of communication are being introduced in the teaching learning process. Offline learning, on line learning, blended learning are some of the resources that can be used in educational institutions. Collaborative learning, individualized learning strategies can enhance the quality of group as well as individual learning. with the real society. This can ensure the applicability of knowledge.

• **Wider learning opportunities for pupils**

Application of latest ICT in education has provided many options to the learners to opt for the course of their choices. Many Online courses are available for them to select any as per their aptitude and interest. Students can evaluate their own progress through different quizzes, ready to use Online tests. This can ensure fulfillment of the employment required in the job market thus minimizing the problem of unemployment. It can also provide more efficient and effective citizens to the society as per the changing needs.

Check your Progress - III
1. What is Educational Technology?
2. What is ICT? Explain any two benefits of ICT in Education.

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1.5 HISTORICAL PERSPECTIVE OF EDUCATIONAL TECHNOLOGY

We may study the development of educational technology in three different groups of events as follows:

I. 14th Century. Instruction was restricted to mouth at the initial stage and then to manuscript. It is not that the teachers of this period failed to notice the importance of individual differences or motivation. But they put more emphasis on manuscript.

In the 15th century the art of printing was developed. Books were printed. However, they were mostly on topics of religion and grammar.

In the 16th century, Peter Ramus introduced text-books in higher education.

II. 17th Century. In the second group, we peep into the 17th century and here we see John Comenius introducing text-books for children. He produced an illustrated book in 1657—"Orbus Pictures." He wrote about a hundred text-books. But the circulation was very much limited. J. Rosseau, H. Spencer, Froebel, Pesstallozi etc. helped in changing the concept of in-~ struction and pupils. The child was put into the centre. Next came J. Dewey. He tried to introduce the scientific method in education. E. Thorndike conducted experiments and put forward the learning theories. Then came John Adam's concrete-abstract continuum, i.e, define the object—show a model—diagram and then come to the verbal description.

III. 20th Century, in this century, we ,had other sciences like sound recording, photography etc. being developed and these added to the process of learning and teaching. Even electronic transmission was advancing. And all these aided the development of educational technology.

In this third group, we enter into the period of First and Second World Wars. During the First World War, the testing movement started. Binet was the forefather of this movement. During the Second World War, we could see the application of behavioural sciences to teaching and learning. In between, by 1925 Sidney L. experimented with programmed instruction. During 1938 and 1940, the concept of visual aids helped the process of learning. It thus paved the way for audio-visual education. In 1954 we got Edgar Dale's "Cone of Experience." Also during the same period, Weiner studied human engineering and also worked on the science of cybernetics. By 1950, the world had also got Instructional Theories by Bruno, Glasser etc. In 1953, Gordan Pask applied the

principles of cybernetics to education. In 1970, different developments took place and the concept of Educational Technology took its shape more neatly. Pioneering work in CAI (Computerised Applied Instruction) was carried out by Pask.

Development of communication, system-approach, social psychology (inter-group relationship), human factor approach to behavioural science — all these contributed to the development of educational technology. So also the audio-visual movements contributed to the development of education technology.

By this,, it is clear how the things in the field of education changed their original shapes and formed into an altogether new one. But the question that now arose was: "Is audio-visual education different from the principles of educational technology?" The answer to this is as given below.

Audio-visual Aids
1. Audio-visual aids only try to improve the quality of the . message.
2. Audio-visual aids ignore the individual differences.
3. Audio-visual aids do not take into consideration the enrichment of other fields.
4. Audio-visual aids are only materials

Educational' Technology
Educational technology concentrates on the psychological principles.

Educational technology emphasizes on individual differences.

Educational technology takes into consideration the development of social anthropology.

Educational technology is definitely a technique.

While thus going through the history of educational technology, it is also essential to note certain important events that helped for the development of educational technology. The Government of India sent a proposal to establish a centre for curriculum and media development under the United Nations Development and Programme Scheme (UNDP) and this proposal was approved in 1970 by Wilber Schramm. It was, therefore, felt by the Indian educationists to have a Centre for Educational Technology at Delhi and accordingly it was established at NCERT. Then in 1973, another unit for educational technology in the Ministry of Education was also established. After this the Government of India wanted educational technology cells to be established in different states. Today, we have educational

technology cells in thirteen different states, among them being, Maharashtra, Gujarat, Orissa, Madhya Pradesh, Andhra Pradesh, Kar-nataka, Uttar Pradesh, Rajasthan and Tamil Nadu. Educational Technology cells have also been started at all the four Regional Colleges of Education, that is, at Bhopal, Ajmer, Mysore and Bhubaneswar

1.6 EMERGING TRENDS IN EDUCATIONAL TECHNOLOGY

The two major trends that have developed in the process of educational technology are: (1) technology for mass instruction and (ii) technology for individual instruction. Included in the first type are instructional broadcasting, television filmed lectures, CCTV, motion pictures etc. Under technology for individual instruction, there are equipments and materials designed for individual operation such as teaching machines, programmed instruction, auto-tutorial system, computer-assisted instruction, language laboratories, learning modules etc.

Programmed Instruction

In a fast developing world, the teacher cannot and ought not to be left alone to depend upon his own resources and talents to disseminate knowledge to the pupils. The classroom teacher should be supplied with reliable instructional material based upon the dependable findings of educational technology. This will help him to do his job with maximum perfection. Programmed learning is one such big step in this direction. In this the subject-matter or content of the course displays a few distinct characteristics such as:

JuiueatiQnal Technology — Its Nature and Scope _

(i) a clear-cut statement of the objectives;
(ii) the material to be learned is itemised and presented serially;
(iii) frequent and unambiguous responses from every student are required throughout the whole sequence. Unless the learner makes some responses which are relevant to the learning task, no learning will occur;
(iv) feedback of information about the correctness or otherwise of the responses is given to the pupil before the next frame or item is presented.

Modular Scheduling

A module is a short unit of instruction dealing with a single conceptual unit of subject matter. Each course is built in the "bank" of a number of modules and each module is designed around a list of objectives and student projects. A variety of learning activities centred around the learner and incorporating a multi-media approach is provided. The components of modules include modular

lecture unit, laboratory unit, programmed instruction unit, workshop unit, individual study unit, film unit, audio-tape unit, video-tape unit etc.

Multi-media Approach

For effective and efficient learning, it is now accepted that there should be a multi-media approach. Edgar Dale (1969) through his "Cone of Experience" has demonstrated that in any learning situation, the more the senses are stimulated, the more the person learns and the longer he retains. Dale describes how the different types of aids, starting from verbal symbols up to direct purposeful experiences, are interrelated and effective in the learning process. The different materials of the experiences presented in the cone may be classified into three: (i) non-projected aids; (ii) projected aids; and (iii) activity aids.

The following are some specific applications of instructional technology in imparting formal education:

1. Use films, television, slide-tape presentation and so forth as an alternative to a lecture for presentation of information.

2. Buy, borrow or produce 2" x 2" colour slides, showing the steps in a process to be demonstrated.

3. Use an opaque projection to show a printed diagramme.

4. Make a transparency from a cartoon or drawing in a few seconds on a thermographic copier and show it to the class using an overhead projector (OHP).

5. Draw chalkboard diagrams once on transparency masters; then project the transparencies made from these masters on OHP, thus saving the time wasted in re-wording them each year

Record questions, problems, exercises and background information on different subject or at different levels of difficulty on tape for use by individuals or small groups with cassette play back units. While some students are interacting with the recorded material, you will to free to work intensively with the others.

Check your Progress - IV
1. What are the two major trends developed in the process of Educational Technology.
2. Write short notes on programmed learning.

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1.7 LET US SUM UP

In this unit we have discussed about the concept of information technology, communication technology, instructional technology & Educational Technology. We have also discussed about the need & Significance of information communication technology with reference to it's historical perspectives & emerging trends.

IT - "Information Technology" is the use of hardware and software for efficient management of information i.e. storage, retrieval, processing, communication and sharing of information for social, economical and caltural upliftment. It is very much useful for

- Sharing of resources
- Professional development of teachers
- research
- gaining total quality management and
- distance education.

CT :
"Communication Technology" is the activity of designing constructing and maintaining communication systems. It is the electronic system used for communication between individuals or groups. It is useful for the physically absent individuals or groups at the same location.

IT
"Instructional Technology" is the application of system approach in the systemic design of a learning system. It helps to bring about improvement in help of necessary media and material.

ET
"Educational Technology" is interpreted in two ways :
To describe the use of technology in education means the use of equipment to imply the concept of technology of education means improving the effectiveness of learning. It is the application of IT & CT. in education. "It helps the learner to make himself free from mere information receiving and to devote his time for planning, arranging and evaluating learning experiences."

ICT - "Information communication Technology" is the technology which uses the information to meet human need or purposes including processing and exchanging. It is the umbrella term for all the above terms like. IT, ET & CT. It focusses mainly on computer technology. It helps to improve the efficiency and effectiveness at all revels and in both formal & nonformal setting.

ICT is the need of the how inorder to cope and complete with the advancing world of Technology.

Unit End Exercises

1. Explain the concept of information technology & differentiate it from instructional technology.

2. Explain the use of ICT in Education with it's need & significance.

3. Write short notes on :
   a. Modular Scheduling.
   b. Multimedia approach.
   c. Use of ICT in Education.

References :

1. Kulsum Umme "Information communication Technology in Education" 2008, H. P. Bhargave Book Honse, Agra

2. Rao Usha "Educational Technology" 2005, Himalaya Publishing House Delhi.

4. w.w.w. Geogle.com Mac millan publishing company.

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2A

PSYCHOLOGICAL PRINCIPALS OF ICT

Unit Structure :

2A.1. Objectives

2A.2. Learner Analysis

2A.3. Need for Powerful Learning Environments

2A.4. The potential of ICT in powerful learning environments

2A.5. Processes associated with ICT

2A.1 OBJECTIVES

- This unit deals with the various psychological principles of ICT and hence by the end of the unit you will be able to:
- State the various approaches to learner analysis
- Justify the need to conduct a learner analysis before the commencement of the teaching learning process
- Explain the potential of ICT in developing a powerful learning environment
- State the processes of associated with ICT learning
- Discuss the advantages of knowing the different processes that are associated with ICT

2A.2 LEARNER ANALYSIS

Just as people differ in many respects, so do ways in which they learn differ. Some of these differences are evident in the kinds of experiences each person requires to learn and, if competence in a skill is to be acquired, in the amount of time and practice each person needs. It is essential, therefore, early in the planning process, to give attention to the characteristics, abilities, and experiences of the learners - both as a group and as individuals.

Kemp, Morrison, and Ross, 1998:

When designing instructional opportunities, the designer often assumes that everyone learns the way he or she does. Unfortunately that could never be farther from the truth. For the program to be effective, it must be stimulating to the targeted

audience. How can that be accomplished? The construction of an audience profile with the use of questionnaires can be a valuable start. The key to instructional design is to work around the participants rather than the content. It is very important to not develop a program based on the characteristics you hope your audience will have. You must be realistic, the audience may come to you with a wider variety of interests and knowledge. This may seem overwhelming and confusing for a program designer, but with careful preparation and open mindedness, a successful project can result.

Before preparing instructional strategies or materials, instructional designers should be able to answer the following question: "Who is the intended and appropriate learner?" (Rothwell & Kazanas, 1998, p. 81). Ideally, instruction should be designed around the individual learner and not the content or the teacher. It is not responsible to design lessons for the majority while students with specific learning needs are neglected, although time, money, and circumstances sometimes dictate this, in which case, online teachers may face the challenge of producing a single online lesson plan to be used by students with a wide range of needs.

Rothwell and Kazanas (1998) state there are two kinds of learner-related characteristics: "1) prerequisite knowledge, skills, and attitudes, and 2) other learner-related characteristics" (p. 84). Some of these "other" characteristics, as outlined by Rothwell and Kazanas, may include the students' demographic characteristics, physiological qualities, aptitudes, experience, learning styles, attitudes, and value systems. Given that online instructors are often not in a face-to-face environment with their students, they face a greater challenge in identifying these characteristics, but the need remains to identify them and consider them if the instructional strategies designed and the delivery methods selected are to be effective.

Other authors take different approaches to learner analysis. For example, Kemp, Morrison, and Ross (1998) outline three categories of learner characteristics: general characteristics, specific entry competencies, and learning styles. In these categories, there is the idea of the typical learner, the one who represents the aggregation of the general, specific, and stylistic characteristics and for whom the instruction is designed. This has been a very common approach in designing technology-based instruction for twenty years, and while it has been demonstrated to work very well in environments where the learners are homogeneous, it is easy to see how it may be decreasingly useful in environments where learners are significantly different from each other. In an increasingly multicultural society with different educational options and sensitivities to gender, age, cultural and religious differences, and ability levels, it is increasingly common to

find more heterogeneous groups of learners and, consequently, designing instruction for these learners becomes more of a challenge. In many cases, the instructional designs we see focus on the typical learner and do not allow for the needs of those who vary from this hypothetical construct. In fact, there may be no individual who actually embodies all of the characteristics of the typical learner in any program.

Whether the differences between learners are based on gender, age, education, cultural differences, or on learning styles, providing for the needs of all potential learners means making changes in the design of the program to reflect those needs. In some instances, designers provide different experiences or representations of the content that they think will address students' desires for different forms of perceptual experience, or more adequately represent differences in gender, age, culture, education, or experience. In a very few cases, designers try to discern what sort of learner is using the system and present the materials in a way which they anticipate would be better for the learner. However, in the cases where the designers make changes to satisfy the differences among learners, they simply leave it to the learners to make choices among various alternatives on their own. Almost never does a single design attempt to deal with all the possible variations in learners dealt with in this module and there is a good reason for this. Additions and alternatives within a learning environment add to the costs of a project. The development of technology-based learning environments is already a costly business and in most cases, budgets will not allow for designing for all aspects of flexibility.

In her review of the learning style literature, Swanson (1995) cites the recommendations made by Claxton and Murrel (1987) for institutions of higher education interested in improving the teaching and learning process by using learning style information It is important for educators to be sensitive to their students' characteristics. It is likely that some students may be fully aware of their learning style and will be able to communicate this to their teachers.

General characteristics include demographic descriptors such as gender, age, education, and cultural or socioeconomic factors. While age and grade level may be easy enough to obtain for an online educator, information on cultural or socioeconomic factors are more difficult to collect in an online environment.

Specific entry competencies refer to the "knowledge and skills that the learners either possess or lack: prerequisite skills, target skills, and attitudes" (Heinich, Molenda, Russell, & Smaldino, 1996, p. 36). Online educators can seldom make assumptions about the prior learning experiences of their students, and,

therefore, must establish methods to address their individual differences. The decision to use constructivist learning strategies is one method of allowing for diverse learning abilities without confining all students to one lock-step approach. The implementation of individual learning plans is another approach that may be utilized to address diverse entry competencies; however, this approach is likely to be more costly and time-consuming.

Finally, learning style is defined as the "the cognitive, affective, and physiological factors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment" (Keefe, 1979; as cited in Swanson, 1995, p. 2). Students' reactions to a learning environment or instructional method are likely to be influenced by their learning style. The development of an instructional method that would provide an optimal learning experience for each student is an ideal goal, but its attainment is often unsuccessful due to obvious financial and logistical reasonsIn the reading, you will become introduced to the onion metaphor that Curry (1983) uses as a framework for understanding learning style theories in which the "layers of an onion are analogous to the different levels of a person's characteristic or style" (Swanson, 1995, p. 2).

At the centre, you will find the basic personality traits, and the outer layers include information-processing, social interaction, and, finally, instructional preference. Swanson (1995) cites Claxton and Murrell (1987), who propose that student preferences at each layer become stronger and more stable towards the core, making it less susceptible to change "in response to intervention by the researcher or instructor" (p. 3). You may wish to refer to this metaphor, and think about the relationships between the layers, when performing your analysis of learners for your online lesson.

There are two well-known approaches to learning style that you should take a note of in the reading. In the first and innermost layer of the onion, which contains personality models, you will find the Myers-Briggs Type Indicator (MBTI). Swanson (1995) describes this instrument as a comprehensive one that is reported to describe personality accurately. In the second layer of information processing models, you should get to know Kolb's Learning Styles Inventory, which places students into one of four categories of learning styles. This knowledge can then be used, as mentioned previously, to better understand the learning needs of online students.

Finally, it is important that you become acquainted with a current theory involving different types of intelligence. In 1983, Gardner described seven aspects of intelligence: linguistic, musical, logical-mathematical, spatial, bodily-kinesthetic, interpersonal (the ability to understand other people), and intrapersonal (the ability to

understand oneself) (Gardner, 1993). In this theory of multiple intelligences, it is implied that:

> *Teachers, curriculum planners, and media specialists should work together to design a curriculum in which students have the chance to develop these different aspects of intelligence. It also implies that students vary widely in terms of their strengths and weaknesses in each of these areas. A school adopting this approach would have students engaged in a much wider variety of methods and media than is typical now. The type of individualized instructional plan and records of progress implied in this approach lend themselves well to active learning methods, interactive technologies, and information management systems. (Heinich et al., 1996, p. 37)*

2A.3. THE NEED FOR POWERFUL LEARNING ENVIRONMENTS

Education should offer conditions needed to optimize learning and promote the transfer of knowledge and skills. Authenticity is an important issue which should be addressed in the design and development of learning environments (Collins, 1996). Learning environments need to reflect the potential uses of knowledge that pupils are expected to master, in order to prevent the acquired knowledge from becoming inert (Bransford, Sherwood, Hasselbring, Kinzer, & Williams, 1990; Duffy & Knuth, 1990). Rich contexts and tasks that are as authentic as possible should be provided by presenting links to the world outside school. In addition, teachers should stimulate pupils to engage in active knowledge construction. This calls for open-ended learning environments instead of learning environments which focus on a mere transmission of facts (Collins, 1996; Hannafin, Hall, Land, & Hill, 1994; Jonassen, Peck, & Wilson, 1999). Co-operation and interaction in the classroom environment are important in order to foster the acquisition of learning skills, problem solving skills, and social relations (Bennett & Dunne, 1994; Slavin, 1995; Susman, 1998). Finally, since classes are of mixed ability, differentiation is considered to be one of the key criteria for effective classroom practice (Bearne, 1996; Kerry & Kerry, 1997; Wang, 1990).

Teachers are expected to adapt the educational setting to the needs and capabilities of the individual pupils. Powerful learning environments foster optimal learning processes by reflecting the key aspects outlined above. In conclusion, the following four main characteristics of powerful learning environments are distinguished:

- rich contexts and tasks that are as authentic as possible are provided to present links to the world outside school;
- active and independent learning is stimulated;

- co-operative learning is stimulated;
- the curriculum is adapted to the needs and capabilities of the individual pupils.

2A.4. THE POTENTIAL OF ICT IN POWERFUL LEARNING ENVIRONMENTS

ICT may contribute to creating powerful learning environments in numerous ways. ICT provides opportunities to access an abundance of information using multiple information resources and viewing information from multiple perspectives, thus fostering the authenticity of learning environments. ICT may also make complex processes easier to understand through simulations that, again, contribute to authentic learning environments. Thus, ICT may function as a facilitator of active learning and higher-order thinking (Alexander, 1999; Jonassen, 1999). The use of ICT may foster co-operative learning and reflection about the content (Susman, 1998). Furthermore, ICT may serve as a tool to curriculum differentiation, providing opportunities for adapting the learning content and tasks to the needs and capabilities of each individual pupil and by providing tailored feedback (Mooij, 1999; Smeets & Mooij, 2001). As Stoddart and Niederhauser (1993) point out, ICT may fit into a spectrum of instructional approaches, varying from traditional to innovative. Niederhauser and Stoddart (2001) distinguish two main types of software use in education: skill-based transmission software, and open-ended constructivist software. Typically, skill-based software aims at enhancing pupils' skills by administering drill and practice exercises. Open-ended software may serve as a tool for helping learners build knowledge (Jonassen, 1999; Squires, 1999). This type of ICT use may be expected to contribute especially to powerful learning environments.

However, research shows that the focus in schools in general is on traditional, skill-based ICT use (Chalkley & Nicholas, 1997; Richardson, 1997; Smeets & Mooij, 2001; Williams, Coles, Wilson, Richardson, & Tuson, 2000). In addition, in a recent study of the impact of ICT on pupil attainment, in which 60 schools were involved, it was found that the proportion of lessons involving ICT was generally small. Some positive relations between the amount of ICT use and pupil attainment were found, but the relationship found was not consistent over all subjects at all key stages. Therefore, the authors assume that the type of use is important (Harrison et al., 2002). Obviously, the selection and use of software by teachers can have a significant impact on the learning environment. In this respect, the teacher's skills with regard to ICT use play an important role (Smeets et al., 1999; Veen, 1995). Another aspect which may of course influence the use of ICT is access to technology (Kennewell, Parkinson, & Tanner, 2000; OTA,

1995). This refers not only to the number of computers, but also to the placement of the equipment, e.g. in the classroom or in a computer room. Kennewell et al. (2000) feel it is essential that computers be placed in the classroom, in order to maximize the opportunities for curriculum activity. These authors state that the number of computers available is of less significance.

In addition, teachers' pedagogical perspectives and their views on how ICT can contribute to the learning environment may play an important role in their actual use of ICT in the classroom (Drenoyanni & Selwood, 1998; Higgins & Moseley, 2001; Hokanson & Hooper, 2000; Niederhauser & Stoddart, 2001). However, Sinko and Lehtinen (1999) point out that often there is a conflict between approving of certain principles with regard to learning environment design and development by teachers, and the actual implementation of these principles in classrooms. The shift towards more pupil-centred learning environments requires teachers to create an intellectual environment in which knowledge is acquired. The teacher is no longer the all-knowing controller of activities. At times, she or he is learner and explorer with the pupils. In particular, this applies to open-ended learning arrangements (Hannafin & Savenye, 1993; Keeler, 1996). Niederhauser and Stoddart (2001) found that teachers who adhered to traditional transmission approaches to instruction, tended to prefer skill-based software, whereas most teachers who supported constructivist views of teaching and learning, used skill-based as well as open-ended software. This conclusion is consistent with observations made by Pisapia (1994a) that in exemplary classrooms teachers may use resources in different ways, such as drill and practice exercises, simulations, problem-solving activities, and productivity tools. A characteristic of these classrooms is that pupil use of learning technologies is woven integrally into the patterns of teaching. Teacher-centred teachers, on the other hand, tend to use traditional instructional methods, and to regard learning technologies mainly as basic skill reinforcers, motivators, or 'special treats' (Pisapia, 1994b). Demetriadis et al. (2003) concluded that teachers are strongly oriented towards fulfilling the established school instructional targets. As a result of this, according to these authors, teachers tend to ignore innovative learning activities because they are disturbing.

2A.5 PROCESSES ASSOCIATED WITH ICT

According to Yang, Mohamed & Beyerbach (1999), educators must first learn what the computer is and what it can do. This would reduce computer anxiety, as computer anxiety among educators has been considered a stumbling block to integrating computers into education programs. Such a program would "reduce computer anxiety, by improving computer perception (Yang, Mohamed & Beyerbach, 1999, p.13). However, according to the

same source, the best way to reduce anxiety towards computers would be " a positive attitude towards participation in computer-based training and the use of computers in the classroom" (p.16).

As educators, we certainly need to have an open mind to new ideas and to teach our students to do the same, in order for them to learn how to develop a critical attitude towards stimuli around them.

Generally speaking we can say that there is a shortage of well-trained technology teachers(Wash, Lovedahl & Paige (2000), "there is an acute need for developing a cadre of teachers, curriculum developers, teacher educators and administrators who can effectively lead educational reform and implementation in technology education " (Dugger, 1999, p.5). In order for the educators to understand the benefits of the new approach and to get involved to teaching with ICT, they need to understand two important issues that pertain to the process of ICT learning:

a) The stages that students and teachers pass through with respect to adaptation to change. This would give them a solid ground on what to expect and would eliminate them possible false expectations that they could interpret as failure of teaching with ICT.

b) The process of students' learning with ICT, in order for them to be able to visualize the benefits.

a) STAGES OF INNOVATION ADOPTION

People seem to react to change according to personal characteristics and such personal evaluations seem to affect their decision of accepting innovation. Rogers (1995), as cited in Johnson, Gatz & Hicks (1997), contests that a very small percentage of the population are what we call innovators. These are people who like new things and want to be the first ones who try them. Early adopters follow, who are people eager to test something new early enough, but not to be the first ones. People who belong to the category of early majority follow. These are people who wait until they receive positive feedback first about an innovation. Finally, there is the late majority or laggards category that includes people who will be the last ones who will adapt themselves to the new situation (all cited in Johnson, Gatz & Hicks, 1997). In terms of the technology situation, teachers seem to be at different stages in various countries around the world. However, generally speaking, the majority of educators are still at early stages of the innovation cycle.

The process of adapting to innovation seems to be circular, as at the time laggards adopt the innovation, this is not considered an innovation any longer, and innovators start considering another

innovation to be used. This cycle ideally reflects the changing modern technological world in all areas.

Effective communication of the innovation's characteristics is considered to be a key element in the transfer process (Johnson, Gatz & Hicks, 1997). For this reason, in terms of teaching using technology-based projects in the classroom, teachers should be informed about this new teaching approach in order to be confident enough with it and start using it. This can be achieved only through staff development programs on educational technology that will give teachers the necessary background in terms of equipment used and the teaching methodology to be applied.

Stages of Students' Involvement with Educational Technology

One of the most important issues if we want to understand how students' learning with educational technology takes place, is to understand the process of students' familiarization with technology. As educators, we also have to be prepared to face the fact that each student has a different adoption rate, as far as computer knowledge is concerned. Teachers have to deal with this issue and to take into consideration not only students' adoption rates in terms of the utilization of technology in the classroom, but also the adoption rate of "important others", in most cases that of their parents, that is, what they consider as an "acceptable" way of learning for their children.

Students and parents have to understand that, as latest research has proved, integration of technology into the curriculum can enhance students' learning (Leask & Pachler, 1999), as "technology activities are a valuable vehicle for all types of learning" (Stables, 1997, p.51). As also cited in Stables (1997), Kibell, Stables and Green (1996), have found that there are three different formulations regarding educational technology that can be identified as stages of learning with technology: a) awareness of technology, b) competence of technology and c) capability of technology.

Stage 1: Awareness of Technology: Adoption to Innovation

The most difficult step in the learning process is this one, as students have to get accustomed to a new way of learning. This is the reason why some scholars say that it is better for children to start with educational technology as a method of learning as early as possible, as they do not know other ways of learning, yet.

Rogers (1995) developed a generalized theory concerning the way that innovation is adopted. He defined innovation as "an idea or object that is perceived as new by an individual or other unit of adoption and that creates uncertainty and resistance in those affected by it" (cited in Ndahi, 1999, p. 2). Cited in the same source, Rogers states that "newness in reference to an innovation does not

refer to new knowledge, but to an idea, practice or object about which the person has not yet developed favorite or non-favorite attitudes, not adopted nor rejected" (p.2). This is a very important part if we consider that students are not predisposed neither in favor nor against educational technology as a teaching method. As a result, this may be an indication that teachers' attitude towards educational technology and practice may influence students' attitude too. We assume that attitudes towards the method would also positively affect their learning process.

As Rogers (1995) mentions, in order for a new idea to be adopted, certain characteristics have to be achieved through training: changes in the value system, information and knowledge. These characteristics may affect the rate of adoption (Ndahi, 1999). It is evident, therefore, that teachers influence to a large extent the students' learning process by the way they present the material in the class, as well as by their own general attitude towards educational technology.

Stage 2 : Competence of Technology

With competence of technology we can signify the stage at which students learn how to utilize technological means. One of the most important concepts of the learning process at this stage is what Draper, Brown, et al (1994) have defined as "task grasp", that is the task that actually is regulating a learner's behavior. There are various factors that influence how this "task grasp" can be achieved through educational technology.

According to Frost & Pierson (1998), "students learn best by beginning with concrete experience and then move progressively to reflection and abstract understanding" (p.40). This leads us towards the project-based concept, as it employs this gradual transition of students from simple to more complicated tasks, through real-life experiences. By engaging in projects, students combine learning with practical experience and learning within social context (Stables, 2000).

Another factor that influences students' learning is students' capabilities at a particular age. According to Shield (2000), "the learning task should be tailored to the students' capabilities rather than the students having to fit in the software designer's generalized understanding of how learning should take place" (Andaloro & Bellmonte, 1998, as cited in Shield , 2000, p. 9). This means that in order for the learning process to smoothly lead to the desired learning outcome, teachers should be very helpful when employing texts, reference sources, multimedia and communication tools (Shield, 2000), as they have to adopt them to students' learning capabilities.

Stage 3 : Capabilities of Technology

At this stage students have learned about technology and its use and they start using it as a mean that facilitates their way towards the desired outcome. This means that at this stage, students as they have initiative for their actions, start finding out the most efficient way to achieve their goals. As cited in Hill & Smith (1998), this is a very important stage as research has shown that moving towards student-centered classrooms can be very effective, as this method of teaching "takes advantage of multiple human abilities (Smith 1992), recognizes the social basis of learning (Vygotsky, 1978) and values learning in context (Lave, 1988)" (p. 42).

b) HOW STUDENTS LEARN WITH TECHNOLOGY

One of the biggest questions we have in mind when we think about educational technology from the educational point of view, is what is the process involved in order for learning to take place. Schultz (2000), in his study has found a strong relationship between technology and the way of thinking. Characteristically, he mentions that not only the technological progress clearly reflects the way people think at a particular point in time, but also the way people think is clearly mirrored in technology. This is because technology tries to facilitate the process towards the solution of current problems and current problems are the cause for having the process of improving technology initiated. According to Schultz (2000), this interrelationship of technology to human way of thinking also reflects the cognitive abilities of the individuals.

Based on the above, we could follow Shield's model (Shield, 2000) in order to explain the process of students learning with educational technology that is schematically represented in

Figure 1
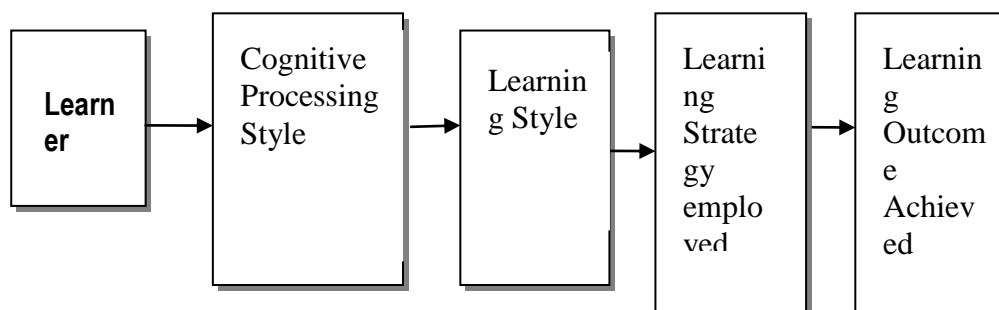
Students' Cognitive Processing Style

According to the above scheme, each individual, according to his/her personal cognitive abilities and learning style has to employ the most appropriate learning strategy in order to achieve the desired learning outcome. Therefore, the role of the teachers is, for a given group of students, to provide educational technology activities of an appropriate level of difficulty based on their cognitive abilities (age, fast vs. slow learners), that are expressed in a variety of ways (i.e: multimedia, the Internet, etc.),in order to adjust the curriculum to a variety of learning styles (visual, audio, by-doing) expressed through project-based activities based on the active learning approach. Additionally, teachers have to provide a plethora of learning strategies in order for the students to learn how to select the one , that is most appropriate for their desired learning outcome. Based on Stables (1997), what is most important in this process is for the children to express and to develop their own ideas. Teachers are there to facilitate this process and to identify where the learning blockage occurs, in order to facilitate the learning process.

In addition to Piaget's theory of cognitive adoption, based on their cognitive processing styles, learners can be divided into two additional categories, as Ellis (1994), cited in Leask (1999) describes:
a) Focusers: those who concentrate on one aspect of the problem at a time and proceed in a step-by-step manner
b) Scanners: those who tackle several aspects of the problem at the same time and allow ideas to crystallize slowly

The above categorization seems to be related to whether a person has a deductive or an inductive way of reasoning, that is unconsciously whether he starts his/her thinking process from a general or a specific idea respectively. Along with the concepts of assimilation and accommodation, this composes the cognitive processing style of each individual.

Students' Learning Styles

Generally speaking, if we measure learning as the amount of information people can recall after learning has taken place, studies have shown that people can recall 20% of what they have heard, 30% of what they have seen, 50% of what they have experienced and nearly 90% of what they have heard, seen and experienced simultaneously. These percentages are certainly not rigid, as each individual has a learning style of his own. Based on this, he/she learns better by hearing (audio learners), by seeing (visual learners) or by doing (kinaesthetic learners). The advantage of teaching with multimedia technology is that it covers all the learning styles at the same time, as it combines text, sound and interactivity of the user with the program. This is considered as the main advantage of teaching with technology over the traditional method of instruction.

Additionally, apart of the way students learn they tend to employ other type of learning patterns according to their personalities and personal preferences on how they want to learn. Willing (1987), cited in <u>Leask</u> (1999), has studied how these personal preferences affect the learning style of each individual. From his study we conclude that students' learning styles also highly depend on:

a) <u>Structured vs. spontaneous learning</u> :The degree of flexibility an individual wants during the learning process, that is how much structured and well-organized or spontaneous the individual wants the learning material.

b) <u>Autonomous vs. Instructor-led learning</u> :The degree to which the individual wants autonomy or another individual (teacher) to get involved in the learning process.

Teachers should identify the learning style of the classroom, that is the learning style of the majority of their students and try to employ the best teaching method that would be of benefit to them, but also to be flexible enough to provide challenging activities to those who learn better in this way. Teaching with ICT certainly offers this option. However, the reality is that teachers have a tendency to teach according to how they would like to be taught themselves.

Learning Strategies Involved

No matter what the cognitive process involved and the learning strategy of each individual student is, the teaching method, that is the learning strategy teachers choose to teach with, highly affects the amount and the quality of learning that takes place. Therefore, the learning strategies presented in class should always take into consideration both students' cognitive processes and learning styles.

Unit End Exercises

Q1. With the help of suitable examples discuss the need to consider learner characteristics while designing or preparing for a teaching learning process.

Q2. What are the characteristics of a powerful learning environment? Discuss the role of ICT in developing a powerful learning environment.

Q3. Why is it necessary for educators to understand the different stages of adaptation to ICT which students undergo? Discuss these stages as a process of the teaching learning process.

Q4. Describe the various factors that interact in the process of involvement of the students learning through ICT.

REFERENCES:

http://www.quasar.ualberta.ca/EDIT489/modules/edpy489_7_Learner.htm - top
Alexander, J.O. (1999). Collaborative design, constructivist learning, information technology immersion, & electronic communities: a case study. Interpersonal Computing and Technology: An Electronic Journal for the 21st Century 7 (1–2).

Bransford, J. D., Sherwood, R. D., Hasselbring, T. S., Kinzer, C. K., & Williams, S. M. (1990). Anchored instruction: why we need it and how technology can help. In D. Nix & R. Spiro (Eds.), Cognition, education, multimedia.

Exploring ideas in high technology (pp. 115–141). Hillsdale, NJ: Lawrence Erlbaum Associates.

E. Smeets (2004) Does ICT contribute to powerful learning environments in primary education?

Computers & Education 44 (2005) 343–355 available at www.elsevier.com/locate/compedu Gardner, H. (1993). Frames of Mind: The Theory of Multiple Intelligences. (tenth-anniversary edition). New York, NY: BasicBooks.

Heinich, R., Molenda, M., Russell, J.D., & Smaldino, S.E. (1996). Instructional Media and Technologies for Learning. (5th ed.) Englewood Cliffs, NJ: Prentice-Hall.

Kemp, J. E., Morrison, G. R., & Ross, S. M. (2001). Designing effective instruction (3rd ed.) Upper Saddle River, NJ: Prentice-Hall. Marisa Keramidá (2002) Processes Involved With ICT Learning, Retreived on July 10, 2002, Available: http://noesis.usal.es/documentos/educare/articulo6/art6.pdf

Muirhead, B. (1999, April). Virtual Schooling: What is it? Where is it going? What are the issues? Presented at the ADETA Video Conference, Edmonton, Alberta.

Rothwell, W. J., & Kazanas, H. C. (1998). Mastering the instructional design process: A systematic approach. San Francisco, CA: Jossey-Bass Publishers.

Swanson, L. J. (1995). Learning styles: A review of the literature. ERIC Document Reproduction Service No. ED 387067.

Alexander, J.O. (1999). Collaborative design, constructivist learning, information technology immersion, & electronic communities: a case study. Interpersonal Computing and Technology: An Electronic Journal for the 21st Century 7 (1–2).

Schulz, E. A. (2000). Cognitive Psychology as the Basis for Technical Instruction? I Don't Think So [31 paragraphs], Journal of Industrial Teacher Education, 37(4) [Online], Available: http://scholar.lib.vt.edu/ejournals/JITE/v37n4/schultz.html [2001, April 12].

Shield, G. (2000). A Critical Appraisal of Learning Technology Using Information and Communication Technologies [31 paragraphs], The Journal of Technology Studies, XXIV(1) [Online], Available: http://scholar.lib.vt.edu/ejournals/JTS/Winter-Spring-2000/shield.html [2001, April 12].

Stables, K. (1997).Critical issues to Consider when Introducing Technology Education into the Curriculum of young Learners , Journal of Technology Education, 8(2),50-65.

Todd, R. (1999). Design and Technology Yields a New Paradigm for Elementary Schooling [45 paragraphs], The Journal of Technology Studies, XXV(2) [Online], Available: http://scholar.lib.vt.edu/ejournals/JTS/Summer-Fall-1999/todd.html [2001, April 12].

Wash, S. L., Lovedahl, G. G. & Paige, W. D. (2000). A Comparison of Traditionally and Alternatively Certified Technology Education Teachers' Professional Development and Receptivity to Change [41paragraphs]. Journal of Industrial Teacher Education, 37(2) [Online],

Available: http://scholar.lib.vt.edu/ejournals/JITE/v37n2/wash.html [2001, April 12].

Yang, H. H., Mohamed, D. & Beyerbach, B. (2000). An Investigation of Computer Anxiety Among Vocational-Technical Teachers [31 paragraphs], Journal of Industrial Teacher Education, 37(1) [Online], Available: http://scholar.lib.vt.edu/ejournals/JITE/v37n1/yang.html [2001, April 12].

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2B

PSYCHOLOGICAL PRINCIPALS OF ICT

Unit Structure

2B.1. Objectives
2B.2. Factors Affecting and Facilitating ICT Learning
     i Factors Affecting ICT Learning
     ii Factors facilitating ICT learning
2B.3. Application of Theories of Learning to ICT
     I Behaviourism
     Ii Conitivism
     Iii Constructivism
2B.4. Adult Learning
2B.5. Learning Styles

2B.1 OBJECTIVES

This unit deals with the various psychological principles of ICT and hence by the end of the unit you will be able to:

Explain the various factors that affect ICT, Suggest ways of facilitating ICT, State the contribution of different theories of learning to ICT learning process, Justify the need having the different theories to guide the teaching learning process, Explain the characteristics of an adult learner, Describe the relationship between ICT and adult learning, Discuss the need for understanding adult learning style as a basis for planning ICT learning.

2B. 2. FACTORS AFFECTING AND FACILITATING ICT LEARNING

The introduction of information technologies (ITs) in education has been identified strongly with a variety of applications

over the years. Computers, internet, educational software, laptops and PDAs are concepts largely used in education as technological icons to show to what extent schools are in line with modern life. However, these technologies are often considered fads but also they show the tip of the iceberg in educational issues. There are many issues that are considered to inter play to determine the extent to which ICT is used. In this unit, the different sides of this iceberg will be analyzed to understand more comprehensively what the factors that affect and facilitate ICT learning are.

i. Factors Affecting ICT Learning

1. Teacher-level barriers

- lack of time — for both formal training and self-directed exploration (Fabry & Higgs 1997), and for preparing ICT resources for lessons (Preston *et al.* 2000) _ lack of self-confidence in using ICT (Pelgrum 2001)

- negative experiences with ICT in the past (Snoeyink & Ertmer 2001)

- fear of embarrassment in front of pupils and colleagues, loss of status and an effective degrading of professional skills (Russell & Bradley 1997)

- classroom management difficulties when using ICT, especially where pupil-to-computer ratios are poor (Drenoyianni & Selwood 1998; Cox *et al.* 1999)

- lack of the knowledge necessary to enable teachers to resolve technical problems when they occur (VanFossen 1999)

- lack of personal change management skills (Cox *et al.* 1999)

- perception that technology does not enhance learning (Yuen & Ma 2002; Preston *et al.* 2000)

- lack of motivation to change long-standing pedagogical practices (Snoeyink & Ertmer 2001)

- perception of computers as complicated and difficult to use (Cox *et al.* 1999).

2. School-level barriers

- lack of ICT equipment (Pelgrum 2001; Guha 2000), and the cost of acquiring, using and maintaining ICT resources (Cox *et al.* 1999)

- lack of access to ICT equipment due to organisational factors such as the deployment of computers in ICT suites rather than classrooms (Fabry & Higgs 1997; Cuban *et al.* 2001)

- obsolescence of software and hardware (Preston *et al.* 2000)

- unreliability of equipment (Butler & Sellbom 2002; Cuban *et al.* 2001)

- lack of technical support (Preston et al. 2000; Cox *et al.* 1999)

- lack of administrative support (Albaugh 1997; Butler & Sellbom 2002)

- lack of institutional support through leadership, planning and the involvement of teachers as well as managers in implementing change (Larner & Timberlake 1995; Cox *et al.* 1999)

- lack of training differentiated according to teachers' existing ICT skill levels (Veen 1993)

- lack of training focusing on integrating technology in the classroom rather than simply teaching basic skills (VanFossen 1999).

3. Explanation of findings

This section explores in greater depth the barriers identified in the literature, the reasons behind them, and the relations between them. **External and internal barriers** Many authors categorise barriers as external (first order) or internal (second order). First-order barriers include lack of equipment, unreliability, lack of technical support and other resource-related issues; second-order barriers include both school-level factors such as organizational culture and teacher-level factors such as beliefs about teaching and technology, and openness to change (Snoeyink & Ertmer 2001). A lack of equipment is the highest rated barrier internationally (Pelgrum 2001), often cited even in well-resourced countries. Indeed, one study (Guha 2000) found that teachers who used technology most were more likely to complain about a lack of equipment. It would appear therefore this is less a barrier to the introduction of technology than to its use in creative and innovative ways. While these first-order barriers are clearly significant, research suggests the importance teachers attach to them can reflect their own second-order barriers (Ertmer *et al.* 1999). In particular, teachers' beliefs about the relevance of ICT to their subject can magnify or reduce the effect of practical difficulties they may encounter. First-order barriers may even mask second order barriers: perceptions of computers as difficult to use may be as much to do with lack of confidence as with the hardware or software itself (Snoeyink & Ertmer 2001). It is impossible to separate first-order from second-order barriers, or barriers at the teacher level from those at the school or policy level (Mumtaz 2000).

4. Attitudes

Attitudes towards ICT, therefore, can be barriers in themselves and can influence or be influenced by other barriers. One study (Fabry & Higgs 1997) divided attitudes into three groups: self-confidence with ICT, perceived relevance of ICT, and innovativeness. Although attitudes partly depend on personality

(Guha 2000), the importance of previous computer experience is widely recognised (Snoeyink & Ertmer 2001). Negative experiences affect perceptions of the ease of use and relevance of ICT, reducing confidence and increasing anxiety. Computer anxiety and anxiety about change are key factors limiting teachers' use of technology (Larner & Timberlake 1995). Underlying these anxieties are fear of embarrassment when using computers (Russell & Bradley 1997) and fear of losing professional status through a downgrading of traditional pedagogical skills (Fabry & Higgs 1997).

5. Training

ICT training can help overcome barriers, yet many authors argue that it often fails to do so.While a lack of time and training are major obstacles (Guha 2000; Cox *et al.*1999), research suggests there are weaknesses in the design and delivery of many courses. By focusing on basic ICT skill, training fails to prepare teachers to integrate ICT in their pedagogy (VanFossen 1999; Wild 1996). One study (Snoeyink & Ertmer 2001), on the other hand, found that computer novices preferred to be taught basic skills before addressing pedagogical integration of technology. This illustrates the need for differentiated training, taking into account teachers' varying levels of computer experience and learning styles (Veen 1993). Initial teacher training receives particular attention in the literature. Within institutions offering initial teacher training, access to ICT can be problematic (Murphy & Greenwood 1998), but a perhaps more serious barrier lies in the fact that tutors often have little experience of using technology to deliver the curriculum (Simpson *et al.* 1999). As a result, pre-service teachers lack practical models of integration, leading to a disparity between their expectations of ICT use and their actual use (Whetstone & Carr-Chellman 2001). A lack of encouragement to use ICT during teaching practice and varying resources in schools exacerbate this problem (Murphy & Greenwood 1998); for new teachers as much as experienced ones, integration requires both access to ICT in the classroom and the motivation to use it.

ii. Factors facilitating ICT learning

1. Pedagogical objectives and goals

The research on educational innovation suggests that it is important for schools to share a reformed vision of teaching and learning in order to create sustainable change at the school and classroom levels. Additionally, in respect to ICT integration, research suggests that successful projects have clear and consistent messages concerning the role of ICT in supporting that vision, and that teachers see how ICT supports their students' learning. Most of the time it is found that although the vision of teaching and learning present in each school resonated with the national (or state) curricula, each school had interpreted the broad vision into a practical understanding that could be implemented in

their context. This process of reinterpretation of an abstract vision of teaching and learning with ICT into practical activities appears to be a fundamental step on the process of real classroom reform. The Indian education system is moving away from a traditional system based on memorization and testing to support a more student-centered approach to teaching and learning with ICT . This change is expressed in the state curricula in terms of curricular frameworks that are often difficult to translate into practice (Rampal, 2002).

2. Leadership

The research literature also indicates that leadership at various levels of the system is important if an innovative project is to take root and grow at the classroom level. Most of these schools function with two levels of leadership—first there is the national or provincial ministry of education that sets overall policy, curricula, and national assessment, and second, there is the building leadership that makes the day-to-day decisions. While issues of national leadership are important for technology projects (Kozma, 2005; Hepp et al., 2004), research shows that leadership within the schools is equally important. Connecting to the discussion in the previous section, the school's leadership is the key nexus in the process of reinterpreting a broad, abstract vision into a practical vision. The findings from these six schools highlight three aspects of the role of building-level leaders in supporting a process of ICT integration and pedagogical innovation. First, leadership does not come only from the principal.

Second, in all of the schools, the leaders of the ICT initiatives should not just set the vision and provide clear expectations for teachers, they provide support and guidance in teachers' classrooms.

Third, a central role for the school principal—or the person with administrative authority—is to make key decisions about resource allocation. An instructional leader as described above is very important, but there are also specific administrative and logistic challenges around using ICT that school administrators must solve. All of these schools had resource limitations on time, infrastructure, staff, space, and funding, and the administrators had to find solutions to allow change and innovation to take place with the resources that were available. ICT infrastructure is a constant problem for schools in developing countries, and the decisions administrators have to make are often frustrating because they cannot give all students all the access they would like to give them.

3. Professional development and ongoing support

For much the same reasons that supportive leadership is important in helping teachers innovate, ongoing professional development also appears to be a critical factor. In the context of

education reform, the tools and teaching strategies are new to many of the teachers; therefore, both the quality of the professional development courses and the presence of ongoing support for teachers in their classrooms are important. Research suggests that teachers must be offered multiple points of entry into practices supporting ICT use and student centered teaching. This allows teachers to begin changing their practice from whatever point their context and current practice requires. Research also highlights two features of the teachers' professional learning occurring in these schools: the importance of follow-up, and the informal professional communities that needs to exist in schools. Teachers should design their own unit plans which are important as it helps teachers to bridge the gap between the theoretical discussion of a training course and the practical needs of classrooms. Schools that have established a culture of constant improvement and professional learning tend to be more conducive to ICT for teaching and learning. Daniel Light (2010) in his case study said that Educators at all of the schools under study talked about teachers meeting in groups to plan and discuss new strategies and to share challenges and successes had contributed to the rich use of ICT for teaching and learning in schools..

4. Experimentation, adaptation, and critical reflection

Research literature's perspective offers an interesting insight on the importance of experimentation for ICT integration and education reform. Findings reveal that the role a culture of experimentation plays in school-wide change and its relationship to leadership, pedagogical goals, and professional development. Educators usually exhibit a willingness to experiment and take on the challenges of trying to do new things. If professional development provides teachers access to information about new tools and practices, there will be a willingness to experiment with novel ideas, and openness to reflect on the successes and failures, in order to create positive changes. In these schools, the culture of experimentation is promoted by the leadership and is in line with each school's pedagogical goals.

5. Time

Much like a physical resource, time is a scarce resource that schools must manage carefully.

Time in relation to ICT implementation has to be viewed in two dimensions: (1) teachers' professional development and planning time, and (2) students' time in the classroom or learning activity. Each school should develop their own strategies for training teachers and implementing the use of ICT depending on the particularities of the larger system.

6. ICT infrastructure

In most developing countries, ICT Infrastructure also is commonly a limited resource in schools. With limited resources, it is often difficult for schools to provide sufficient access so students can use ICT during their classes. Research studies suggest that no single strategy will work for all schools with resource limits. Instead, each school developed unique strategies to provide meaningful learning activities using ICT tools, whether it was teachers using ICT-based teaching aids or student ICT use. Although many urban Indian schools have computer labs, there are still too many students to give classes consistent and frequent ICT access during the school day. Thus, the schools in India need to work on strategies to make facilities available to both students and teachers during school hours.

7. Financing and Sustainability

Costs and sustainability are ongoing challenges for all of these schools when attempting to bring in new, complex resources such as ICT. These schools attempt to do two things to manage sustainability of their ICT activities: First, they try to obtain resources from as many sources as possible, and second, they try to control the costs related to ICT activities. All of the successful schools utilize multiple strategies to obtain funds or ICT resources. There are three basic sources of funding the schools rely on. First, all three countries have government programs that provide an infrastructure to support these schools. The government programs provide the schools with a basic level of resources, but each of these schools has gone farther. A second critical source is the community: Successful schools have developed good relations with the surrounding community, and the communities value the ICT initiatives of the school. Finally, some schools had their own small sources of revenue: Some of the public schools have concessions, such as a school café or a photocopy shop. These schools also attempted to control other costs associated with ICT, such as ink, paper, and peripherals. For the success of ICT in learning, schools should be encouraged to look at all the tree options of financing and sustainability.

The responsibility for change cannot rest solely on the shoulders of the teachers—bringing about these changes is a long-term, incremental process. There is a broad range of factors, from leadership to funding to effective professional development, that help create and sustain the conditions for change. Effective reform requires sustained investment and support along multiple dimensions of the educational system, including physical and technical infrastructure, human resources, curricular frameworks, standards, and assessments. In the end, the success of teachers is dependent on the conditions in which they work.

2B.3. APPLICATION OF THEORIES OF LEARNING TO

ICT

The challenges of information technology (IT) for education have been studied for about 40 years. Due to rapid technological developments the field is continuously changing in intriguing ways. The use of communication technologies has become widespread; education has been attracted by the potential of IT to go beyond classroom walls to provide learning opportunities at any time and at any place. Today while we are conceptualizing the nature of schooling, the common parlance is to describe a curriculum that contains content and is conveyed by a particular set of pedagogies. Its learning outcomes are evaluated by a suite of assessments; and – in the case of technology-based instruction – various aspects of content, pedagogy, and assessment are instantiated via computer tools and applications, digital media, and virtual environments. What we need to discuss is how various theories of learning and forms of pedagogy shape the technologies used to instantiate them, and how the evolution of computers and telecommunications is widening the range of instructional designs available.

In this unit we are going to discuss; What are the major types of instructional technologies that educators have created – or adapted – over the past few decades to serve as their toolbox? On what philosophies about teaching and instructional design are these pedagogical tools, applications, media, and environments based? For what types of learning has each proven effective?

The Current Spectrum of Instructional ICT

Many alternative conceptual frameworks exist for describing the relationships among learning theories, pedagogical strategies, instructional designs, and information and communication technologies. For some parts of its analysis, this chapter draws on an *Instructional Design Knowledge Base* developed by Dabbagh (2006) (http://classweb.gmu.edu/ndabbagh/Resources/IDKB/models_theor ies.htm). In the matrix that represents this conceptual framework, each school of thought posits basic principles and theories about learning; these inform the goals and models that school of thought has for instruction, which in turn influences the group's perspective on the design of pedagogical media. Many category systems are available to characterize contrasting positions about these issues. Drawing on Ertmer and Newby (1993) and Driscoll (2005), Dabbagh lists three competing schools of thought on how people learn: Objectivism/Behaviorism, Cognitivism/Pragmatism, and Constructivism/ Interpretivism:

1. Objectivism posits that reality is external and is objective, and knowledge is gained through experiences. Behaviorists believe that, since learning is based on experience, instruction centers on manipulating environmental factors to create instructional events

inculcating content and procedures in ways that alter students' behaviors.

2. Pragmatism posits that reality is mediated through cognitively developed representations, and knowledge is negotiated through experience and thinking. Cognitivists believe that, since learning involves both experience and thinking, instruction centers on helping learners develop interrelated, symbolic mental constructs that form the basis of knowledge and skills.

3. Interpretivism posits that reality is internal, and knowledge is constructed. Constructivists believe that, since learning involves constructing one's own knowledge, instruction centers on helping learners to actively invent individual meaning from experience. Each school of thought is not a single unified theory, but rather a collection of theories distinct from each other, but loosely related by a common set of fundamental assumptions. This chapter draws on Dabbagh's framework, but provides a somewhat different perspective on each school of thought and its work, based on material from the National Research Council report, *How People Learn* (Bransford et al., 2000).

Of course, educational ICT do not neatly cluster into discrete categories. Any given pedagogical tool, application, medium, or environment may incorporate perspectives from more than one of these intellectual positions. Imagine a multidimensional design space in which various specific instantiations of instructional technologies are represented; the dimensions reflect assumptions about learning, teaching, and instructional design. Some areas of that design space are more densely populated with clusters of ICT.

i. **Behaviorist Instructional Technologies**

As Dabbagh describes, Behaviorist theories of learning assume that knowledge is an absolute, reflecting universal truths about reality. Human behaviors, such as learning, are purposive, but are guided by unknowable inner states. Relationships between contextual instructional variables (stimuli) and observable, measurable student behaviors (responses) are the means to generate learning. Learning is indicated when a correct response follows the presentation of an instructional environmental stimulus. Instruction uses immediate consequences to reinforce behaviors to be learned and to repress incorrect responses to a pedagogical stimulus. As a basic example of this model of teaching and learning, a drill-and-skill instructional application is presenting a student with a series of single digit addition problems. Each time the student gets an answer correct, music plays and an entertaining animation is shown. Each time an incorrect answer is entered, a message is displayed, such as "Wrong; Try Again." The problems are programmed to repeat occasionally, with problems previously

answered incorrectly displayed more frequently. The instructional program keeps track of right and wrong answers, so the teacher can access information about the learner's performance over time. The psychological theories that underlie Behaviorist instruction initially were developed about a century ago and are associated with researchers such as Skinner (1950), Thorndyke (1913), and Watson (1913). Some Behaviorist researchers were willing to acknowledge the existence of inner states that might influence learning (Hull, 1943; Spence, 1942). Elaborate, modern instructional design strategies predominantly based on Behaviorist theories include Gagne (1988), Dick and Carey (1996), Smith and Ragan (1999), and Merrill (2002).

As Dabbagh indicates, in this school of thought, the purpose of education is for students to acquire skills of discrimination (recalling facts), generalization (defining and illustrating concepts), association (applying explanations), and chaining (automatically performing a specified procedure). The learner must know how to execute the proper response as well as the conditions under which the response is made. Knowledge and skills are transferred as learned behaviors; in classic Behaviorist instruction, internal mental processing is not considered as part of instructional design or assessment. Student motivation to achieve these goals is extrinsic, by associating pleasant stimuli with correct answers and neutral or even negative stimuli with incorrect responses. Computer-assisted instruction (CAI) and learner management systems (LMS) are the two types of instructional technologies most closely associated with this school of thought, although many other ICT tools and applications utilize some aspects of Behaviorist design. Atkinson (1968) and Suppes (Suppes and Morningstar, 1968) were pioneers of computer-based instruction, as exemplified by the development of the PLATO and TICCIT CAI systems used in some schools in the 1970s. Instructional designers have since utilized this educational philosophy to create huge amounts of educational software, training students on content and skills in fields as disparate as reading, geography, history, mathematics, typing, science, and the operation of military equipment. What the parts of these diverse subject areas taught by CAI have in common is an emphasis on factual knowledge and recipe-like procedures: material with a few correct ways of accomplishing tasks. So, for example, CAI can teach simple skills such as alternative algorithms for division, or contrasting ways to assemble and disassemble a gun, in which number of permissible variants is small and the end result is always the same. Factual knowledge, such as the year Columbus discovered America, is similar in its cognitive attributes: one right answer, basic mental processes primarily involving assimilation into memory. A contrasting illustration of knowledge and skills not well taught by CAI is learning how to write an evocative essay on "My Summer Vacation." Behaviorist instruction can help with the spelling and grammar aspects of this task, but effective literary style

is not reducible to a narrow range of "correct" rhetorical and narrative processes.

CAI as a pedagogical application is limited both in what it can teach and in the types of engagement they offer to learners. As discussed above, only some forms of content and skills are effectively mastered by Behaviorist instructional methods, and much of modern curriculum lies outside the range of these pedagogical media. Also, learning involving low-level retention is typically not deeply interesting no matter what form of motivation is used; so many students quickly tire of music, animations, simple games, and other CAI forms of extrinsic reward, leading to apathy about mastering content and skills. This weakness is exacerbated by a undamental assumption of Behaviorist instructional design that no complex knowledge or skill is learnable until the student has mastered every simple underlying subskill. This tenet leads to long initial sequences of low-level CAI in which students often lose sight of why they should care about learning the material, which may seem to them remote from the eventual goal-state of a more complex knowledge or skill with real-world utility.

ii. Cognitivist Instructional Technologies

As Dabbagh describes, Cognitivist theories of learning assume that reality is objective, but mediated through symbolic mental constructs. Students learn through mastering building blocks of knowledge based on preexisting relationships among content and skills. Instructors organize and sequence these building blocks to facilitate optimal mental processing. Knowledge acquisition is a mental activity that also entails internal coding and structuring by the student. Successful learning is dependent not only on what the teacher or pedagogical medium presents, but also on what the student does to process this input, storing and retrieving information organized in memory. The various psychological theories that underlie differing models within the general framework of Cognitivist instruction were developed by diverse groups during the second half of the twentieth century. Researchers whose theories were formative in developing this school of thought include Anderson (1993), Bruner (1960), Mayer (1977), Norman (1980), Newell and Simon (1972), and Palincsar and Brown (1984). Instructional design strategies based on Cognitivist theories often are designed to help students understand disciplinary knowledge (Case, 1992; Lee and Ashby, 2001; Hunt and Minstrell, 1994).

An example of an extensively developed, empirically grounded Cognitivist theory is Richard Mayer's work on multimedia learning. As summarized by Mayer and Moreno (1998):

In multimedia learning, the learner engages in three important cognitive processes. The first cognitive progress,

selecting, is applied to incoming verbal information to yield a text base and is applied to incoming visual information to yield an image base. The second cognitive process, organizing, is applied to the word base to create a verbally based model of the to-be-explained system and is applied to the image base to create a visually based model of the tobe- explained system. Finally, the third process, integrating, occurs when the learner builds connections between corresponding events (or states or parts) in the verbally based model and the visually based model. Mayer's theory illustrates goals for instruction characteristic of the Cognitivist school of thought, which include (National Research Council, 2005):

- Providing a deep foundation of factual knowledge and procedural skills
- Linking facts, skills, and ideas via conceptual frameworks – organizing domain knowledge as experts in that field do, in ways that facilitate retrieval and application
- Helping students develop skills that involve improving their own thinking processes, such as setting their own learning goals and monitoring progress in reaching these

Student motivation to achieve these goals is determined by a variety of intrinsic and extrinsic factors, such as satisfaction from achievement, contributing to others, and challenge and curiosity (Pintrich and Schunk, 2001). Although a wide variety of instructional technologies incorporate some principles from Cognitivism, intelligent tutoring systems (ITS) like Andes are veridical examples, illustrating pedagogical media based on this school of thought. As VanLehn (2006) describes, ITS have two loops by which the computer guides learning. The outer loop executes once for each task, where a task usually consists of solving a complex, multistep problem; its purpose is to select an appropriate task for the learner, given the student's past performance. The inner loop executes once for each step taken by the student in the solution of a task; its purpose is to provide feedback and hints on that specific step, as well as to assess the student's evolving competence and to update a model of what the student is judged to know at this point in the instructional sequence. That model of presumed student knowledge is eventually used by the outer loop to select a next task that is appropriate for the student. The National Science Foundation (NSF)-funded Pittsburgh Science of Learning Center (http://www.learnlab.org/) is dedicated to designing and studying this type of instructional strategy. Core research questions this Center is currently addressing include:

1. *Cotraining.* When, how, and why do students' use of multiple inputs, representations, or strategies facilitate learning, by providing an avenue for "self-supervised" learning that goes beyond learning supported by teacher and peer feedback?

2. *Dialogue*. When, how, and why does classroom talk and tutorial dialog, whether by human or computer, promote robust learning?

3. *Refinement*. How do learners determine the causal connections between cues in the environment, their actions, and desired knowledge; and how can instructional support and feedback facilitate learners in making such connections?

4. *Fluency*. How does more isolated learning of knowledge components interact with learning within larger authentic performances, and how can instruction support such interactions to yield more fluent and robust learning?

Scholars disagree on how broad a range of knowledge and skills Cognitive instructional technologies can teach. What the diverse subject areas now taught by pedagogical media like ITS have in common is well-defined content and skills, material with a few correct ways of accomplishing tasks. Current examples of ITS usage include mathematical reasoning, problem solving in scientific fields, learning a second language, and learning to read. The range of knowledge and procedures is somewhat similar to what is currently taught by Behaviorist instructional technologies, but more complex in detailed learning outcomes. Proponents of Cognitivist approaches believe that eventually ITS-like educational devices, coupled with human instructors, will teach most of the curriculum, including less-well-defined skills such as the rhetoric of writing an evocative essay. However, three decades of work toward this ambitious goal have yielded limited progress to date.

Some research studies have evaluated the effectiveness of ITS (illustrative of veridical Cognitivist instructional technologies). Overall, research findings show that ITS indicate a higher level of educational effectiveness than CAI or LMS instructional technologies.

iii. Constructivist Instructional Technologies

As Dabbagh describes, Constructivist theories of learning assume that meaning is imposed by the individual rather than existing in the world independently. People construct new knowledge and understandings based on what they already know and believe, which is shaped by their developmental level, their prior experiences, and their socio cultural background and context. Knowledge is embedded in the setting in which it is used; learning involves mastering authentic tasks in meaningful, realistic situations. Learners build personal interpretations of reality based on experiences and interactions with others, creating novel and situation-specific understandings. Instruction can foster learning by providing rich, loosely structured experiences and guidance (such as apprenticeships, coaching, and mentoring) that encourage

meaning-making without imposing a fixed set of knowledge and skills.

2B.4 ADULT LEARNING THEORY

Andragogy is the term used to define and explain adult education. Reischmann (2004) states that there are three understandings of the term andragogy: firstly, andragogy is the academic approach to the education of adults, the skill of those involved in education comprehending and supporting the lifelong education of adults; secondly, andragogy involves the instruction for adults focusing more on the learning process and less on the content being taught; thirdly, andragogy requires changing specific teaching methods to reflect the nature and disposition
of learners as opposed to simply diluting a pedagogical approach which does not cater for the specific and very different needs of adults.

The Department of Education and Science's Learning for Life: White Paper on Adult Education (2000) expands upon these ideas, recommending that when teaching adults, teachers need to:

1. Use a systemic approach by designing educational policies to embrace the life cycle. Adult education teachers must acknowledge and accept that learners' previous educational experiences may not have been favourable. From the onset, many adult learners may bring a preconceived idea to the classroom, of what their learning experience should entail;

2. Eliminate educational access barriers within a supportive management structure. All learners have the right to enhance their learning, irrespective of gender, age, disability or ethnic origin;

3. Design the course with consideration for each learner. Knowles (1990) presents a theory of andragogy to establish a learning theory specific to adults, stating that unlike pedagogy many adults are self-directed and like to take responsibility for their decisions. Furthermore, andragogy makes certain assumptions in relation to how adults prefer to learn. Most notably, adult learners need to know why they need to learn something, approach learning as a problem solving exercise and learn best when the topic is of immediate value to them. Adults also view learning from a practical viewpoint and in many cases may not be interested in knowledge for its own sake.

Adult learners primarily return to education for four reasons: to improve work prospects; to obtain qualifications; to overcome learning blocks instilled from previous educational experiences; and

to fulfil dreams (Scanlon 2008). In light of these factors, the next section will address what role ICT plays in andragogy.

ICT in Adult Education

Much research has been conducted into the effectiveness and usefulness of integrating ICT into classrooms. However, its integration into an adult learning environment is a relatively new concept which, as yet, has not been fully explored. Traditionally, adult education in many countries was mainly concerned with developing basic educational skills such as literacy and numeracy. Therefore, many adult education teachers do not see the need for ICT integration. Indeed, many view ICT as a distraction (Ginsburg *et al* 2000). These authors also assert that the ability to use ICT effectively is equally as important as learning the basic skills of reading and writing. In the twenty first century, it is no longer an issue as to whether ICT should be used in the education system. The majority of learners, irrespective of age, have access to ICT and learners need to become competent in using ICT for career preparation. This increased ICT access has resulted in many learners today being comfortable with technology and not afraid to use technology to learn. Strommen and Lincoln (1992) and Sutherland *et al* (2000) support this by declaring that from 10 a young age, learners encounter technology all around them. Many believe that this is the main aim for ICT use in today's classroom. Many learners want and expect more from their educational experience, alongside their qualifications. Indeed, a wide range of individual goals exists within any single learning environment, especially for the adult learner. Alexander (2000) argues that educational goals may be influenced by local and national employment trends and highlights the fear that the any countries economy may fall behind other countries if they do not integrate ICT effectively in education.

For many adults, returning to education can be their first step to resuming learning within a structured learning environment (Keogh and Downes 1998). Many will encounter ICT in education for the first time. Not all learners though will learn more effectively if ICT is used (Healy 1998: Townsend 1997). Consideration needs to be given to the differences between learners and how they learn (Ross and Schulz 1999). In response to this differentiation, ICT has the ability to integrate pictures, video, animation, text and sound. Abrams (1996) stated that this multi-sensory element helps individual learners to learn in different ways, as it can be tailored to meet their differing learning styles. Similarly, educators should avoid ICT resources that consist of a series of attractive images, sounds and video that offer little educational value (Aldrich *et al* 1998). Adult learners may be apprehensive about returning to education. Using interactivity, ICT and Computer Aided Instruction

(CAI) could be viewed as a mechanism to conquer this fear. Furthermore, Light *et al* (1997) states that CAI also allows learners to participate more in their learning than they would in a faceto-face forum.

Kuittinen (1998) argues that CAI should be based on what users need and want to achieve. ICT could be used to motivate learners to achieve their individual learning goals. Moreover, a need for interactivity is reinforced by Leach and Moon (2000) who argue that computer use is more effective when both teaching and learning processes are interactive. The centrality of all learners' needs is critical to effective learning. Identification of these needs can be achieved if teachers take time to ascertain each individual learner's prior ICT knowledge and experience. Accordingly, teachers can build upon this existing knowledge and provide suitable ICT activities and learning opportunities (Cook and Finlayson 1999). As the extent of ICT use within a classroom is in part dependent on learners' preferred learning styles, the next section will outline the affect ICT has on learning styles.

Learner-centred versus teacher-centred learning

Some adult learners prefer a more teacher-centred learning approach while others favour a more learner-centred approach. Miller and Olson (1995) argue that using ICT in the classroom has signified a restructuring of the way teachers plan. Consequently, teachers must be open to change and be adaptable. Planning to suit each individual learner's needs and being flexible within this, enables educators to adapt and to use ICT in a manner which puts learners at the centre of the planning and the consequent intended learning process. This learner-centred approach is best achieved when learners are given opportunities to explore within a computer learning environment, which is supportive. This will promote ownership of the learning process for the learners and encourage critical thinking skills (Lai 1993). The promotion of this more learner-centred approach provides more opportunities for the differentiated needs and learning styles of individual learners (Kirkpatrick and Cuban 1998).

Despite this, ICT may not match the expectations of its users and some software fails to promote higher order thinking skills (Kirkpatrick and Cuban 1998). The use of ICT requires a deviation from the more behaviourally based instructional applications of computer technology towards exposure to more interactive and multifaceted ICT, which is seen to facilitate the aforementioned higher order thinking skills (Baron and Goldman 1994). A learner's favoured learning approach is intrinsically linked to their preferred learning style. Consequently, these cannot be ignored in deciding how to integrate ICT into a learning environment.

2B.5. LEARNING STYLES

Although research has been conducted on the effect of ICT on learning outcomes (Chen and Ford 1997), educators are now cognisant of the impact technology has on learning styles. Ross and Schulz (1999) state that ICT effectiveness can only be identified if the fundamental differences that exist between learners are explored. Learners may be visual, auditory, or kinaesthetic learners. Gardner (1993) stated that everyone has different types and levels of intelligences and this is why they learn and indeed prefer to learn in different ways.

Using ICT within a classroom encourages and supports the constructivist approach to learning, such as that explored by Vygotsky (1978). Constructivism views learning as a process in which learners actively construct new ideas or concepts based upon their current and past knowledge (Lai 1993). Constructivism can be viewed as a very personal endeavour, whereby learners' own experiences are applied in a practical real-world context. Knowles (1990) viewed this as a major contributor to the needs of an adult learner. Gardner (1993) further stated that the learning process should centre around the learner, as it is only through this approach that each learner can acquire and enhance independent thinking and learning skills. Eisenberg and Johnson (2002) reinforce this, stating that a behaviourist approach to learning limits a learner's ability to link understanding and develop problem solving skills. In direct comparison to a constructivist classroom, a behaviourist classroom environment centres on the teacher. The teacher decides on the class objectives, breaks them into stages and assists the learner to reach them. The main disadvantage of this teaching method is that learners are not active in their learning, Gonzalez 2002 (cited in Russell 2002). However, a behaviourist classroom can be adapted to integrate ICT if teachers use ICT to attain the desired class objectives.

Any discussion regarding ICT must acknowledge the significance of other influences upon computer use. Engagement theory has much in common with the constructivist approach, as it claims that learner centrality is further advanced when learners are provided with activities that are both meaningful and provide authentic opportunities to interact with peers (Marshall 2007).

A major difference between a young learner and an adult learner is life experience. Kolb (1984) created an experiential learning circle outlining the role of experience upon a learning situation (Fig. 2.1).
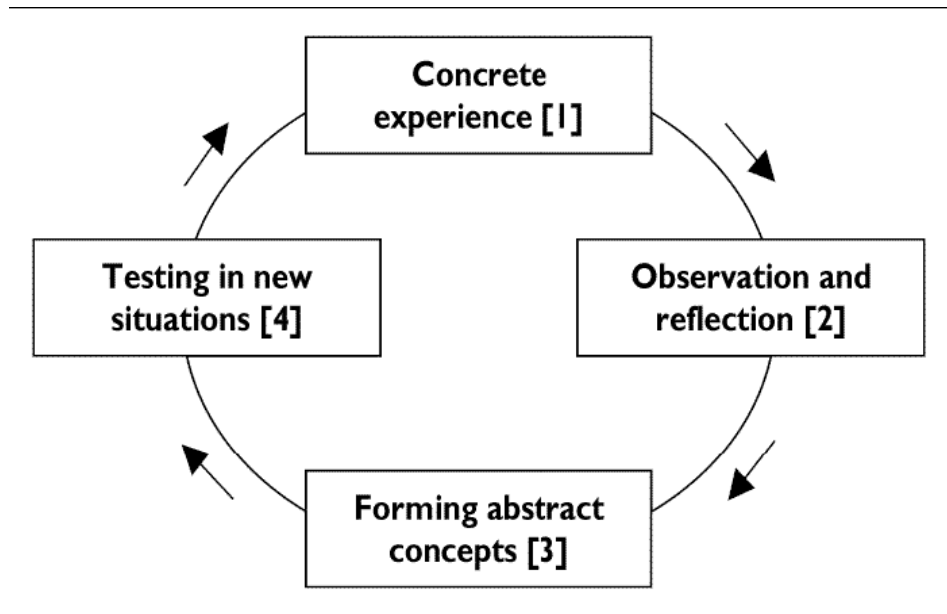
Fig 2.1: *Kolb's Experiential Learning Circle Source: Smith (2001)*

Kolb argues that learning could begin at any point on the circle, although in most instances, it begins at the first point, the concrete experience or action. The learner then observes the effects of this action and attempts to understand the effect (forms abstract concepts). Learners then recognise what procedures would follow a similar action in a new situation (testing). Although adhering to individual learning approaches plays a major role in determining whether and how computer use is promoted in a classroom, other factors also influence effective ICT use. Indeed, Leach and Moon (2000) argue that the learning approach is inconsequential if ICT is not integrated into both the planning and implementation of the actual curriculum.

Unit End Exercises
Q1. Explain the various factors that affect ICT learning.
Q2. Discuss why environmental factors play such an important role in the ICT learning process.
Q3. In order to see that ICT is deeply integrated in the curriculum, suggest ways to facilitate ICT learning.
Q4. Discuss the contribution of the different theories of learning to ICT learning.
Q5. How can ICT support a learner centered environment for learning.
Q6. Sate the unique characteristics of adult learners.
Q7. Discuss the need for understanding adult learning styles while planning an ICT based instructional design.

REFERENCES

Alexander, R. J. (2004). *Towards dialogic teaching: Rethinking classroom talk*. York: Dialogos.

Alspaugh, J. W. (1999). The relationship between the number of students per computer and educational outcomes. *Journal of Educational Research, 21*(2), 141–150.

J. Voogt and G. Knezek: *International Handbook of Information Technology in Primary and Secondary Education*.

Kanaya, T., Light, D. & Mcmillan Culp, K. 2005. Factors Influencing Outcomes from a Technology-Focused Professional Development Program . Journal for Research in Technology Education, 37, 313-329.

Light . D.2010. Multiple factors supporting the transition to ICT-rich learning environments in India, Turkey, and Chile . *International Journal of Education and Development using Information and Communication Technology (IJEDICT),* 2010, Vol. 6, Issue 4, pp.39-51.

Rampal, A. 2002. Texts in Context: Development of Curricula, Textbooks and Teaching and
Learning Materials. In: GOVINDA, R. (ed.) India education report. New Delhi: Oxford University Press.

International Development Research Centre (IDRC). (2005). Wireless teacher training & e-learning platform. Retrieved 19th March 2005, from http://web.idrc.ca/en/ev-51270-201-1-DO_TOPIC.html

Leahy, Noeleen ,Irwin, Joanne (2010). An investigation of the factors that promote and hinder the use of ICT in an Irish adult education and training centre. University of Limerick, Department of Education and Professional Studies **http://hdl.handle.net/10344/963** retrieved on July 29,2011.

COX, M., PRESTON, C. & COX, K. (1999),'What factors support or prevent teachers from using ICT in their classrooms?', paper presented at the British Educational Research Association Annual Conference, University of Sussex at Brighton, September 2–5. Retrieved from
http://www.mmiweb.org.uk/publications/ict/Research_Barriers_TandL.pdf on 23.7.11

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3

INSTRUCTIONAL DESIGN

Unit Structure

3.0 OBJECTIVES

This unit deals with a brief introduction of the concept of instructional designs, Need for instructional designs and the levels of instructional design. This is followed by an overview of the different theories and models of instructional design with a detailed emphasis on ADDIE model and Dick and Carrey Model. This is then followed by the general steps in the development of an instructional design. Hence by the end of the unit you will be able to:

- Describe the concept of an instructional design,
- Explain the need for using instructional designs,
- Discuss the various steps of ADDIE model,
- Describe Dick and Carrey's Model of Instructional Design,
- Explain the various steps I developing an instructional design.

3.1 WHAT IS AN INSTRUCTIONAL DESIGN?

Many definitions exist for instructional design - all of them

are an expression of underlying philosophies and view points of what is involved in the learning process. Distinguishing the underlying philosophy of learning (in terms of: How does learning occur? What factors influence learning? What is the role of memory? How does transfer occur? What types of learning are best explained by the theory? Learning theories can help instructors and designers select the design model most congruent with their education philosophies. The following is a listing of ID definitions:

- Instructional Design is the systematic process of translating general principles of learning and instruction into plans for instructional materials and learning.

- Instructional design is a systematic approach to planning and producing effective instructional materials. It is similar to lesson planning, but more elaborate and more detailed.

- Instructional Design is the systematic development of instructional specifications using learning and instructional theory to ensure the quality of instruction. It is the entire process of analysis of learning needs and goals and the development of a delivery system to meet those needs. It includes development of instructional materials and activities; and tryout and evaluation of all instruction and learner activities.

- In general, ID theory needs to move in the direction of flexibility and learner-empowerment if it is to allow ID to keep up with technological and institutional changes...."Like the chiropractor who realigns your spine, we might become healthier from a realignment of our theories. If we admit to and attempt to accommodate some of the uncertainty, indeterminism, and unpredictability that pervade our complex world, we will develop stronger theories and practices that will have more powerful (if not predictable) effects on human learning."

- Instructional design is the process by which instruction, computer-based or not, is created. Instructional design provides a framework for the creative process of design, and ensures the learners' needs are met.

- Instructional design ("ID", also known as instructional systems design or "ISD") is a tested and proven methodology for developing instruction. It first gained popularity in World War II, where the Instructional design approach fared so well that it was quickly co-opted into corporate training. In the fifty years that followed, ID has become the standard for producing excellent training in both the military and corporate realms, as well as textbook authoring and development of computer-based learning material

- Instructional design is a systematic approach to course

development that ensures that specific learning goals are accomplished. It is an iterative process that requires ongoing evaluation and feedback.

- Instructional Design is the art and science of creating an instructional environment and materials that will bring the learner from the state of not being able to accomplish certain tasks to the state of being able to accomplish those tasks. Instructional Design is based on theoretical and practical research in the areas of cognition, educational psychology, and problem solving.

3.2 WHY USE INSTRUCTIONAL DESIGN?[1]

With a foundation of what instructional design (ID) is, , we will now focus on the WHY of ID. Many classroom activities don't leave a "trail" that can be viewed by others (at least not directly - successes of graduates of a program can be evaluated and the relevance of courses assessed). Instructional designs provide the learner and all involved in the process of teaching and learning a concrete plan and an evidence of what is and why is it being transacted in the teaching learning situation. Content, discussions, interactions, etc. can all be evaluated and reviewed by persons other than the instructor. As such, quality can be assessed more objectively. ID is a quality process. It seeks to ensure that critical concepts are explored through content presentation and learning activities.

Beyond quality and transparency issues, the greatest value ID offers is to students of online programs. The greatest objective of ID is to serve the learning needs and success of students through effective presentation of content and fostering of interaction.

Additional benefits instructional design offers e learning:

- "Distance learning courses are likely to fail if they are delivered as if they were traditional courses." (Smith, 1996)

- "Pedagogy must drive the choice of instructional technology, not the other way around." (Chizmar & Walbert, 1999)

- "Compared with a human instructor, technology is less adaptive. Once a plan of integration is implemented, it is less likely to change it according to student's reactions. This is why instructional design plays an important role in bridging pedagogy and technology. Subject contents have to be well organized and

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[1]   Instructional Design in E learning, George Siemens (2002). Retrieved from http://www.elearnspace.org/Articles/InstructionalDesign.htm on May 10,2011.

strategies for teaching via a chosen medium have to be well-thought-out. Instructional design can help educators making the best use of technology; therefore guarantee a successful integration."

- Provides consistency between various courses developed by various instructors/designers. The general look and process of content exploration is standardized.

- In a classroom, an instructor can adjust "on the fly"...if, during the design process, a concept was not communicated clearly, a classroom instructor can clarify. Online, this type of adjustment is usually not possible. The design process must anticipate and meet potential concerns/amibiguities...or put another way ID tries to do online what the instructor does in a classroom.

- ID focuses on the most effective way to present content

- ID begins with the learner and the learner experience

- Quality of course is ensured through ID - covers all the phases of good development

- ID gives structure to the student's process of working through course material

- Appropriate use of technology: "With e-learning and blended learning proving to be no more effective than traditional classroom methods, why are so few training professionals recognising this simple fact: Technology, no matter how advanced, cannot compensate for its misapplication. Here's why instructional design is - and always has been - the key to unlocking the true potential of available learning technologies."

- Accelerate development. A current concern in elearning is development time. ID can speed up development time.

- Creates a transparent process - easier to track and utilize the experiences of development teams (a knowledge management issue)

- "Too much of the structure of educational technology is built upon the sand of relativism, rather than the rock of science. When winds of new paradigms blow and the sands of old paradigms shift; then the structure of educational technology slides toward the sea of pseudo-science and mythology. We stand firm against the shifting sands of new paradigms and "realities." We have drawn a line in the sand. We boldly reclaim the technology of instructional design that is built upon the rock of instructional science."

3.3 LEVELS OF INSTRUCTIONAL DESIGN:

Instructional design is important for both face-to-face and distance education systems. Organizing a programme of study without instructional design is to invite failure. Interestingly, as we can see in most of the instructional designs other than ADDIE, instructional design is carried out as a process; and Romiszowski (1982) elaborates on the four levels of instructional design emphasizing that in the process of instructional design the teacher is often just one member of the team. The four levels of instructional design are:

1. **Level 1:** The 'course' level with many objectives to achieve in the course (often it is the curriculum level decisions)

2. **Level 2:** The 'lesson' level, where the course structure becomes clear with each lesson having specific outcomes (often part of the syllabus design)

3. **Level 3:** The 'instructional event' level, where each objectives of the lesson is detailed out sequentially (often called lesson plan)

4. **Level 4:** The 'learning step' level, where each instructional event is planned and written in some script or self-instructional material (often the last implementation part of the process)

3.4 OVERVIEW OF THEORIES AND MODELS OF INSTRUCTIONAL DESIGNS

What are Theories and Models?

What is a theory?

A theory provides a general explanation for observations made over time.

A theory explains and predicts behavior.

A theory can never be established beyond all doubt.

A theory may be modified.

Theories seldom have to be thrown out completely if thoroughly tested but sometimes a theory may be widely accepted for a long time and later disproved.

(Dorin, Demmin & Gabel, 1990)

What is a model?

A model is a mental picture that helps us understand something we cannot see or experience directly.

(Dorin, Demmin & Gabel, 1990)

3.5 OVERVIEW OF LEARNING THEORIES

Learning theories have significant bearing on instructional design, as there is a logical development from learning to instruction. Instructional design optimizes learning outcomes while learning theories are the backbone of any instructional design. Instructional design is the articulation or the manifestation of the learning theories, and its main aim is to optimize learning by using the known theories of learning.

Strain (1994) states that a wide divergence of views exists among the researchers in instructional design regarding the relative contribution of various schools of psychology and claims that instructional design has grown out of the systems approach with its roots firmly in behaviorists psychology that has dominated instructional design since the 1960s. However, Hannafin and Reiber (1989) point out that instructional design developed in the 1980s by Gagne, Merrill, Reigeluth and Scandura is largely due to the influence of cognitive theories of learning. Of course the emphasis has been on how information is retrieved, selected, processed and perceived. More recent developments are due to Constructivist learning theories. Instructional designers no longer depend on any one theory. They draw upon and incorporate from different learning theories, mix those with other information and apply the results to meet human needs (van Patten, 1989).

Let us examine the three basic schools of theories of learning, namely, Behaviorism, Cognitivism and Constructivism. These three schools of learning theories have implications for instructional design. In short, behaviorists believe that learning results in changing the learning behaviour whereas cognitivists believe that learning occurs when learners add new concepts and ideas to their cognitive structure. Constructivists believe that the

learners

construct knowledge for themselves -- each learner individually. All the three learning theories have implications for instructional design.

3.6   LEARNING THEORIES AND THEIR IMPLICATIONS FOR INSTRUCTIONAL DESIGN

Behaviourists emphasize changes in behaviour as the outcome of learning. Behaviourist principle of reinforcement, retention and transfer of learning are important design considerations, as learning is facilitated by reinforcing the correct performances. Statements of behavioural objectives allow the learners to know specifically when they have achieved their objectives. In this way, learners can monitor their own progress. The knowledge of objectives serves as a reinforcing agent. The frequency of reinforcement is also a design issue. Presenting the content of the instruction in smaller steps, followed by testing and reinforcing performance immediately, does this. Retention of the information for the learners is also important for the instructional designer. Materials that provide more reinforcing activities help in the retention of what has been learnt.

Cognitive psychologists like Piaget, Bruner and Ausubel contend that learning is an internal process that cannot be observed directly. Learners first remember and then retrieve information from the memory. Cognitivists emphasize on how the human mind works. They put particular emphasis on memory. The implication of this theory for the instructional designers is that they could use various techniques like chunking, mnemonics and meaningful organization of content and give practice for storing and retrieving information. Practice implies provision of increased opportunities to the learners for reward and reinforcement. Cognitive structures are created through practice, which leads to an efficient use of long-term memory. For example, instructional designers include pictures used in video programmes or practice exercises in the self-learning material that offer opportunities for practice.

Practice is important in learning cognitive tasks as well as motor skills.

Constructivists promote an open ended learning experience where methods and results of learning are not easily measured and are different for each learner. The implication of constructivism for the instructional designer is that the learners should attach themselves to the content domains. Constructivists believe that learning occurs when it is situated, contextual, problem based, social and authentic. Learning theories influence Instructional

Design in a significant way. Learning theory becomes an essential element in the preparation of instructional design professionals because they permeate all dimensions of instructional design (Schiffman, 1991). There is no one single theory which designers keep in mind while designing the instructional strategies and content. Ertmer and Newby (1993) feel that the

- behavioural approach can effectively facilitate mastery of the content,

- cognitive strategies are useful in teaching problem solving tactics, and

- constructivist strategies are suited for dealing with ill defined problems.

Let us examine a few instructional design theories and models. Before we do so, let us see the difference between a theory and a model. A theory provides a general explanation for observations and explains the behaviour whereas a model is a mental picture that helps us to understand something that we cannot see or experience directly (Dorin, Demmin and Gabel, 1990). There are various instructional design theories and models developed by various authors. Let us explore what is an instructional design theory. Reigeluth (1999) defines an instructional design theory as the one "that offers explicit guidance on how to better help people learn and develop". The kinds of learning may include cognitive, emotional, social, physical and spiritual learning. Reigeluth (1999) states four major characteristics that all instruction design theories have in common. These are:

- Design Orientation
- Identification of methods of instruction and situations,
- Methods of instruction can be broken down into more detail components and methods,
- Choice of probabilistic methods.

The design theories have become important as they help the stakeholders to develop a vision of the instruction early in the design process (Diamond, 1980). This vision is in terms of ends (how learners will be different as a result of it) and the means (how those changes in the learners will be fostered). Banathy (1991) states that instructional design theories should allow for much greater use of the notion of "userdesigner" . This means that the users play a major role in designing their own instruction.

These theories are also important as they provide guidance at three levels (Reigeluth, 1999). These are:

- methods that best facilitate learning under different situations,
- learning tool features that best allow an array of alternative methods to be made

  available to learners,

- system features that best allow an instructional design team to design quality learning

  tools.

3.7 AN ECLECTIC APPROACH TO THEORY IN INSTRUCTIONAL DESIGN

The function of ID is more of an application of theory, rather than a theory itself. Trying to tie Instructional Design to one particular theory is like school vs. the real world. What we learn in a school environment does not always match what is out there in the real world, just as the prescriptions of theory do not always apply in practice, (the real world). From a pragmatic point of view, instructional designers find what works and use it.

Behaviorism, cognitivism and constructivism - what works where and how do we knit everything together to at least give ourselves some focus in our approach to instructional design? First of all we do not need to abandon the systems approach but we must modify it to accommodate constructivist values. We must allow circumstances surrounding the learning situation to help us decide which approach to learning is most appropriate. It is necessary to realize that some learning problems require highly prescriptive solutions, whereas others are more suited to learner control of the environment. (Schwier, 1995)

Jonnassen in *Manifesto for a Constructive Approach to Technology in Higher Education* ([On-line]) identified the following types of learning and matched them with what he believes to be appropriate learning theory approaches.

1. Introductory Learning - learners have very little directly transferable prior knowledge about a skill or content area. They are at the initial stages of schema assembly and integration. At this stage classical instructional design is most suitable because it is predetermined, constrained, sequential and criterion-referenced. The learner can develop some anchors for further exploration.

2. Advanced Knowledge Acquisition - follows introductory knowledge and precedes expert knowledge. At this point

constructivist approaches may be introduced.

3. Expertise is the final stage of knowledge acquisition. In this stage the learner is able to make intelligent decisions within the learning environment. A constructivist approach would work well in this case.

Having pointed out the different levels of learning, Jonassen stresses that it is still important to consider the context before recommending any specific methodology.

Reigeluth's Elaboration Theory which organizes instruction in increasing order of complexity and moves from prerequisite learning to learner control may work in the eclectic approach to instructional design, since the learner can be introduced to the main concepts of a course and then move on to more of a self directed study that is meaningful to them and their particular context.

After having compared and contrasted behaviorism, cognitivism and constructivism, Ertmer and Newby (1993) feel that the instructional approach used for novice learners may not be efficiently stimulating for a learner who is familiar with the content. They do not advocate one single learning theory, but stress that instructional strategy and content addressed depend on the level of the learners. Similar to Jonassen, they match learning theories with the content to be learned: ... a behavioral approach can effectively facilitate mastery of the content of a profession (knowing what); cognitive strategies are useful in teaching problem -solving tactics where defined facts and rules are applied in unfamiliar situations (knowing how); and constructivist strategies are especially suited to dealing with ill-defined problems through reflection-in-action. (Ertmer P. & Newby, T., 1993)

Behavioral ... tasks requiring a low degree of processing (e.g., basic paired associations, discriminations, rote memorization) seem to be facilitated by strategies most frequently associated with a behavioral outlook (e.g., stimulus-response, contiguity feedback/ reinforcement).

Cognitive
Tasks requiring an increased level of processing (e.g., classifications, rule or procedural executions) are primarily associated with strategies having a stronger cognitive emphasis (e.g., schematic organization, analogical reasoning, algorithmic problem solving).

Constructive
Tasks demanding high levels of processing (e.g., heuristic problem solving, personal selection and monitoring of cognitive strategies) are frequently est learned with strategies advanced by

the constructivist perspective (e.g., situated learning, cognitive apprenticeships, social negotiation.

(Ertmer P. & Newby, T., 1993)

Ertmer and Newby (1993) believe that the strategies promoted by different learning theories overlap (the same strategy for a different reason) and that learning theory strategies are concentrated along different points of a continuum depending of the focus of the learning theory - the level of cognitive processing required.

3.8   OVERVIEW OF MODELS

At the root of Instructional Design and/or Instructional Design Models, is a systematic process that Instructional Designers should follow in order to achieve the creation of efficient and effective instruction. Or more simply put, Instructional Design (ID) is a framework for learning (Siemens, 2002). This framework asks the Instructional Designer to assess the desired outcomes of the learning and begin to apply an ID model that is most appropriate to assist in achievement of these desired outcomes. Despite some ID models being quite generic in nature, they are incredibly popular and capable because they present a very effective, yet general, model to build various types of instruction to meet different objectives in learning.

Below you will see a variety of popular models listed. These items do not attempt to outline the specifics of any Instructional Design model, but rather serve to convey the variety and possible application of these models to specific instructional task. As you may notice, or soon come to learn, most of these models can be modified to meet your specific needs. Their systematic *frameworks* allow you to borrow from their strengths and retrofit several models to meet your differing needs.

3.8   INSTRUCTIONAL DESIGN MODELS

Instructional design, very loosely defined, is a system or process of organizing learning resources to ensure learners achieve established learning outcomes. As such, it is essentially a

framework for learning. From a designers perspective, various models can be followed in the instructional design process. It is important to note that, at best, a model is a representation of actual occurrences and, as such, should be utilized only to the extent that it is manageable for the particular situation or task. Put another way, perhaps one model is more effective for designing a math course, and another model is more effective for designing soft skill courses (like managing people, customer service, etc.).

Instructional design (ID) models grew out of the teaching profession and came to fruition during World War II when the nation had to be quickly trained and troops mobilized to run the equipment of war. A combination of face-to-face, hands-on, individualized, and group units of instruction were developed by the armed forces using ID models to effectively train massive numbers of troops.

However, all of them share some basic features:

- Needs assessment
- Goal and objective identification
- Audience and setting analysis
- Content and delivery development
- Evaluation and redesign

Many ID models are depicted in little step-by-step rectangular boxes leading to the impression that you complete each one in the order shown. On the contrary, ID is a dynamic process with constant movement back and forth between the steps. For instance, evaluation is based on objectives but it also helps to clarify the objectives. If evaluation alters the objectives, it also alters the content, and both need to be re-addressed.

Here is an overview of some different models for instructional design:

■ ADDIE - refers to Analyze, Design, Develop, Implement, and Evaluate. This is possibly the best known design model, and is frequently used in academic circles.

■ Dick and Carey Model - "The Dick and Carey model prescribes

a methodology for designing instruction based on a reductionist model of breaking instruction down into smaller components. Instruction is specifically targeted on the skills and knowledge to be taught and supplies the appropriate conditions for the learning of these outcomes." (Details will be discussed in the next sub unit)

■ Robert Gagné's ID Model - "Gagné's approach to instructional design is considered a seminal model that has influenced many other design approaches and particularly the Dick & Carey systems approach. Gagné proposed that events of learning and categories of learning outcomes together provide a framework for an account of learning conditions. "

Robert Gagne is considered to be the foremost contributor to the systematic approach to instructional design and training. Gagne and his followers are known as behaviorists, and their focus is on the outcomes (or behaviors) resulting from training.

Gagne's book, *The Conditions of Learning*, identified the mental conditions for learning. Gagne created a nine-step process called the events of instruction, which correlate to and address the conditions of learning. See the nine events of instruction below:

1. Gain attention
2. Inform learner of objectives
3. Stimulate recall of prior learning
4. Present stimulus material
5. Provide learner guidance
6. Elicit performance
7. Provide feedback
8. Assess performance
9. Enhance retention transfer

■ Minimalism " The Minimalist theory of J.M. Carroll is a framework for the design of instruction, especially training materials for computer users. The theory suggests that (1) all learning tasks should be meaningful and self-contained activities, (2) learners should be given realistic projects as quickly as possible, (3) instruction should permit self-directed reasoning and improvising by increasing the number of active learning activities, (4) training materials and activities should provide for error recognition and recovery and, (5) there should be a close linkage between the training and actual system."

■ Kemp, Morrison, and Ross Nine step instructional design

model.

The Jerold Kemp instructional design method and model defines nine different components of an instructional design and at the same time adopts a continuous implementation/evaluation model.

Kemp adopts a wide view, the oval shape of his model conveys that the design and development process is a continuous cycle that requires constant planning, design, development and assessment to insure effective instruction. The model is systemic and nonlinear and seems to encourage designers to work in all areas as appropriate (Steven McGriff).

The model is particularly useful for developing instructional programs that blend technology, pedagogy and content to deliver effective, inclusive (reliable) and efficient learning.

According to McGriff, Kemp identifies nine key elements:

1. Identify instructional problems, and specify goals for designing an instructional program.
2. Examine learner characteristics that should receive attention during planning.
3. Identify subject content, and analyze task components related to stated goals and purposes.
4. State instructional objectives for the learner.
5. Sequence content within each instructional unit for logical learning.
6. Design instructional strategies so that each learner can master the objectives.
7. Plan the instructional message and delivery.
8. Develop evaluation instruments to assess objectives.
9. Select resources to support instruction and learning activities.

Figure 1 below illustrates the Kemp instructional design model:
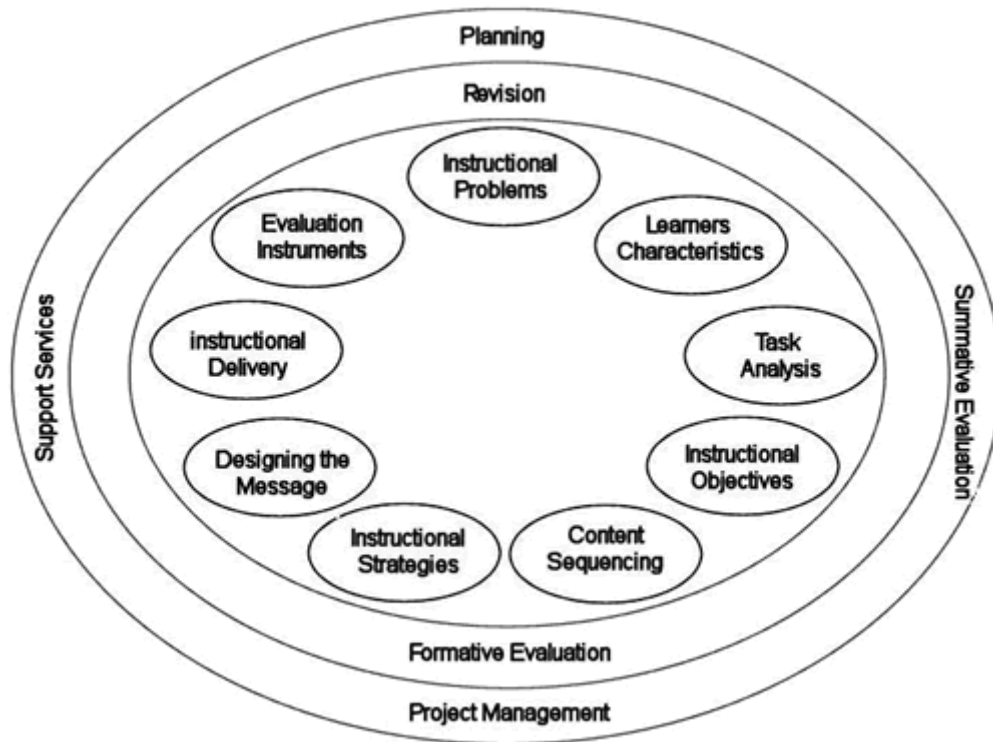
- Rapid Prototyping - "Generally, rapid prototyping models involve learners and/or subject matter experts (SMEs) interacting with prototypes and instructional designers in a continuous review/revision cycle. Developing a prototype is practically the first step, while front-end analysis is generally reduced or convereted into an on-going, interactive process between subject-matter, objectives, and materials " Thiagi - Rapid ID

- Epathic Instructional Design - 5-step process: Observe, capture data, reflect and analyze, brainstorm for solutions, develop prototypes

3.9   ADDIE MODEL

The ADDIE instructional design model is the generic process traditionally used by instructional designers and training developers. The five phases—Analysis, Design, Development, Implementation, and Evaluation—represent a dynamic, flexible guideline for building effective training and performance support tools.

Analysis

In the analysis phase, the instructional problem is clarified, the instructional goals and objectives are established and the learning environment and learner's existing knowledge and skills are identified.

Design

The design phase deals with learning objectives, assessment instruments, exercises, content, subject matter analysis, lesson planning and media selection. The design phase should be systematic and specific.

Development

The development phase is where instructional designers and developers create and assemble the content assets that were blueprinted in the design phase. In this phase, storyboards are created, content is written and graphics are designed. If e learning is involved, programmers work to develop and/or integrate technologies.

Implementation

During the implementation phase, a procedure for training the facilitators and the learners is developed. The facilitators' training should cover the course curriculum, learning outcomes, method of delivery, and testing procedures.

Evaluation

The evaluation phase consists of two parts: formative and summative. Formative evaluation is present in each stage of the ADDIE process. Summative evaluation consists of tests designed for domain specific criterion-related referenced items and providing opportunities for feedback from the users which were identified.

It is an Instructional Systems Design (ISD) model. Most of the current instructional design models are spin-offs or variations of the ADDIE instructional design model; other models include the Dick & Carey and Kemp Instructional System Design (ISD) models. One commonly accepted improvement to this model is the use of rapid prototyping. This is the idea of receiving continual or formative

feedback while instructional materials are being created. This model attempts to save time and money by catching problems while they are still easy to fix.

3.10 DICK AND CAREY MODEL

Stage 1. Instructional Goals
* Instructional Goal: Desirable state of affairs by instruction
* Needs Analysis : Analysis of a discrepancy between an instructional goal and the present state of affairs or a personal perception of needs.

Stage 2. Instructional Analysis
* Purpose : To determine the skills involved in reaching a goal
* Task Analysis (procedural analysis) : about the product of which would be a list of steps and the skills used at each step in the procedure
* Information-Processing Analysis : about the mental operations used by a person who has learned a complex skills
* Learning-Task Analysis : about the objectives of instruction that involve intellectual skills

Stage 3. Entry Behaviors and Learner Characteristics
* Purpose : To determine which of the required enabling skills the learners bring to the learning task
* Intellectual skills
* Abilities such as verbal comprehension and spatial orientation
* Traits of personality

Stage 4. Performance Objectives
* Purpose : To translate the needs and goals into specific and detailed objectives
* Functions : Determining whether the instruction related to its goals. Focusing the lesson planning upon appropriate conditions of learning Guiding the development of measures of learner performance Assisting learners in their study efforts.

Stage 5. Criterion-Referenced Test Items
* To diagnose an individual possessions of the necessary prerequisites for learning new skills
* To check the results of student learning during the process of

a lesson
* To provide document of students progress for parents or administrators
* Useful in evaluating the instructional system itself (Formative/ Summative evaluation)
* Early determination of performance measures before development of lesson plan and instructional materials

Stage 6. Instructional Strategy
* Purpose : To outline how instructional activities will relate to the accomplishment of the objectives
* The best lesson design : Demonstrating knowledge about the learners, tasks reflected in the objectives, and effectiveness of teaching strategies
  e.g. Choice of delivering system. Teacher-led, Group-paced vs. Learner-centered, Learner-paced

Stage 7. Instructional Materials
* Purpose : To select printed or other media intended to convey events of instruction.
* Use of existing materials when it is possible
* Need for development of new materials, otherwise
* Role of teacher : It depends on the choice of delivery system

Stage 8. Formative Evaluation
* Purpose : To provide data for revising and improving instructional materials
* To revise the instruction so as to make it as effective as possible for larger number of students
* One on One : One evaluator sitting with one learner to interview
* Small Group
* Field Trial

Stage 9. Summative Evaluation
* Purpose : To study the effectiveness of system as a whole
* Conducted after the system has passed through its formative stage
* Small scale/ Large Scale
* Short period/ Long period

The picture below shows you the steps in their model:
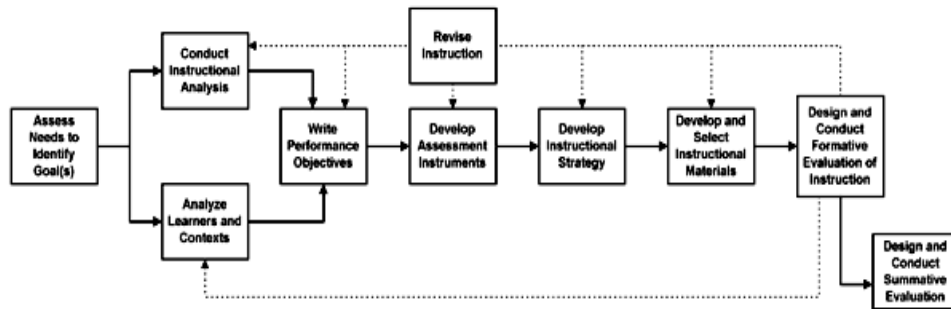
3.11 STAGES OF DEVELOPING AN INSTRUCTIONAL

DESIGN[2]

The purpose of this document is to outline the 10 stage process commonly used by Cape Media in the design and development of an eLearning product. Permission must be obtained from Cape Media for the dissemination or other use of this document.

Stage 1 - Instructional Goals
Conduct analysis of a discrepancy between the ultimate, desired outcome and the present state of affairs. A perception of needs may or may not be an accurate assessment.

Stage 2 - Needs Analysis
Task Analysis determines and lists the steps and skills used at each step in the given procedure involved in reaching the goal. The TA can include an Information-Processing Analysis (learners' mental operations) and/or a Learning-Task Analysis (objectives of instruction involving intellectual skills).

Stage 3 – Audience and Environmental Analysis
The Audience Analysis determines which of the required enabling skills the learners bring to the learning task, such as intellectual skills, abilities (verbal comprehension, spatial orientation), and personality traits. The Environmental Analysis is used to evaluate the learning environment and its related conditions, advantages, and potential problems.

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[2]   Erik Lord Annapolis (2006) Stages of Instructional Design Cape Media, Retrieved on May 10,2011 from
http://www.capemedia.net/whitepapers/CapeMedia_ID-stages.pdf

Stage 4 - Performance Objectives

Translate the needs and goals into specific and detailed objectives by determining whether the instruction is related to its goals. Considerations include focusing the lesson plan on appropriate learning conditions, guiding the development of performance measures, and assisting learners in their study efforts where applicable.

Stage 5 - Criterion-Referenced Test Items

Diagnose the necessary prerequisites for learning new skills through testing the results of student learning. Such diagnosis includes determination of performance measures before development of lesson plan and instructional materials, documentation of learners' progress, and evaluation of the instructional system.

Stage 6 - Instructional Strategy

Outline how instructional activities relate to the objectives, ideally by demonstrating knowledge of the learners, their learning preference, and effectiveness of related teaching strategies. Tasks must be reflected in the objectives and the ideal delivery method and/or system is determined (teacher-led or learner-centered, group pace or learner pace, etc.).

Stage 7 - Instructional Materials

Ideally working closely with the Subject-Matter Expert (SME), determine available instructional materials and create a plan for developing unavailable, but required, materials to ultimately convey the events of instruction. Also determine the role of the instructor, if applicable.

Stage 8 - Development

While the larger burden of this stage falls on the developers of the courseware, the Instructional Design principles must fold into the process. The development is reviewed at particular milestones to ensure comprehensive ID strategies are present in the training, ensuring important concepts from clear navigation to valid information are present.

Stage 9 - Formative Evaluation

Provide data for revising and improving instructional materials after the overall instructional design document is complete. Ideally, evaluation should take place in both a small, representative sample environment (small group) as well as a 'true-to-life' environment (field trial).

Stage 10 - Summative Evaluation

Study the effectiveness of system as a whole after the

formative evaluation and actual implementation. A variety of methods can be used, from simple surveys to actual, related numbers (productivity, etc.). This stage generally occurs 6 to 12 months after the training has been implemented.

Check Your Progress

Q1. Describe the concept of an instructional design.

Q2. With the help of suitable examples explain the need for using instructional designs in the teaching learning process.

Q3. Discuss with the help of illustrations the various steps of ADDIE model.

Q4. Describe Dick and Carrey's Model of Instructional Design.

Q5. Explain the various steps in developing an instructional design.

3.12 GENERAL RESOURCES AND LINKS

Books:

Dick, Walter, Carey, Lou, and James O. Carey. <u>The Systematic Design of Instruction</u>, 5th ed. New York: Longman, c2001.

Reigeluth, Charles M., ed. <u>Instructional-Design Theories and Models: An Overview of Their Current Status</u>. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1983.

Wilson, Brent G., ed. <u>Constructivist Learning Environments: Case Studies in Instructional Design</u>. Foreword by David N. Perkins. Englewood Cliffs, N.J.: Educational Technology Publications, 1996.

Websites:

Sherri   Braxton-Lieber,   Ph.D.
http://www.seas.gwu.edu/student/sbraxton/ISD/design_models.html

Gustafson, K. & Branch, R.M. (1997). Module4: An overview of instructional systems design.   [online version at University of Alberta.

(Updated   2004,   October   2)]   Retrieved   May   2011
http://www.quasar.ualberta.ca/edit573/modules/module4.htm

Kruse, Kevin. (N/A). Gagne's nine events of instruction: An introduction.

 e-learningGuru.com. Retrieved May 2006
 http://www.e- learningguru.com/articles/art3_3.htm

Siemens, George. (2002, September 30). Instructional design in e-learning. elearnspace Retrieved May 2011 from
 http://www.elearnspace.org/Articles/InstructionalDesign.htm

Professional Organizations:

The Association for Educational Communications and Technology
http://www.aect.org/

American Society for Training and Development

http://www.astd.org/

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4A

COMPUTERS IN EDUCATION (A) COMPUTERS HARDWARE

UNIT STRUCTURE:

4.0 OBJECTIVES

After reading this chapter you will be able to

- Explain what is a computer
- Describe the features of a computer

- Explain the Classification of Computers
- Describe the Structure of Computer
- Explain the different Input Devices
- Explain the different Output Devices
- Describe the different Combination Input and Output Devices
- Explain the features and use of Electronic Smart Board in Education
- Describe other Computer Devices

4.1 INTRODUCTION

Gurukul System of Education was in vogue in India. The main characteristics of Gurukul System were dedicated and knowledgeable teachers, individualized and learner centered teaching, and self-motivated students eager to learn. This system changed due to increase in number of students. Consequently, the number of teachers increased. Some teachers are born but rest of them has to be given rigorous training so as to develop the required competency to become a teacher. Teachers have been conscious about the quality of their teaching. To enhance the quality, some teachers use teaching aids, like, charts, models – static & working, specimen, slides, etc. The lust for quality is still on. This is the age of INFORMATION dominated by the Digital Technology. The Digital Technology has influenced all aspects of human life. Education is not an exception. At present majority of devices are based on Digital Technology. One such device is Computer.

4.2 COMPUTER HARDWARE

The INFORMATION AGE that is brought before us in this 21st century has seen the impact of COMPUTERS and INTERNET radically transforming our lives and opening up new vistas of knowledge, information, work, employment, business, entertainment and communication. Our lives are touched everyday by computers and information systems. Many a times the contact is direct and obvious, such as when we create documents using word processors or when we connect to the internet. Other times the contact is not obvious.

The Computer is an electronic device that has the capacity to store, retrieve & process both qualitative & quantitative information fast and accurately. The computers were never developed for improving quality of teaching – learning process. But researchers started using Computers for teaching purpose. It gave birth to Computer Assisted Instruction (CAI), Computer Managed Instruction (CMI), Computer Based Instruction (CBI), etc. People started developing CAI for teaching different subjects at School as well as Higher Education level.

4A.2.1 WHAT IS A COMPUTER?

Computer is a general purpose machine that converts raw facts into required information according to a set of instructions that are fed into it. It is a machine which executes an ALGORITHM or a finite sequence of instructions to process data in order to produce the required results. The physical components, of which a computer is made up of, are known as HARDWARE. The instructions that tell it what to do are called as SOFTWARE. The primary objective with which the computer were invented was for Computing – Calculating. The pressure of World War II initiated many research.

The thrust was on development of Radar technology –was to spot enemy aircraft followed by accurate aiming of guns to the aircrafts. This required great deal of calculations. Ballistic Research Laboratory of the US Army and Moore school of Electrical Engineering-1946-developed first large scale computer-ENIAC [Electronic Numerical Integrator and Computer]. The computer thus developed was a **FAST CALCULATING MACHINE.** But 80% of today's computing is non numerical. Today's computer is a device acting on raw facts or data which are either numerical or non-numerical in nature. Therefore a COMPUTER is :

- A fast calculating device that can perform arithmetic operations.

- A fast electronic device that processes the input data according to the instructions given by the user and provides information as output.

- An electronic device that stores, retrieves, and processes data, and can be programmed with instructions.

A computer is composed of hardware and software, and can exist in a variety of sizes and configurations.

4A.2.2 FEATURES OF COMPUTER

Computers have revolutionized our lives because of the following features:

- **Speed:** The computer can process million of instructions per second.

- **Accuracy:** It can ensure consistently very high degree of accuracy in computation.

- **Storage:** The capacity of computer to store data is very vast.

- **Versatility:** Though computers are basically designed to carry out arithmetic operations yet they are capable of performing almost any task which has a series of logical steps.

- **Diligence:** It does not get tired of work & never loses the concentration. Same degree of speed & accuracy for any extent of time continuously & with same amount of efficiency.

- **Programmable:** It can be programmed to function automatically.

- **Large and Perfect Memory:** Each and every function is accurately stored over large periods of time.

- **Automation:** Instructions are carried out obediently with no questions asked. Once all the instructions are given to it, it works automatically.

4A.2.3 CLASSIFICATION OF COMPUTERS
There are three classifications of computers based on **TYPE, PURPOSE and CONFIGURATION**

4A.2.3.1 <u>CLASSIFICATION BASED ON TYPE:</u>

<u>Digital Computers:</u>

- Computers that work with digits

- All expressions are represented in the form of binary digits [0 and 1] inside the computers.

- All operations are done using these digits at very high speed.

- Known as counting devices

- Performs only one mathematical operation-Addition

<u>Analog Computers:</u>

- Works by measuring voltages and currents rather than by the process of counting

- Does not calculate directly with numbers

- They measure continuous physical magnitudes such as temperature, pressure, voltage

- Establishes analog [Similarity] between two quantities

- One is essentially –electric signals or pulse Eg: the petrol pump may have an analog computer that converts the pumped petrol into two measurements-quantity of petrol and the price for that quantity.

- Do not have the ability to store large amount of data.

- Do not have the extensive logical facilities like digital computers

<u>Hybrid Computers:</u>

- The best features of digital and analog computers are combined in Hybrid computers.

- Processes continuous and discrete data.
- Mainly used for scientific applications, research computers, industrial control processes.

4A.2.3.2 CLASSIFICATION BASED ON PURPOSE:

General Purpose Computer System:
- Computers used in day to day life
- Designed to perform variety of tasks

Special Purpose Computer System:
- Stored program digital computers whose architecture is designed for one or more specific applications.

Examples:
- Computers meant for process control in an industry
- Computers meant for desk top publishing
- Computers meant for air traffic control
- Robots
- Hidden computers
- Word Processor
- Knowledge information processing systems
- Optical computers
- Palmtop/Pocket computers

4A.2.3.3 CLASSIFICATION BASED ON CONFIGURATION/ MEMORY TYPE:

Microcomputer System:
- Use microprocessors
- Available in small size
- CPU is contained either in a single chip or on a few chips
- When the microprocessor is equipped with memory and input/output control circuitry…is known as microcomputer
- Two types- Personal computers and Home computers
- Personal Computers: Accounting ,financial analysis Word processing, Computer graphics
- Home Computers: is also a personal computer, which is used for video games/entertainment, education, household, accounts, and maintaining personal budget

Mini Computer System:
- Designed to store large data
- Work faster as compared to microcomputers

• Is used to Process control in industries and as Time sharing devices in industries

Medium sized Computer:

• Much faster and much larger storage capacities as compared to minicomputers
• Is used for Commercial data processing, Engineering and scientific data processing, Computer aided design [CAD] and Computer Aided Manufacture[CAM]

Large Sized Computers:

• Large computer systems of first to third generation
• Greater data processing capacities
• Is used for Complex engineering designs, Online communication with large database and Scientific research

Supercomputers:

• Highly sophisticated and highly efficient systems
• Extraordinarily large storage capacities ,power speed
• Is used in Weather forecast and to design complicated machines [supersonic jet].

4A.2.4 STRUCTURE OF COMPUTER

The structure of a Computer consists of the following **Main**

Components:
1] Input/output devices
2] Central Processing Unit [CPU]
3] Memory unit

Input/output devices:

Before a computer does processing, it must be given data & instructions. After processing the output must be displayed. The input device is used to enter the data and instructions into a computer. There are many peripheral devices used as input / output units for the computer. **Input/output devices** allow computer to communicate:

- With other computers
- With humans

CPU:

Central Processing Unit is brains of computer. It performs all processing of input data. It is contained on a single chip called microprocessor- brain of the computer system – two basic components. The CPU consists of the following distinct parts:

1] Arithmetic Logic Unit [ALU]

All calculations & comparisons are performed in ALU. It is responsible for all arithmetic operations like addition, subtraction, multiplication & division as well as logical operations such as less than, equal to & greater than. ALU performs two types of operations – arithmetic and logical.

- Arithmetic operations- fundamental math operations- addition, subtraction, multiplication and division.
- Logical Operations- consist of comparisons to whether one is equal, less than or greater than the others.

2] Control Unit:

It is responsible for controlling the transfer of data & instructions among other units of computer. It tells the rest of the computer system how to carry out a program's instructions. It is central nervous system of computer. It obtains instructions from memory, interprets them & directs the operation of the computer. The two main tasks of CPU are-
1. Fetch instructions from memory.
2. Execute the instructions

3] Memory Unit:

Memory is the holding area for data, instructions and information. Memory is contained on chips connected to the system board. It stores programs and data. All programs and data encoded as zeros and ones. Bit is the unit of storage that can be either a zero or a one. There are three types of memory: Random Access Memory (RAM), Read Only Memory (ROM) and Complementary metal-oxide semiconductor (CMOS).

RAM [RANDOM-ACCESS MEMORY]

Random-access memory (usually known by its acronym, **RAM**) is a type of storage It is an integrated circuits that allow the stored data to be accessed in any order, i.e. at *random*, of its physical location and whether or not it is related to the previous piece of data The word *random* thus refers to the fact that any piece of data can be returned in a constant time, regardless.

Random access memory or *RAM* most commonly refers to computer chips that temporarily store dynamic data to enhance computer performance. By storing frequently used or active files in random access memory, the computer can access the data faster than if it to retrieve it from the far-larger hard drive. Random access memory is also used in printers and other devices.

Random access memory is volatile memory, meaning it loses its contents once power is cut. This is different from non-volatile memory such as hard disks and flash memory, which do not require a power source to retain data. When a computer shuts down properly, all data located in random access memory is committed to permanent storage on the hard drive or flash drive. At the next boot-up, RAM begins to fill with programs automatically loaded at startup, and with files opened by the user.

There are several different types of random access memory chips which come several to a "stick." A stick of RAM is a small circuit board shaped like a large stick of gum. Sticks of RAM fit into "banks" on the motherboard. Adding one or more sticks increases RAM storage and performance.

ROM [READ ONLY MEMORY]
Read Only Memory is not volatile and cannot be changed by the user. "Read Only" means that CPU can read, or retrieve data and programs written on ROM chip.

COMPLEMENTARY METAL-OXIDE SEMICONDUCTOR (CMOS)
CMOS provides flexibility and expandability for a computer system. It contains essential information that is required every time the computer system is turned on. It supplies information as the current date, time, amount of RAM, type of keyboard, mouse, monitor and disk drives. It is powered by battery and does not lose its contents when system is turned off.

The computer components can be broadly divided into two categories- **hardware & software.**

Hardware:
The term hardware refers to the physical components of the computer such as the system unit, mouse, keyboard, monitor etc.

Software:
The software is the instructions that make the computer work. Software is held either on your computers hard disk, CD-ROM, DVD or on a diskette (floppy disk) and is loaded (i.e. copied) from the disk into the computers ram (random access memory), as and when required.

4A.2.5 INPUT DEVICES

INPUT is any data or instructions that are used by a computer. Input devices are hardware used to translate words, sounds, images and actions that people understand into a form that the system unit can process.

In addition to keyboards and mice, there are a wide variety of other input devices which include pointing, scanning, image capturing and audio-input devices.

4.2.5.1 KEYBOARD

The keyboard is an important peripheral that is used as an input device of a computer. The keyboard is still the commonest way of entering information into a computer. It is used for manual entry. Keyboards are available for desktop computers, laptop computers, PDA and smart phones. They range from full sized to miniature and rigid to flexible. Usually, there are around 110 keys on a computer keyboard. The keyboard is used to enter letters, numbers and other special function keys, which are used for some special functions.

The keyboard has three types of keys:
Alphanumeric keys:

It contents Letter keys, Digit keys, and Special character keys. These keys are used to type all the alphabets, numbers & special symbols [eg. $, @, %, # etc.]

Special keys:

These keys are used for the special functions. These are also called as non pintable control keys. These are sued for backspacing, going to next line, moving curser up & down, delete, insert, tabulation etc.

Function keys:

These are used to give special commands depending upon the software of used. These are labeled as F1, F2, up to F15 & when pressed will invoke programmes stored in computer.

Besides the above mentioned keys the keyboard also has Escape Key, Windows Key, Space bar and Navigation keys,

When any key is pressed, an electronic signal is produced this signal is detected by a keyboard encoder that sends a binary code corresponding to the key pressed to the CPU.

There are different types of keyboards available, depending on the layout of the keyboard, QWERTY and AZERTY. The QWERTY keyboards are most commonly used nowadays and have the six alphabets (Q, W, E, R, T, and Y) in the first row of the keyboard. The AZERTY keyboards are used primarily, in the French countries.

There are different types of keyboards:

• **Traditional Keyboards**-full sized, rigid, rectangular that include function, navigational and numeric keys.

• **Flexible Keyboards**- fold or roll up for easy packing or storage, provide mobile users with a full sized keyboard with minial storage requirements.

• **Ergonomic Keyboards** – *similar to traditional keyboard.* It is specially designed as per the comfort of the hands and wrist of the keyboard user. The ergonomic keyboards are designed to prevent the carpal tunnel syndrome, which causes numbness and tingling sensation in hands and fingers after typing for a long duration. These keyboards also help the keyboard user maintain a comfortable position.

• **Wireless Keyboards**- transmit input to the system unit through the air in three ways-Bluetooth Keyboards ,Infrared (IR) Keyboards and Radio Frequency Keyboards

• **PDA Keyboards**-miniature keyboards for PDAs to send email,create documents and more

4A.2.5.2 POINTING DEVICES

A **pointing device** is an input interface (specifically a human interface device) that allows a user to input spatial (i.e., continuous and multi-dimensional) data to a computer. While the most common pointing device by far is the mouse, many more devices have been developed.

A "rodent" is a technical term referring to a device which generates mouse-like input. However, the term "mouse" is commonly used as a metaphor for devices that move the cursor.

A mouse is a small handheld device pushed over a horizontal surface. A mouse moves the graphical pointer by being slid across a smooth surface. The conventional **roller-ball** mouse uses a ball to create this action: the ball is in contact with two small shafts that are set at right angles to each other. As the ball moves these shafts rotate, and the rotation is measured by sensors within

the mouse. The distance and direction information from the sensors is then transmitted to the computer, and the computer moves the graphical pointer on the screen by following the movements of the mouse. Another common mouse is the **optical** mouse. This device is very similar to the conventional mouse but uses visible or infrared light instead of a roller-ball to detect the changes in position. A Mini-mouse is a small egg-sized mouse for use with laptop computers; usually small enough for use on a free area of the laptop body itself, it is typically optical, includes a retractable cord and uses a USB port to save battery life. Three Devices similar to mouse are **trackballs, touch pads and pointing sticks.**

A **trackball** is a pointing device consisting of a ball housed in a socket containing sensors to detect rotation of the ball about two axes, similar to an upside-down mouse: as the user rolls the ball with a thumb, fingers, or palm the mouse cursor on the screen will also move.

A **touchpad or trackpad** is a flat surface that can detect finger contact. It's a stationary pointing device, commonly used on laptop computers. At least one physical button normally comes with the touchpad, but the user can also generate a mouse click by tapping on the pad. Advanced features include pressure sensitivity and special gestures such as scrolling by moving one's finger along an edge.

A **pointing stick** is a pressure sensitive small nub used like a joystick. It's usually found on laptops embedded between the 'G', 'H', and 'B' keys. It operates by sensing the force applied by the user. The corresponding "mouse" buttons are commonly placed just below the spacebar. It is also found on mice and some desktop keyboards.

A **Joystick** is the most popular input device for computer games.

A **touch screen** is a device embedded into the screen of the TV monitor, or system LCD monitor screens of laptop computers. Users interact with the device by physically pressing items shown on the screen, either with their fingers or some helping tool.

A **light pen** is a device similar to a touch screen, but uses a special light sensitive pen instead of the finger, which allows for more accurate screen input. As the tip of the light pen makes contact with the screen, it sends a signal back to the computer containing the coordinates of the pixels at that point.

Stylus is a pen like device commonly used with tablet PCs and PDAs. A stylus interacts with computer through handwriting

recognition software which translates handwritten notes into a form that the system unit can process

4A.2.5.3 SCANNER

Scanners move across text and images and convert them in a form that the system unit can process. A scanner is a device that optically scans images, printed text, handwriting, or an object, and converts it to a digital image. Some scanners can also read text by converting them to digital code. The scanners are very useful for convert in the typed pages into word-processing files. Graphic scanners convert a printed image into video image without converting it to digital code

There are three types of scanners:
- Optical Scanners,
- Bar code readers and
- Character and mark recognition devices.
-

Optical Scanner:

Optical Scanners, like traditional copy machines, can make a copy from an original. Simply known as scanner, accepts documents consisting of text and /or images and converts them into machine- readable form.

There are two types of optical scanners: Flatbed and Portable

Flatbed scanner is much like a copy machine. The image to be scanned is placed on a glass surface and the scanner records the image from below.

Portable scanner is typically a handheld device that slides across the image, making direct contact.

Card Readers:

Nearly everyone uses a credit card, debit card, access card or some type of identification card. These cards typically have the user's name, some type of identification number and signature embossed on the card. Card readers interpret this encoded information. By far the most common is magnetic card reader. The information is stored on a thin magnetic strip located on the back of the card. When the card is swiped through the magnetic card reader, the information is read.

Bar Code Readers:
Handheld wand readers or platform scanners containing photoelectric cells that scan or read bar codes or the vertical zebra striped marks printed on product containers.

Character and Mark Recognition Devices:

Character and Mark Recognition Devices are scanners that are able to recognize special characters and marks.

There are three types of Character and Mark Recognition Devices:

Magnetic Ink Character Recognition (MICR): It is used to recognize the magnetically charged characters. The Characters are written with special ink or magnetic ink. It is used in banks cheques and deposit slip

Optical Character Recognition (OCR): It is an Optical scanner used for reading bar code data. Printed characters consisting a number of bars of varying thickness & spacing between them can be read by light source and changed into machine readable code Bar code data. It is used for large volume applications like reading passenger ticket, computer printed bill of companies. It is used in department stores, issuing books in the library and encoding ID.

Optical Mark Recognition (OMR): OMR is used to recognize the type of mark made by pen or pencil. It is used where one out of a few alternatives is to be selected & marked. The OMR detect the mark & sends corresponding signal to the processor. If the mark is present, the amount of reflected light is reduced & thus OMR detects the presence of the mark for each answer. Used for competitive exams having objective type questions.

4A.2.5.4 IMAGE CAPTURING DEVICE

Image capturing devices create or capture original images. These include:

Digital Cameras are similar to traditional camera except that images are recorded digitally on a disk.

Digital Video Cameras record motion digitally on a disk.

Web Cameras are specialized digital video cameras that capture images and send them to a computer for broadcast over internet **Web cams** (**web cameras**) are small cameras (usually, though not always, video cameras), whose images can be accessed using the World Wide Web, instant messaging, or a PC video conferencing application. The term webcam is also used to describe the low-resolution digital video cameras designed for such purposes, but which can also be used to record in a non-real-time fashion.

Web-accessible cameras involve a digital camera which uploads images to a web server, either continuously or at regular intervals. This may be achieved by a camera attached to a PC, or

by dedicated hardware. Webcams connected to PCs can act as web-accessible cameras with certain software. The captured files can be saved locally, uploaded to an internet server (via FTP or HTTP) (from which they can be made accessible to anyone over the web), or privately e-mailed to the user per predefined rules. Options for image size and quality, overlaying logos, and time stamping images are usually available. File names can be sequential numbers or current time. Some software allows automatic erasure of old files when not needed.

As webcam capabilities have been added to instant messaging text chat services such as AOL Instant Messenger, one-to-one live video communication over the internet has now reached millions of mainstream PC users worldwide.

4A.2.5.5 AUDIO –INPUT DEVICES

Audio input devices converts sounds into a form that can be processed by a system unit. A microphone is an audio input device. A microphone, which was originally invented by Emile Berliner in 1877, is a device which allows you to record voices or sounds and place them onto computers, generally as a wav file. Microphones also can be used with other applications such as a voice dictation program or a voice conference program. While not all computers come with microphones, a microphone can be purchased at a local retail store.

4A.2.6 OUTPUT DEVICES

Output is processed data or information which may typically take the form of text, graphics, photos, audio, and/or video. Output devices are any hardware used to provide or create output.

4A.2.6.1 MONITORS

Monitors are most frequently used output data which displays visual images of text and graphics. Monitor is a piece of electrical equipment which displays images generated from the video output of devices such as computers, without producing a permanent record. Monitors obviously display what is going on in your computer. They can run at various resolutions and refresh rates. It consists of a Cathode Ray Tube [CRT] which displays character as an output. It forms images from tiny dots, called pixels, which are arranged in a rectangular form. The sharpness of the image depends on the number of pixels.

4A.2.6.2 PRINTERS

Printers translate information that has been processed by the system unit and present the information on paper. The Printer output is called hard copy.In computing, a printer is a peripheral which produces a hard copy (permanent human-readable text and/or graphics) of documents stored in electronic form, usually on physical print media such as paper or transparencies. Printers are

mainly classified into two categories IMPACT & NON IMPACT printers

IMPACT PRINTER

The printer head strikes on the paper physically to generate the desired character or line. Impact printers are noisier and slower than non impact printers, such as ink-jet and laser printers, but can be used to produce carbon copies.

The **Character Printer** prints one character at a time.

Daisy Wheel Printers print the character by a mechanism that uses a plastic or a metal hub with spokes, called daisy wheel. The characters are embossed on the radiating spoke & printed by striking these spokes on paper.

Dot Matrix Printers print the characters by putting the dots onto the paper.

The **Line Printers** print one line at a time

Drum Printers print a line by rotating the drum having a ring of characters for each print position. The hammer strikes each character of the drum simultaneously, so that entire line is printed for one full rotation of the drum. It is also called as Barrel Printer.

Chain Printers print the line by rotating a chain having ring characters for each print position

NON-IMPACT PRINTERS

Non-impact printers are much quieter than impact printers as their printing heads do not strike the paper. The term non impact is important primarily in that it distinguishes quiet printers from noisy (impact) printers.

The main types of non-impact printer are: Thermal Printer, Laser Printer and Ink Jet Printer.

Thermal Printer

Characters are formed by heated elements being placed in contact with special heat sensitive paper forming darkened dots when the elements reach a critical temperature. Thermal printer paper tends to darken over time due to exposure to sunlight and heat. The standard of print produced is poor. Ink dies from a heated printing element Thermal transfer printers use wax or to transfer an image to a page. Thermal printers are widely used in battery powered equipment such as portable calculators.

Laser Printer

A laser printer directs a beam of light that electrically charges an image on a photosensitive drum. Toner attracts and adheres to the dots on the drum and a heating element fixes the image on the paper. These printers can print in excess of 20,000 lines per minute.

A photoconductive drum is initially charged and then a high intensity laser beam is used to discharge selected areas on the drum. These discharged areas correspond to the white areas of the printed document.

Toner is attracted to parts of the drum with a high charge. The drum rotates and transfers the toner to the paper which has an even greater electrical charge. Finally a heater fixes the toner onto the paper.

Ink Jet Printers

Inkjet printers use color cartridges which combine magenta, yellow and cyan inks to create color tones. A black cartridge is also used for crisp monochrome output. This method of printing can generate up to 200 cps and allows for good quality, cheap color printing. Ink jet printers spray electrically charged ink through tiny nozzles in the printing element. The ink passes through an electrically charged field that forms the image in matrix form. These printers offer very high-quality resolution and print up to 300 cps.

4A.2.6.3 AUDIO OUTPUT DEVICES

Audio output devices translate audio information from the computer into sounds that people can understand. The most widely used Audio output devices are speakers and headphones. These devices are connected to a sound card in the system unit. The sound card is used to capture as well as play back recorded sounds. Audio output devices are used to play music, vocalize translations from one language to another, and communicate information from computer system t users.

4A.2.7 COMBINATION INPUT AND OUTPUT DEVICES

Many devices combine input and output capabilities. Sometimes this is done to sace space and other times it is done for very specialized applications. Some of the common combination devices are as follows:

Fax Machine is a separate standalone device for sending and receiving images over telephone lines.

Multifunctional Devices (MFD) typically combines the capabilities of a scanner, printer, fax and copy machine.

Internet Telephones are specialized input and output devices for receiving and sending voice communication- is connected through a USB port and operate like a traditional telephone.

4A.2.8 ELECTRONIC SMART BOARD

Electronic smart board combine the look and feel of a regular whiteboard with the power of a computer so you can save and print notes, collaborate on electronic documents, share information and run multimedia materials. When combined with an LCD panel or projector, the SMART Board becomes a large, touch-sensitive screen. Use your finger on the Board as you would use a mouse to move between spreadsheets, documents, presentation software and CD ROMs or Web sites

.
You can pick up a pen from the SMART Pen Tray and write notes over your applications in electronic ink to focus your audience's attention, and the touch-sensitive screen tells the computer what color pen you are using and your notes are projected onto the screen in the correct color. You can save these notes on the computer or print your notes to create handouts for later distribution. An interactive whiteboard that turns your computer into a powerful tool for teaching, collaborating and presenting SMART Boards combine the power of a computer with the simplicity & ease of use of a traditional whiteboard. The SMART Board is an interactive whiteboard. The Smart Board supports two presentation file types: Adobe Acrobat and PowerPoint.

- The interactive electronic whiteboard is great for demonstrations. It is a colorful tool.

- The board can accommodate different learning styles.

- Tactile learners can benefit from touching and marking at the board, audio learners can have the class discussion; visual learners can see what is taking place as it develops at the board.

- All ages of students respond favorably to board use.

- Distance learning is an excellent setting for interactive whiteboard use.

- The boards are clean and attractive tools. There is no messy chalk dust or other by-product, which can limit use.

- One-computer classrooms can maximize the use of limited computer access by using the whiteboard. Students can work together with individuals contributing at the board, other participants at the computer, and the group as a whole discussing the activity. While it is true that acquiring the board and the projector is an expense, the use of this set-up

can be viewed as a cost-cutter when it makes it possible for one computer to serve multiple students.

- It is interactive. Users can be contributing directly by input both at the computer and at the board.

- The board is great for meetings are lessons where the participants need printed copies of the proceedings. At the end of a brainstorming activity, for example, copies of the resulting document can be printed and distributed, as well as be saved for future work.

- It motivates students to participate in the class.

- The class room atmosphere becomes lively.

- It Saves lessons to present to students who were absent.

- It is used as highlighter tool to highlight nouns, verbs, adjectives, etc.

4A.2.9 OTHER COMPUTER DEVICES
DISK DRIVE

Disk storage is a general category of a computer storage mechanism, in which data is recorded on planar, round and rotating surfaces (disks, discs, or platters). A disk drive is a peripheral device used to collect information from. Main implementations are hard disks, floppy disks and optical discs. Nowadays the term disk storage almost exclusively refers to hard disk storage.

A storage device that holds, spins, reads and writes magnetic disks or optical (CD, DVD,) disks. It may be a receptacle for removable disk cartridges, floppy disks or optical media, or it may contain non-removable platters like most hard disk drives.

A **hard disk drive** (**HDD**), commonly referred to as a hard drive, hard disk, or fixed disk drive, is a non-volatile storage device which stores digitally encoded data on rapidly rotating platters with magnetic surfaces. Early HDDs had removable media; however, an HDD today is typically a sealed unit

CD ROM

An abbreviation of "Compact Disc read-only memory" is a pre-pressed Compact Disc that contains data accessible but not writable by a computer. While the Compact Disc format was originally designed for music storage and playback, the 1985 yellow book standard developed by Sony and Philips adapted the format to hold any form of binary data.

CD-ROMs are popularly used to distribute computer software, including games and multimedia applications, though any data can be stored (up to the capacity limit of a disc). Some CDs hold both computer data and audio with the latter capable of being

played on a CD player, whilst data (such as software or digital video) is only usable on a computer (such as PC CD-ROMs).

A CD-ROM (*Compact Disk Read Only Memory)* is a drive that reads aluminum-coated round plastic discs but is incapable to writing any disc. The CD-ROM diskettes are 12 x 12 cm with a width of .1cm, as shown in the above picture. The disc is made of a polycarbonate wafer and is coated with a metallic film, usually an aluminum alloy. This aluminum film is the portion of the disc that the CD-ROM drive reads for information. The aluminum film (*strata*) is then covered by a plastic polycarbonate coating that protects the underlying data. A label will usually be placed on the top of the disc and data is read from the bottom of the CD.

CD-ROM drives are generally used just to install a program or copy CDs, both of which are usually done rarely on most users' computers, the extra speed isn't usually very important. The speed can play a big role if you do a lot of CD burning at high speeds or some audio extraction from audio CDs (i.e. converting CDs to MP3s).

CD-R/RW (which stands for Recordable / Re-Writable) drives (burners, writers) allow a user to create their own CDs of audio and/or data. These drives are great for backup purposes and for creating your own audio CD compilations. The **floppy disk drive** reads data from and writes data to a small disk .When the computer system needs to access data on the diskette, the read/write heads are stepped by signals generated by the computer system's floppy controller.

PROJECTOR
A data projector is a device that takes a signal from a computer, TV or video source and produces a large image using projected light. Communication is a key learning skill and a data projector allows a teacher or student a whole new dimension in how they share ideas, information, charts, images, animations, audio or video. Learning is much more powerful if it offers support for a variety of intelligences such as visual-spatial, bodily-kinesthetic, musical, interpersonal, intrapersonal, linguistic, and logical-mathematical - a projector can help to achieve this variety in a classroom. Data projectors can also be partnered with an interactive whiteboard to offer additional teaching strategies. A good data projector can show a large clear image that is visible from all parts of the classroom.

Unit End Exercises
1.   What is a computer?
2. Describe the features of a computer
3. Explain the Classification of Computers

4. Describe the Structure of Computer
5. Explain the different Input Devices
6. Explain the different Output Devices
7. Describe the different Combination Input and Output Devices
8. Explain the features and use of Electronic Smart Board in Education
9. Describe different Computer Devices

FEEDBACK
QUESTION NO   GUIDELINES
 1   4A.2.1
 2   4A.2.2
 3   4A.2.3, 4A.2.3.1, 4A.2.3.2, and 4A.2.3.3
 4   4A.2.4
 5   4A.2.5 - 4A.2.5.1, 4A.2.5.2, 4 A.2.5.3, 4A.2.5.4, 4A.2.5.5
 6   4 A.2.6, 4A.2.6.1, 4A.2.6.2, 4A.2.6.3
 7   4A.2.7
 8   4A.2.8
 9   4A.2.9

SUGGESTED READINGS AND REFRENCES

Vanaja,M. and Rajasekar, S. (2010): Educational Technology & Computer Education

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4B

COMPUTERS IN EDUCATION (B) COMPUTERS SOFTWARE

Unit structure:

4B.0 OBJECTIVES

After reading this chapter you will be able to:

- Explain what is Computer software
- Explain what is Systems Software
- Describe the Operating Systems
- Describe the Utilities
- Describe the Device Drivers
- Explain what is Application Software
- Describe Word Processors
- Describe Spreadsheets
- Describe Presentation Graphics

4B.1 INTRODUCTION

When most people think about computers, they think about surfing the web, creating reports, analyzing data, storing information, making presentations, and any number of valuable applications. But we usually do not think about the more mundane and behind the scenes computer activities: loading and running programs, coordinating networks that share resources, organizing files, protecting our computers from viruses, performing periodic maintenance to avoid problems and controlling hardware devices so that they can communicate with one another. Typically, these activities go on behind the scenes without our help. But these activities are vital for effective functioning of our computers. A little knowledge about these activities can go a long way to make your computing life easier.

To effectively use computers, competent end users need to understand the functionality of systems software, including operating systems, utility programs and device drivers.

4B.2 SYSTEM SOFTWARE

End users use application software to accomplish specific tasks. For example, we use word processors to create brochures, letters and reports. However, end users also use system software. System software works with end users, application software, and computer hardware to handle the majority of technical details. For example, system software controls where a word processing program is stored in memory, how commands are converted so that the system unit can process them and where a completed document or file is saved.

System Software is not a single program. Rather it is collection or a system of programs that handle hundreds of technical details with little or no user intervention. System Software consists of four types of program:
- Operating Systems,
- Utilities,
- Device Drivers and
- Language Translators
-

4B.2.1 OPERATING SYSTEMS
Operating systems coordinate computer resources, provide an interface between users and the computer and run applications. It is a collection of programs that handle many technical details related to using a computer without which the computer will be useless.

FUNCTIONS:
Every computer has an operating system and every

operating system performs a variety of functions. These functions can be classified into three groups:

Managing Resources: These programs coordinate all the computer's resources including memory, processing, storage and devices such as printers and monitors. They also monitor system performance, schedule jobs, provide security, and start up the computer.

Providing User Interface: Users interact with application programs and computer hardware through **graphic user interface (GUI)** which uses graphical elements such as icons and windows.

Running Applications: These programs load and run applications such as word processors, spreadsheets etc. Most OS support **Multitasking** or the ability to switch between different applications stored in memory. With multitasking, you could have Word and Excel running at the same time and switch easily between the two applications.

FEATURES:

Starting or restarting a computer – booting the system. A **warm boot** occurs when computer is already on and one restarts it without turning off the power. Starting a computer that has been turned off is called a **cold boot**. You typically interact with Operating System through GUI. Most Operating System provides a space called DESKTOP which provides access to computer resources. Operating Systems have features in common with Application Programs, including

- **ICONS:** graphic representations for a program or function.
- **POINTER:** controlled by a mouse and changes shape depending upon its current function. For example, when shaped like an arrow, the pointer can be used to select items such as an icon.
- **WINDOWS**: rectangular areas for displaying information and running programs.
- **MENUS:** provide a list of options or commands.
- **DIALOGUE BOXES:** provide information or request input.
- **Help:** provides online assistance for operating system functions and procedures.

Most Operating System store data as FILES. Related files are stored within a folder.

CATEGORIES:

While there are hundreds of different operating systems, there are only three basic categories: embedded, network or stand-

alone.

- **Embedded Operating Systems** are used for handheld computers and smaller devices like PDAs. Popular embedded operating systems include Windows CE and Windows XP Embedded.

- **Network Operating Systems** are used to control and coordinate computers that are networked or linked together. They are typically located on one of the connected computer's hard disk which is called as network server.

- **Stand Alone Operating Systems** also called **desktop operating systems** control single desktop or notebook computer.

The Operating System is often referred to as the software environment or platform. Microsoft's Windows is by far the most popular microcomputer operating system.MAC Os is another Operating System designed to run with Apple computers. The UNIX Operating System was originally designed to run on minicomputers in network environments. There are large numbers of different versions of UNIX. One receiving a great deal of attention today is LINUX. Linux was originally developed by a graduate student at the University of Helsinki, Linus Torvalds, in 1991. He allowed free distribution of the operating system code and encouraged others to modify and further develop code. Linux is one of the most popular and powerful alternatives to Windows Operating System.

4B.2.2 UTILITIES

Ideally, microcomputers continuously run without problems. However there are times when the internal hard disks can crash, computers can freeze up; operations slow down, and so on. These events can make computing frustrating. That's where UTILITIES come into picture. **Utilities** are specialized programs designed to make computing easy. There are hundreds of different utility programs. The most essential are

- ✓ **Troubleshooting or diagnostic:** recognize and correct problems ideally before it becomes serious
- ✓ **Antivirus Programs:** guard your computer system against virus programs or other damaging programs that can invade your computer system.
- ✓ **Uninstall Programs:** that allow you to safely and completely remove unneeded programs and related files from your hard disk.
- ✓ **Backup Programs:** that makes copies of original files to be used in case the originals are lost or damaged.

✓ **File compression Programs:** that reduces size of file so they require less storage space and can be sent more efficiently over the internet.

Like application software suites, Utility suites combine several programs into one package. Three best known utilities suites are McAfee Office, Norton System Works and V Communications Systems Suite.

4B.2.3 DEVICE DRIVERS

Every device, such as mouse or printer that is connected to a computer system has a special program associated with it. This program, called device driver or simply a drive, works with the operating system to allow communication between the device and rest of the computer system. Each time the computer system is started, the operating system loads all of the device drivers into memory. When a new device is added to a computer system, a new device driver must be installed before the device can be used.

4B.3 APPLICATION SOFTWARE'S

Application software can be described as end user software and is used to accomplish a number of tasks. Application software can be divided into two categories. One category, basic applications, which include word processors, spreadsheets, database management systems and presentation graphics. The other category , specialized applications include thousands of other programs that are narrowly focused on specific disciplines and occupations. These include Desktop publishing programs, Image Editors, Audio and Video software, Web authoring programs etc.

4B.3.1 WORD PROCESSORS

Word Processors create text based documents and are one of the most flexible and widely used software tools.MS Word is a powerful, full-featured word processing program that gives its users the tools to create a variety of professional documents. It is the most popular and user friendly word processor which can be used in any work involving creating and managing text like letters, memos, reports, newsletters, manuals, and a wide range of other business and personal documents. The word processor has many helpful, time saving features that enable the user to design a document in a professional manner, quickly and easily.

FEATURES
I] BASIC FILE HANDLING

a) File/ Folder

A file is a named collection of related information that is recorded on secondary storage. It is a smallest unit of secondary

storage. Files are the most important mechanism for storing data permanently on mass-storage devices. Permanently means that the data is not lost when the machine is switched off. Files can contain:

- data in a format that can be interpreted by programs, but not easily by humans (binary files);

- Alphanumeric characters, codified in a standard way and directly readable by a human user (text files). Text files are normally organized in a sequence of lines, each containing a sequence of characters and ending with a special character (usually the new line character).

- Each file is characterized by a name and a directory in which the file is placed (one may consider the whole path that allows one to find the file on the hard-disk as part of the name of the file).

The most important operations on files are: creation, reading from, writing to, renaming, deleting. All these operations can be performed through the operating system (or other application programs), or through suitable operations in a Java program.

File Attributes are Name, Identifier, Type, Location, Size, Protection in particular, ownership, Access time, and modification time.

b) Saving a File and Retrieving File.
Saving a file
To save a document for the first time Click the save button on the standard toolbar or choose file save or file save as from the menu bar .This opens the dialog box. The Open dialog box displays the list of names of files of the given type in a particular drive or folder.

Retrieving File

Open an existing file
There are 4 ways to open an existing document

1. **If the document was recently created, click the windows start button and open the Documents menu. A document can be opened directly if it appears in this menu.**

2. Click the windows start button and then select Open office document. The open office document box appears. Locate the folder that contains the document file. Select the document from the dialog box and click open.

3. Click my document folder on the desk top. The Open dialog box displays a list of names of files & folders. Select the required file from the list displayed in the Open dialog box. Click the Open button in the Open dialog box. The selected file is opened.

4. When word application is open, an existing file can be retrieved as follows:-

Click the open button on the standard toolbar or choose file open command to display an open dialog box. The Open dialog box displays a list of names of files of the given type in a particular drive or folder. Select the required file from the list displayed in the Open dialog box. Click the Open button in the Open dialog box. The selected file is opened.

c) Management of Data Files

Creating a New File/Document

New documents can be created very easily by clicking on new office document on the Windows Start menu, which opens the dialog box .Each tab in this dialog box contains templates for a number of similar documents. To open a new word document, click on the Blank document icon in the General page.

Two ways to create a new document from inside Word application:

1. Choose the new button on the standard toolbar to open a blank workbook directly.

2. Choose File New to open the new dialog box. Click the general tab in the new dialog box to display its options. Select the blank document icon.

Storing

After making some changes in the file/ document, to save a document click the save button on the standard toolbar or choose file save or click Ctrl+ S or click on icon of save.

Deleting

1. To delete the file or a document, open my document, select the specific file and press delete button on the keyboard. The dialogue box opens; the computer asks if you want to delete this file. Select yes.

2. To delete the file or a document, open my document; select the specific file and press right click of mouse. Select option delete. The computer asks if you want to delete this file. Select yes.

d) Saving files on external storage devices, CD, DVD, Floppy and Pen Drive.

Saving files on Floppy and Pen Drive.

➢ Insert a floppy or attach Pen Drive. Click on File form Menu Bar. Select Save As menu. This opens a dialog box. Select the location where you want to save the file & click on save.
➢ Insert a floppy or attach Pen Drive. Select the file. Use Right click of mouse & select copy option. Click My Computer & double click on floppy drive or USB drive. Use right click of mouse and select paste.

Saving files on CD, DVD

➢ You need to have a CD writer or DVD writer respectively to save document on CD or DVD. Insert a CD in CD drive or DVD in DVD Drive. Select the file that you want to save on CD/DVD by using right click of the mouse. Double click on My Document. Double click on CD Drive or DVD Drive & then paste the file with right click of mouse & selecting paste option. Select the option write the document on CD or DVD.

➢ You need to have software to burn the CD or DVD. Click on start & select option Nero express or the software you have installed for burning the CD or DVD copy. Select the file you want to save on CD or DVD & copy it with the help of right click of mouse. Paste that file again with right click of mouse in the opened Nero window. Select the name of the recorder & write name of the CD. Select burn option.

B] FUNCTIONS OF WORD PROCESSOR

i. Basic Formatting Techniques (Editing, Use Of Graphics and Tables)

Editing

Moving the text using Cut & Paste

1. Select the text to be moved

2. Choose

Edit from the menu bar& select cut,

Or Click the Cut button on the standard toolbar

Or Press <ctrl> + <X>

Or Right-click and choose Cut from the shortcut menu. The selected text is deleted from the document and placed on the Clipboard

3. Move the insertion point to the location where the selected text is to be placed

4. Choose Edit from the menu bar & select Paste,

Or Click the Paste button on the standard toolbar

Or Press <ctrl> + <V>

Or Right- click and choose Paste from the shortcut menu

Copying the text using copy &paste

1. Select the text to be copied

2. Choose Edit from the menu bar& select copy

Or Click the Copy button on the standard toolbar

Or Press <ctrl> + <C>

Or Right-click and choose Copy from the shortcut menu. A copy of the selected text is placed on the Clipboard

3. Move the insertion point to the location where the selected text is to be placed

4. Choose Edit from the menu bar & select Paste

Or Click the Paste button on the standard toolbar

Or Press <ctrl> + <V>

Or Right - click and choose Paste from the shortcut menu

To move or copy text using drag and drop

➢ Identify the source text, the text to be moved and its destination; the place the text is to be moved to
➢ Select the source text and drag it to its new location, holding down the left mouse button. Release the mouse button at the new location to drop the text into that position

➢ **Select Move or copy here from the shortcut menu that appears**

Changing Line Setting

Line spacing determines the amount of vertical space between lines of text .It is possible to change the space between lines, and the space above and below the paragraphs.

To set line spacing for existing text:

1. Select the text whose line spacing is to be changed.

2. Choose Format Paragraph from the menu bar or right click and choose paragraph menu to open the paragraph dialog box. Click the Indents and spacing tab if the page is not visible.

Or Click the Line Spacing drop-down list to select the desired line spacing. If the options At Least, Exactly, or Multiple are chosen, enter a number in the 'at 'Control.

Click OK to apply the settings and close the dialog box

Or To set line spacing using the keyboard, press Ctrl+1 to apply single line spacing, Ctrl+5 for 1.5 line spacing,Ctrl+2 for double line spacing to lines in the selected paragraphs.

Or Select icon of line spacing & select the desired line spacing.

Adjusting Margins and gutters

In word the white space between text and edge of the paper the text will be printed on, is determined primarily by margins and optional gutter settings.

Gutters add extra white space for documents that are to be bound.

Word's default margins are 1 inch on the top and bottom and 1.25 inches on the left and right sides of the page. The default settings have no gutter space.

To setup margins and gutters using the Page setup dialog box:

1. Position the insertion point where margin changes are to be made.

2. Choose File Page setup dialog box. Click open the Margins page.

3. Using the Top, Bottom, Left and Right box controls to set the amount of white space on the four edges of the document. The preview area reflects any changes that are being made in the margin settings.

4. The gutter margin should be specified for adding additional space to documents that will be bound. If the binding material takes up half- an –inch, a 0.5" gutter space should be specified. Use the gutter spin box control to specify the desired gutter space. Also specify whether the gutter space is to be added on the top of each page or to the Left in the gutter position area.

5. The mirror margin feature helps to format for back to back printing. The two pages per sheet option allow printing two pages per sheet.

6. The apply to drop down list have two options: Whole document which allows changed settings to be allowed to the whole document. Or this point forward for applying changed settings from the point where the insertion point is positioned.

7. Click Ok to apply the settings and return to the document.

It is possible o change the margin settings using the vertical and horizontal rulers in Print Preview or in Page Layout option.

Point to the margin line on the ruler and the pointer changes to a double-headed arrow.

Hold down the mouse button to display a dotted line extending through the document. This dotted line represents the location of the margin. To adjust the margins, simply drag this dotted line in the desired direction.

Deleting

1. Select the word or a sentence which you want to change & then click delete.

2. Select the word or a sentence which you want to change. Right click of mouse will open a dialog. Select delete from the dialog

box.

Changing font type

Select the content. Click format font. The dialogue box will open select the font type & click ok.

OR Select the content. Select the font type from standard tool bar.

OR Select the content. Use right click of mouse. Select font. The dialogue box will open select the font type & click ok.

Changing font type

Select the content. Click format font. The dialogue box will open select the font size & click ok.

OR Select the content. Select the font size from standard tool bar.

OR Select the content. Use right click of mouse. Select font. The dialogue box will open select the font size & click ok.

Changing font color

Select the content. Click format font. The dialogue box will open select the font color & click ok.

OR Select the content. Select the font color from standard tool bar.

OR Select the content. Use right click of mouse. Select font. The dialogue box will open select the font color & click ok.

Changing font style

Select the content. Click format font. The dialogue box will open select the font style & click ok.

OR Select the content. For making content bold select icon 'B'. For making content italic, select icon '*I*'. For underlining the content select icon 'U'.

OR Select the content. Use right click of mouse. Select font. The dialogue box will open select the font style & click ok.

Use of Graphics [Inserting Clips and Graphics Adding Clips]

Ms Word comes with its own set of pictures in the clipart gallery. The MS word Gallery includes a wide variety of pictures, photographs, sounds and video clips that can be inserted in the document.

To insert a picture from the ClipArt Gallery

1. **Position the insertion point where a picture or clipart is to insert.**

2. **Click the Insert Clip Art button on the Drawing toolbar or choose Insert Picture Clipart from the menu bar to open the Insert Clipart dialog box. Click the Pictures tab to open the page in which various categories of pictures are displayed.**

3. **Choose a desired category. The available Clips of pictures of that category are displayed.**

4. **Click the desired picture from those displayed and click Insert Clip on the menu that appears. The other options available in the menu are: preview clip, add clip to favorites or other categories and find similar clips**

5. **Click the close button on the Clip gallery title bar when finished.The user can also drag a picture or other clip from the Clip Gallery to the document. Use the mouse to drag a selected clip to move it. Drag the clip's sizing handle to resize the clip.**

To insert a picture from another file

1. **Position the insertion point where a picture is to insert.**

2. **Click the Insert Picture from File from the menu bar to open the Insert Picture dialog box**

3. **Locate and select the file from where the picture is to be taken. A preview of the selected file appears in the right pane.**

4. **Click the Insert button in the dialog box to insert the selected picture into the document.**

Inserting Tables into Word Document

1. To insert a table into your word file, open your web file in Word. Place the cursor in the place you want your table to appear. Click Table, Insert, Tab 1.

2. Choose the number of columns and rows you wish. You may also wish to choose a format for your table display.

3. To format, click AutoFormat.

4. This dialog display allows you to choose whether or not the borders, rows, and columns in your table will include shading or colors. Once you have chosen the options you wish, click OK.

ii. Use of Templates (Mail Merge and Letters)

Mail Merge and letters

Word's Mail Merge feature allows a user to quickly create personalized correspondence and other documents by combining (merging) information from two different files. For eg. A list of names and addresses from one file (the data source) can be merged with a form letter in another file (the main document) to produce a number of personalized form letters. Word also enables the user to create catalogs, forms with variable fields or labels.

Choose Tools – Mail Merge from the menu bar. The mail merger dialog box opens. One has to follow six steps here:

1. Select Document Type- Select the type of document (letter, envelop, labels, directory) on which you want to work on. For working on letter select 'letter'.

2. **Starting Document-** Select the way you want to set up your document. The mail merge wizard gives you three options (Use current document, start from template, and start from existing document) & you have to select one from it. If you want to use current document, click on that option. If you want to use the template click on it& also click on use template. The computer will open a dialog box; select the template that you want.

3. Select Recipient- A] for selecting the recipient if the list of recipient is ready with you click on 'use existing list' & also click on browse. My Data Source window will open you have to select the file & click on open. The mail recipient list which you have selected will open, click on ok. To edit this list, click on edit the list.

B] Click on select from outlook for using the contact list already prepared, click on edit list for making changes in it.

C] To create new list, click on 'Type a new list.' Write the details in the address book & click on ok.

4. Write your letter- If you have not already done so then type your letter. To add recipients' information in your letter, click on the location in your computer & then click on 'Address Book' & 'Greeting Line', it will insert formatted address & formatted greeting line. When you finish writing the letter click on 'Next.'

5. Preview the letters- You can preview all the merge letters. For

making changes in recipients' list, click on 'Edit recipients' list'.

6. Complete the list- For printing merged letters click on 'print'. To personalized your letter click on 'Edit individual letter'. This will open a new document with merged letters. To make changes in all the letters, switch back to original document.

iii. Saving Word Documents As Web Pages

1. First, save your document in Word format

2. Then, click on the File menu and select Save as Web Page or Save as HTML.

3. Click on the down arrow to the right of the *Save in:* window and select the location where you wish to save your file.

4. In the *File name:* box, type a name for your file, and check that the *Save as type:* window displays *Web Page* or *HTML Document.*

5. Then, click on Save.

6. A message may display to warn you that because the document is being saved in HTML format, some formatting options could be lost in the save process. At this message, click on Yes.

To preview your document on the web:

1. Open your Word document and then click on the File menu and select Web Page Preview.

2. A browser window will then open and display your document.

3. To exit from the browser window and return to your Word document, click on the X in the top right corner of the browser window.

To modify your document in HTML format:

1. Open your Word document and then click on the View menu and select HTML Source.

2. Make the necessary changes to your document.

3. Then, click on Save.

iv. Convert Word Document into Presentation

If you want to turn a Word document into a PowerPoint presentation, one method you can use is to manually copy the text from one document to the other. This is fine for a small document but can be time consuming for larger ones.

There are a couple of alternative methods for moving your text from a Word document into a PPT presentation. One method is to use the Send To option within Word as described below.

1. Open the document you want to use as a PPT presentation.
2. From the File menu, point to Send To, and click Microsoft PowerPoint.
3. PowerPoint will automatically launch and your text will appear on the various slides. Keep in mind that it will likely require some reorganization but it is a quick way of getting the content into slides.

v. Scan, Print And Prepare Transparency

A] How to Scan Text for Word Processing

1. Turn on the scanner. (The power button is on the top right-hand side.)

2. On the computer, double-click the icon on the desktop labeled "HP Director."

3. In HP Director, click the "Scan Document" icon.

4. In the dialog box that pops up, select the following options:
-"document"
-"scan for editable (OCR) text"
-"original contains graphics" (if the document contains images).
- Where prompted "where do you want to send the scanned image?" select "Microsoft Word" from the drop-down list.

5. Click the "scan" button at the bottom of the dialog box. Scanning may take a minute or two to complete.

6. HP Director will display a preview of the image. Use the rotate buttons on the left side of the window to adjust the image's orientation, if necessary. Adjust the selected region by dragging the corners of the selection box. Click "accept" to go the next step, or click "new scan" to re-scan the document.

7. If there are more documents to scan, click "yes" when prompted to scan more documents. Place the next document on the scanner and back to step 5. Otherwise click "no".

8. The scanned text will appear in a Microsoft Word document, in RTF format. Check the text for spelling errors and save.

Print document

When the print button on the standard toolbar is clicked, Word uses the current print options. By default, Word prints a copy of the document using the Windows default printer.

Alternatively, the user can choose to change the default settings before sending a document to print:

To set options for printing:

1. Choose File Print or press <Ctrl> + <P> to open the Print dialog box

2. If more than one printer is connected, use the Name text box in the Printer area to select a printer other than a default one. The currently selected printer ie displayed in the Name text box

3. Click the Properties button to open a dialog box with options for setting the print   quality,   paper settings, orientation, color etc for the currently selected printer

4. The Page Range controls can be used to choose the range to be printed .Choose from among the options to Print All, Currentpage, and Selection, a range of pages or only designated pages of a document.

5. Specify the number of copies of the document to be printed .In the Copies area, the Number of copies spin box can be used to print more than one copy of the selection, page, multiple pages or the entire document.

6. Indicate in the Print text box whether to print just the even pages, just odd pages or all pages in range

7. Set the Zoom option to specify how many pages to print per sheet in the Pages per sheet box or to specify whether the document is to be called to paper size for printing in the Scale to paper size box

8. Click the Options button to specify other printing options such as printing the document in reverse order, background printing.

9. Click OK to send the document to printer to print with specified settings.

CHECK YOUR PROGRESS

1) What do Word Processors do?

_____

_____

_____

4B.3.2 SPREADSHEETS

Spreadsheet programs organize, analyze and graph numeric data such as budgets, financial reports. A spreadsheet is a powerful application, which can be used to store, manipulate, calculate and analyze data such as numbers, text and formulae. Once used exclusively by accountants, today spreadsheets are widely used by nearly every profession. Well-designed spreadsheets can save hours of work and help you try a variety of scenarios with little effort. An analogy can be drawn between a spreadsheet and an accountant's ledger. A ledger is made up of many pages, each page arranged into a series of rows and columns. Three widely used spreadsheet programs are Microsoft Excel, Corel Quattro Pro, and Lotus 1-2-3.

FEATURES:

Excel, which is the most popular spreadsheet program; is an electronic spreadsheet that adapts calculations from paper and the calculator to the computer. At its simplest level a spreadsheet is used to enter numbers and perform simple calculations but the capabilities of Excel extend far beyond this. Excel provides a number of features including:

1. A range of functions covering a variety of mathematical, statistical, financial and other calculations.

2. A selection of tools to facilitate What If type analyses.

3. A Chart Wizard - to produce graphical representations of data held within workbooks. Graphics can be added to highlight information in worksheets and charts. It has database features which enable sorting, filtering and analyzing of information.

4. Excel allows you to create spreadsheets much like paper ledgers that can perform automatic calculations.

5. Each Excel is a workbook is a grid of columns (Designated by letters) and rows (designated by numbers).

6. The letters and numbers of the columns and rows (called labels) are displayed in gray buttons across the top and left side of the worksheet.

7. Worksheet we see on the screen represents only a tiny portion of our available worksheet space. Excel allows us to create a worksheet up to 256 columns wide and 65,536 rows long.

There are many different practical applications for which a spreadsheet can be used. The obvious ones, which come to mind, are financial applications, such as maintaining budgets and accounts. Other possible applications may include processing course marks or analyzing results from experiments.

Cells

Cells are the points on a worksheet where the rows and columns meet. Each cell can hold letters, numbers or formulae and is referenced by its column and row identifier, so the cell in the top-left corner of the worksheet is cell A1; this is known as the 'cell reference.' When a cell is selected, it is known as the 'Active Cell'. Cell address is a unique identifier comprising of the column name & row number.

Eg. A1- Column A and row 1

C22- Column C and row 22

A worksheet consists of many cells where actual data & formulae are entered. The basic storage location in Excel is a cell. A cell can hold 254 characters.

Row

A row is a collection of consecutive adjacent cells horizontally from left to right & having row header. The worksheet contains of 65,536 rows.

Column

A column is a collection of consecutive adjacent cells vertically from top to bottom & having column header. The worksheet contains of 256 columns.

Header and Footer-

- Column headings (across the top of the worksheet). Columns are labeled by capital letters in alphabetical order: A to IV for total of 256 columns. Each column extends down through all 65,536 rows of the worksheet.

- The row headings (down the left side of the worksheet). Rows are numbered from 1 to 65,536. Each row extends across through all 256 columns of the worksheet.

- A cell (the intersection of a column and a row). Cells are named by their column and row location. Eg. A1, B89, IV 65,536 etc.

FUNCTIONS:
To Insert a Row
1. Click on a cell in the row below, for the new row to be inserted.
2. From the Insert menu choose Rows.

OR
Position mouse pointer over highlighted row.
Click with right button and select insert from popup menu.
Choose Entire row & click OK.

To Insert a Column
1. Click on a cell in the column to the right of the position for the new column to be inserted.
2. From the Insert menu choose Columns.

OR
Position mouse pointer over highlighted row.
Click with right button and select insert from popup menu.
Choose Entire column & click OK.

To Delete a Row
1. Click on any cell in the row to be deleted.
2. From the Edit menu choose Delete.
3. Choose Entire row.
4. Click OK.

OR
Position mouse pointer over highlighted row.
Click with right button and select Delete from popup menu.
Choose Entire row & click OK.
The row is immediately deleted and all rows are automatically shifted up so that no blank rows are left on the worksheet.

To Delete a Column
1. Click on any cell in the column to be deleted.
2. From the Edit menu choose Delete.
3. Choose Entire column.
4. Click OK.

OR
Position mouse pointer over highlighted column.
Click with right button and select Delete from popup menu.
Choose Entire column & click OK.

The highlighted column is immediately deleted and all columns to the right are shifted to the left so that no blank columns are left on the worksheet.

Formatting Cells or Table
Cell formatting & table formatting deals with the way cells and characters within cells, appear. For example: size, colors and alignment of text, cell borders, currency, number of decimal places, date and time formats can be changed. Formatting of cells can be preset before data is typed, or can be amended after data has been entered.

Alignment
When you enter data in Excel, text is left justified and

numbers are right justified. You may wish to change the justification to allow the contents of columns to line up neatly. To justify a cell or range of cells:

1. Select the cells, rows, columns or table to be formatted.
2. From the Format menu, select Cells.
3. Format Cells window will open. Click on the alignment tab
4. Choose the horizontal & vertical alignment
5. Click OK.

OR

Select the cells, rows, columns or table to be formatted.
Put Mouse pointer over highlighted cells, rows, columns or table.
Click with right button and select format -cell. .
Format Cells window will open. Click on the alignment tab.
 Choose the horizontal & vertical alignment. Click OK

OR

Select the cells, rows or columns to be formatted.
Press <ctrl > +<1>
Format Cells window will open. Click on the alignment tab.
Choose the horizontal & vertical alignment. Click OK

Changing Width of Columns

When "# # # # # #" appears in a cell, the cell is too narrow for the data to be displayed.
Select Format menu, column- width to change a width of a column.
 The dialog box will open, type the desired width & click OK.

OR

Position the mouse pointer on the line to the right of the column-heading label (the grey area at the top of the column). As soon as the normal spreadsheet cursor changes to a black cross, click and drag the line separating columns to required width.

OR

 Double-click the left mouse button to automatically widen to size required. Excel uses auto adjust to widen column.

OR

Select the column. From Format menu, select Column. From the Column submenu select AutoFit Selection.

Changing Height of the Row

Place the cell pointer in any cell in the row to be adjusted
From the Format menu, select Rows
From Row submenu, select Height
In the Row Height dialog box, type the desired height

Click on OK.

OR

Position the mouse pointer on the line to the right of the row-heading label (the grey area at the top of the column). As soon as the normal spreadsheet cursor changes to a black cross, click and drag the line separating rows to required height.
Or Along the row point to the border between the rows. When the pointer changes to double arrow ,double click.

OR

Select the Row. From Format menu, select Row. From the Row submenu select AutoFit Selection.

Types of Data

In a spreadsheet there are three basic types of data that can be entered.

1. Labels- Labels are text entries. They do not have value associated with them. We typically use labels to identify what we are talking about. Labels cannot be used for the calculations.
Eg. Name, Wage, Days,Marks

2.Constants- Constants are the entries that have a specific fixed value. They are just numbers. eg. 4.45,79.

3. Formulae- Formulae are entries that have an equation that calculates the value to display. These are mathematical equations. Formulas must begin with an equal to sign (=). Eg. =10+5, = sum (A5:P6)

To change the data type click on Format- Cells.
Select Number tab from the Format Cells window.
 Select the category that you want. For example- Currency, Time, Date, Text, Percentage, Fraction, Accounting, Scientific, Special.

Using Fill Facility

Rather than copying the cells, you can use the Fill command to repeat information to contiguous cells. If the first cell contains the formula, that will be repeated in the additional cells. If the first cell contains the text, that will be repeated in the additional cells.

Type the information in the first cell of the group
Select the group of the cells you wish to be filled (starting with the cell with the contents to be copied)
From the Edit menu, select Fill
From the Fill submenu select Right or Down.

OR

Type the information in the first cell of the group

Click & hold the fill corner of this cell
Drag in the direction you want the information to be copied.

OR
Press <ctrl> + <R> & <ctrl> +<D> respectively.

Using Auto Fill Facility
Microsoft Excel can automatically continue a series of numbers, number/text combinations, dates, or time periods based on a pattern you establish. A custom fill series is a set of data that is used to fill a column in a repeating pattern; for example, North, South, East and West. You can create a custom fill series from existing items that you've listed on a worksheet, or you can type the list from scratch.

Type the word Monday in cell A1. Click on the cell to make it active. Pull the Fill Handle across to cell G1 (the fill handle is a small black dot at the bottom right corner of the active cell). All the cells in Row A now become highlighted. The rest of the week's days will appear in the row as column headings ending with Sunday in cell G1.

Now type a figure 1 in cell A3, type a figure 2 in cell B3. Click on cell A3 and drag and highlight cell B3. Now click and drag the Fill handle at bottom right corner of cell B3 and release on cell D3. The numbers 3 and 4 now appear in cells C3 and D3 respectively. Now click and drag Fill handle to cell G3. The numbers 5, 6, and 7 appear in cells E3, F3 and G3 respectively.

Calculations

Functions
A function is a special prewritten formula that tasks a value (s), performs an operation& returns a value(s). Functions can be used alone or as building blocks in larger formulas. Using functions simplifies & shortens formulas in your worksheets, especially those that perform lengthy & complex calculations. The sequence of characters used to enter a valid function is called the syntax.

SUM

Probably the most popular function in any spreadsheet in the SUM function. The SUM function takes all of the values in each of the specified cells and totals their values. The syntax is: = SUM (first value, second value, etc.)

In the first and second spots you can enter any of the following (constant, cell, range of cells) Eg. =sum (C9:D5)

•Blank cell will return a value of zero to be added to the total.
* Text cells cannot be added to a number and will produce an error.

Using AutoSum

The AutoSum button is a shortcut to a formula for adding together a list of numbers in a range. For example, to add a range of numbers in cells F2 to M2 and display the result in cell N2:

1. Select cell N2.

2. Click on the AutoSum button and the range F2 to M2 will be automatically selected (a moving border will appear around the selected cells).

3. Press Enter and the result will be displayed in cell N2.

   If, when using AutoSum, at step 2 the wrong list of numbers is selected, just manually select the correct list before pressing Enter.

Average

The average function finds the average of the specified data.The syntax is as follows:

= Average (first value, second value, etc)

Text fields and blank entries are not included in the calculations of the average function. eg. = average (R6:W3)

Count

This will return the number of entries in the selected range of cells. The syntax is as follows: =count (value1, value 2, value 3, etc.) For Example =count (S6:V8.)

Sorting

In an ascending sort, Microsoft Excel uses the following order. (In a descending sort, this sort order is reversed except for blank cells, which are always placed last.)

• **Numbers - Numbers are sorted from the smallest negative number to the largest positive number.**

• **Alphanumeric sort - When you sort alphanumeric text, Excel sorts left to right, character by character. For example, if a cell contains the text "A100," Excel places the cell after a cell that contains the entry "A1" and before a cell that contains the entry "A111"**

Sort a list/ single level sorting

Sort rows in ascending order (A toZ or 0 to 9) or descending order (Z to A or 9 to 0)

- **Click a cell in the column you would like to sort by.**

- **Select Data menu. Click Sort Ascending or Sort Descending**

Multilevel sorting

There are some situations where you need to use multi level sorting. Eg. Subjects and marks within the subjects

1. Select the table& select Data- sort to display the sort dialog box

2. Under the sort area, click on the drop down box to see the available columns. Select the first column from the list & click ascending

3. Click then by box drop down arrow, select the second column from the list

4. Click ascending option. Click OK button to apply the selection to the list.

Use of filters

The primary uses of database or list are to find the records containing specific information & to select records based on specific criteria. The process of record selection is called as filtering. The records that meet the specific criteria are filtered out from the records that don't meet the criteria. The two different ways of finding & filtering records in Excel are: 1] AutoFilter, 2] Advance Filter

AutoFilter

The AutoFilter displays & hides entire records on the worksheet.

1. Select the table or the column in the database

2. Choose Data- Filter- Auto Filter

A   drop down arrow will appear to the write of each field name

3. Clicking on this arrow drop down list, shown in the following figure that lists the field's unique entries alphabetically. If you don't see the entry you want, scroll until it is visible

In addition to the unique field entries, you can also select from these options:

All: Show all records

Top 10: Display the top 10 Auto filter

Custom: Display the custom Filter dialog box to set the custom criteria

Blanks: Display only the records where that field contains no entry

Non-Blanks: Display all records with any entry in that field.

4. Click the drop down arrow in the particular column. It displays the list with different name available in that field. Select the option from the drop down list.

5. The auto filter displays only the set of records in the selected field & hides other records in the worksheet.

6. To view again all the records, click again on the drop down list, Select all.

Removing AutoFilter
1. Select the list
2. Select Data-Filter-AutoFilter. This removes automatically the Drop down box in the right side of every field.

Advance Filter

The advance filter command allows extracting the records in your database based on a criterion and then moving the result to a different location on the current worksheet. Advanced Filter allows placing the results to a new worksheet so that you can overcome the problems of using the certain feature of Excel while your database is filtered.

Text Processing
Font style

Select the cells. Select Format Cells. The Format Cells Window will open. Select Font tab. Select the desired font style & click OK.

Font type

Select the cells. Select Format Cells. The Format Cells Window will open. Select Font tab. Select the desired font type & click OK.

Font Size

Select the cells. Select Format Cells. The Format Cells Window will open. Select Font tab. Select the desired font size & click OK.

Font colour

Select the cells. Select Format Cells. The Format Cells Window will open. Select Font tab. Select the desired font colour & click OK.

Shrink Text

To fit the text in the cell, you can shrink its size. It will not increase the width of the cell. Select the cells. Select Format Cells.

The Format Cells Window will open. Select Alignment tab. Select Shrink Text & click OK.

Wrap Text

To fit the text in the cell, it adjusts size of the cell accordingly. It increases the height of the cell to fit text inside.Select the cells. Select Format Cells. The Format Cells Window will open. Select Alignment tab. Select Wrap Text & click OK.

Rotating Text

Rotating the titles allows you to condense the title while keeping column heading readable. Rotating text on a worksheet is useful when you are recording grades & want to clearly label assignments. But if you try to rotate the merged cells, only the first letter will display.
1. Select the cell(s)
2. Click Format- Cells
3. Select Alignment tab from the Format Cells Window that willopen
4. On the alignment tab under orientation, click & drag the Red Diamond to the vertical position
5. Click OK

Graphics

You can add picture, chart, diagram, auto shape in your spreadsheet.

Using Auto Shapes

Excel comes with the set of readymade shapes, you can use in your spreadsheet. The shapes can be resized, rotated, colored. In addition to lines, there are basic shapes, block, arrows, flowcharts, elements, stars, banners. On the Drawing toolbar, click on Auto shapes. Point to the category& then click the shape that you want. To insert the shape with a predefined size, click on the worksheet.

Using Diagram

Click Insert- Diagram on the menu bar
It will open a dialog box. Select the diagram you want to insert. Click OK.
To insert the shape with a predefined size, click on the worksheet.

Using Picture from Clip Art

Excel come with the range of pictures with it. To insert these pictures-

1. Click Insert- Picture on the menu bar, select Clip Art.

2. It will open the Insert Clipart dialog box. Click the Pictures tab to open the page in which various categories of pictures are displayed.

3. Choose a desired category. The available Clips of pictures of that category are displayed.

4. Click the desired picture from those displayed and click Insert Clip on the menu that appears. The other options available in the menu are: preview clip, add clip to favorites or other categories and find similar clips.

5. Click the close button on the Clip gallery title bar when finished

Using Picture from other Files

1. **Click the Insert Picture from File from the menu bar to open the Insert Picture dialog box**

2. **Locate and select the file from where the picture is to be taken. A preview of the selected file appears in the right pane.**

3. **Click the Insert button in the dialog box to insert the selected picture into the document.**

Using Charts

Charts are the effective way to present the information. Excel includes a powerful built-in charting facility that makes it very easy to create a variety of charts. It is a graphical presentation of data contained within a sheet. Each cell is converted into data point. Charts are visually appealing & easy for the user to compare pattern & trends in data.

1. Select the cells that contain the data that you want to appear in the chart. If you want column & row labels to appear in the chart, include the cells that contain them in the selection

2. Click Chart Wizard Button on the Standard toolbar or choose Insert menu Chart

3. Select the type of chart you want to create in the Chart Type list.

4. In the Chart Sub- Type area, click the style you want.

5. Click Next to open Step 2 of the Chart Wizard

Step 2: Data Range & Series

The Chart Wizard's Step 2 contains two tabs- Data Range tab & Series tab

Data Range tab displays the range of address that you selected for chart & in Series tab you can change the cell references for each series. Click Next to open Step 3 of the Chart Wizard.

Step 3: Adding Titles and Legend

1. Type title of the chart

2. Type title of the X-Axis in the Value (X) Axis field

3. Type title of the Y-Axis in the Value (Y) Axis field

4. Click the gridlines tab & & clear its four options so that no gridlines appear in the chart

5. Click Legend tab, click the Show Legend check box & select the option that you want.

6. Click Next to open Step 4 of the Chart Wizard

Step 4: Deciding where to place the chart
In the dialog box opened, Select the option – as a new sheet or as an object in the sheet - related to desired location of the chart.

4B.3.3 PRESENTATION GRAPHICS

Research shows that people learn better when information is presented visually. A picture is indeed worth a thousand words or numbers. Presentation graphics are programs that combine a variety of visual objects to create attractive and visually interesting presentations. Three of the most widely used presentation graphics programs are Microsoft PowerPoint, Corel Presentations and Lotus Freelance Graphics. With PowerPoint's powerful features, the creation of a slide show becomes a lot easier. For example, PowerPoint can be instructed to make a pre-designed presentation and the same can be modified according to your needs. By using the design templates, a professionally designed presentation can be arranged or formatted in a short time.

FEATURES

Elements of a Slide

A slide is an individual page of one presentation. Slides can have titles, text, graphics, sound etc. & it can be in both color & black & white model.

FORMATTING A SLIDE
Font
Font Style

Select a text. To format selected text change the style of text by clicking the Bold, Italic, Underline, or Shadow icon on the Formatting toolbar or select format font & click on bold, Italics, underline or shadow as you wish & click ok.

Font Type

Select a font type from the Font list on the Formatting toolbar.
OR Select a text. Click on format font. From the option Font type select a font type & click ok.

Font Size

Change the font size by selecting the point size from the

Font Size list.

OR
Select a text. Click on format font. From the option Font size select a font size & click ok.

Font Colour
Change font color by clicking the Font Color button arrow and selecting the color you want to use.

OR
Select a text. Click on format font. From the option Font colour select a font colour & click ok.

Colour
The slide background is the color, pattern, or graphic on which your text and images will appear.

To Change the Slide Background:
Select Format → Slide Background from the menu, select a color or fill effect from the drop-down color list, and click Apply or Apply All.

Color Schemes
PowerPoint uses color schemes to group the colors you use in every slide.

• To change the slide color scheme: In the presentation panel on the formatting palette, click the color schemes list arrow and select the color scheme you want to use.
Or select Format → Color scheme from the menu, select a scheme and click Apply or Apply All.

Graphics
Adding graphics
The drawing toolbar functions in PowerPoint the same as in Word. You can also insert pictures, Word Art, and Clip Art. Use Control + the arrow keys to fine-tune placement.

Simultaneously Resizing Multiple Objects:
Hold down the Control key and click on several graphics (you can include text). Click on a single graphic and use the sizing handles to resize it. The other objects will simultaneously adjust their size.

Format a Drawing Object:
Inserting Word Art
1. Choose Insert – Picture- Word Art from a menu bar or click a Word Art button on a drawing toolbar to open a WordArt dialog box
2. Select the Word Art Style in a gallery & click ok

In Edit Word Art Text dialog box that appears that is to be formatted using a Word Art. Use a Font & Font size drop down & bold & italics buttons to format a text if required

Click OK to place a Word Art drawing on a slide.

Adding Clip Art

PowerPoint 2004 comes with a large clip art collection. To insert clip art and open the clip art gallery, choose the Insert menu and select Picture > Clip Art. The Clip Art Gallery will open. The Gallery has a category section. When the category is selected thumbnail images of the clip art available appear in the right section of the gallery. You can maneuver within these sections to find the clip art that suits your needs. You can also use the Search button to find a specific piece of clip art. Once you have selected clip art, clicking on it once will insert it into your PowerPoint presentation. You can then change the location, size, and rotation if you like.

- Insert a Clip Art Graphic: Select Insert → Picture → Clip Art from the menu.

- To Insert a Picture: Select Insert → Picture→ From File from the menu, navigate to and select the file and click Insert.

- To Draw an Object: Click the object button you want to draw on the Drawing toolbar. Click and drag with the pointer until the shape reaches the desired size. To draw a perfectly proportioned shape, hold down the <Shift> key while you drag.

- To Add a Text Box: Click the Text Box button on the Drawing toolbar and click where you want to insert the text with the insertion point.

Pictures

Pictures can also be added to your slides to clarify a point. To insert a picture, it must be saved in a graphical format PowerPoint understands. Such formats include GIF and JPEG. To insert a picture, choose the Insert menu and select Picture > From File... A dialog box will appear from which you can select the name of the file to insert.

Unfortunately, inserting large images or many images can cause your presentation to crash. Before inserting your images into a PowerPoint presentation you should use a graphics application such as Adobe Photoshop or Macromedia Fireworks to reduce the size of your images.

Changing the resolution of an image is especially important when you intend to view the presentation on-screen rather than making printouts since computer screens at best can only display images at 96 dpi, even if the image has a resolution of 300 dpi.

Removing the extra resolution data makes your file smaller and more manageable without compromising the quality of the image.

Drawing Shapes

PowerPoint 2004 provides simple drawing tools for adding shapes to your slides. To insert a shape you must be in Normal View. In this view, the drawing toolbar is located on the bottom or left-hand side of the window. If you don't see the toolbar, go to the View menu and select Toolbars > Drawing

Drawing an object can be accomplished by clicking on the shape icon on the Drawing toolbar and moving the mouse cursor to the desired location on the slide where the object is to be placed. Next, hold down the mouse button while dragging the mouse to form the size of the shape. If you hold down the SHIFT key while dragging, the object will be made with even sides or angles (i.e. making an ellipse a circle).

The AutoShapes icon will display a dialog box of shapes when selected. To insert one of these shapes, choose the shape and drag the mouse to draw the desired size. To add text to a shape, click to select the shape and begin typing.

To change margins, vertical alignment, word wrap, and whether the shape automatically resizes as text is added, first make sure the shape is selected. Choose the Format menu >AutoShape. In the Format window click the Text Box button, make changes, then click OK

Organizational Charts

PowerPoint has a special application called Organization Chart which lets you easily design organizational charts for your slides. To start Organization Chart, choose the Insert **>** Object menu and choose MS Organization Chart from the object box. PowerPoint will then load Organization Chart and let you create your graph.

Tables

Just as you are used to doing in Microsoft Word and Excel, you can create and insert tables within PowerPoint. Go to the Insert menu and select Table and specify the dimensions of your table. You can also use the Table button, which allows you to specify small tables with your mouse as shown in the picture below.

Table Drawing tools:

Pencil tool: You can use this tool to draw lines within the cells in your table.

Eraser tool: You can use this tool to remove any cell, row, or column partition or block of partitions so that they merge. To return

to your normal pointer, simply click outside of the table you are working on. To access these tools:

1. Double-click on the appropriate icon in the toolbar or go to View and select Toolbars**.**

2. From the toolbar menu, select Tables and Borders.

3. The Tables and Borders toolbar containing the pencil and eraser tools will appear.

Table Resizing:

In-table row resize: You can adjust any row's height directly in your table by dragging the row border up or down, just as you can adjust column widths.

Table move handle: You can use the mouse to move your table to another position on the page by holding your mouse down around the upper left-hand corner of your table until a double cross replaces your arrow. Then click and drag your table to another position in your presentation.

Table resize handle: You can change the size of the entire table while maintaining the same row and column proportions. To resize your table:

1. Click on the table to highlight it. A shaded border with small circles at the corners and on the edges will appear when your table is selected.

2. Hold your mouse over any one of the circles on the edge or at the corner until the table resize arrow appears.

3. Drag the table boundary until the table is the size you want. The row and column sizes will change proportionally to their previous sizes.

    To resize the table without constraining the proportions, simply hover over the table edge that you would like to change until the cursor becomes two parallel lines with arrows pointing outwards. Then click and drag the edge to the desired size. Only that row or column will change in width or height, respectively, without affecting the other rows and columns in the table.

Slide Animation

*   **To give a professional look to the slide show presentation. Animation includes special visual and sound effects applied to text or content.**

- PowerPoint allows you to set your own Custom animation effects by defining your own animation types and speed and sound effects on a slide.

Steps to add animation effects

- Animate text and objects -In normal view, display the slide that has the text or objects you want to animate.
- On the Slide Show menu, click Custom Animation, and then click the Effects tab. If you are animating a chart created in Microsoft Graph, click the Chart Effects tab. Under Check to animate slide objects, select the check box next to the text or object you want to animate.
- Under Entry animation and sound and Introduce text (if you are animating text), select the options you want.
- Repeat steps 3 and 4 for every object you want to animate.
- Click the Order and Timing tab.
- To change the order of animation, select the object you want to change under Animation order, and then click one of the arrows to move the object up or down in the list. To set the timing, select the object and then do one of the following:
  To start the animation by clicking the text or object, click on mouse click.
  To start the animation automatically, click automatically, and then enter the number of seconds you want to have elapse between the previous animation and the current one. To preview animations, click Preview. A quick way to create basic animation is to select the object you want to animate (in normal view), click the Slide Show menu, point to Preset Animation, and then click the option you want.

Design Templates

Think of design templates as a coordinated packaged deal. When you decorate a room, you use colors and patterns that all work together. A design template acts in much the same way. It is created so that even though different slide types can have different layouts and graphics, the whole presentation goes together as an attractive package.

Applying the new Design Templates

Design Templates: From the Format Menu, Select Slide Design. The Slide Design Pane opens.

Find a template you like; they are listed in alphabetical order. Select the slides you want the design applied to. Now click on the right side of the design you want to apply. This opens a box that gives you the option to apply to selected slides or apply to all slides. You can apply a different template to slides, for example you might want to use different templates as a visual cue when changing topics. You can remove designs by applying the" default design" template. To Apply a Design Template: Select Format → Slide Design from the menu, or click the Slide Design button on the Standard toolbar, or select a design from the

Presentation panel of the Formatting option.

Slide Transition

A special effect used to progress from one slide to the next in slide show is called a slide transition.

Add transitions to a slide show:

- In slide or slide sorter view, select the slide or slides you want to add a transition to.
- On the Slide Show menu, click Slide Transition.
- In the Effect box, click the transition you want, and then select any other options you want.
- To apply the transition to the selected slide, click Apply.
- To apply the transition to all the slides, click Apply to All.
- Repeat the process for each slide you want to add a transition to.
- To view the transitions, on the Slide Show menu, click Animation Preview.

Sound

Adding Sounds or Movies would be added from the Insert Menu, under Movies and Sounds. Choose something from the clip organizer. Movies should be .mpg or .avi files. It's a bad idea to embed the movie into the PowerPoint – the file gets too big. Sound files show as an icon in the presentation. The sound will play when

you press the icon, or can be set to play automatically. To make sure the sound and movie items play, you should first move them into the folder that contains the presentation, and then insert them into the presentation. To embed a wav file, first go to the Tools menu, Options menu, General tab and increase the number next to "link sounds with file size greater than" to 50,000. Then insert the file.

Movies and Sound Clips

Inserting movies and sound clips is possible in PowerPoint 2004. However, you must save your movie or sound clip files with your PowerPoint presentation or else they will not work. It is recommended that you create a folder and save your presentation and media clips together.

Always test your presentation on the computer you will be presenting on to make sure the necessary applications are installed on the computer. Some media formats are not fully compatible on Windows computers in PowerPoint.

To insert a movie:

1. Select the **Insert** menu **> Movies and Sounds menu > Movie from File.**

2. The movie dialog box will appear. Navigate to the folder containing your movie file.

3. Select the movie file and click **Choose**.

4. The first frame of the movie appears in the center of the slide.

5. A dialog box will ask if you would like the movie to play immediately when you navigate to the slide or when you click on it. Select the option that works best for your presentation 6. To see the movie play during a slide show, click the **Slide Show** button.

7. Click anywhere on the movie frame to play the movie if you set it to play when clicked.

To insert a sound clip:

1. Select the **Insert** menu > **Movies and Sounds** > **Sound from File**.

2. The sound dialog box will appear. Navigate to the folder containing your sound file.

3. Select the sound file and click **Insert**.

4. The sound clip icon will appear in the middle of the slide.

5. A dialog box will ask you if you would like the sound to play immediately when you navigate to the slide or when you click it.

Select the option that works best for your presentation.

6. To hear the sound clip play during the slide show, click the **Slide Show** button.

7. Click on the sound clip icon to hear the clip play if you set it to play when clicked.

Hyperlink:

Insert a textbox. Right-click and select Add Text. Type in a phrase describing the link as text inside the text box. Right click and select Hyperlink. Enter the URL. The link will be active in Slide Show view.

CONVERTING PRESENTATION TO WEB PAGE AND WORD DOCUMENT

Step 1: Opening Your Presentation in Power Point

1. **Open your Presentation in Power Point.**

2. **Use Master Slide Layout to make any changes to background images or color on your presentation. (If no changes are needed, go on to step 7 on the next page).**

3. **To access the Master Slide – Click on View... Master... Slide Master**

4. **To change the background and/or text, click on Format and choose which item you would like to change. To change the background color of your presentation, select Background...from the Format menu. From the window, as illustrated on the left, select a different color and click on the Apply to All button.**

5. **To Exit out of the Slide Master view click on View... and select Normal.**

6. **Save your changes by clicking File... Save As...**

Step 2: Exporting Your Presentation to MS Word

1. Click on File... Send To... Microsoft Word...

2. Select from the box, which page layout you prefer. Click Ok. (This will automatically launch Microsoft Word). For presentations with important graphs or charts. The second option is recommended. These first four options will import images of your slides into Microsoft Word. For presentations without graphs or charts. This is useful for students wishing to take notes while viewing video lectures. Only the text of your presentation will be imported into Microsoft Word.

Step 3: Saving Your Word File as a Web Page

1. Make any changes in Microsoft Word.

2. Save your Word Document as a Web Page.

3. Click on File... Save As Web Page...

4. Title your Document and give your file a name. Click Save. If you created a document containing images, you will need to upload both the Webpage file AND the folder (and its contents). If you have no images in the word file, you will only have one file to upload.

Unit End Exercises

1. Explain what is Computer software
2. Explain what is Systems Software
3. Describe the Operating Systems
4. Describe the Utilities
5. Describe the Device Drivers
6. Explain what is Application Software
7. Describe Word Processors
8. Describe Spreadsheets
9. Describe Presentation Graphics

FEEDBACK

QUESTION NO	GUIDELINES
1.	4B.1
2.	4B.2
3.	4B.2.1
4.	4B.2.2
5.	4B.2.3
6.	4B.3
7.	4B.3.1
8.	4B.3.2
9.	4B.3.3

SUGGESTED READINGS AND REFRENCES

Vanaja,M. and Rajasekar, S. (2010): Educational Technology & Computer Education

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4C

COMPUTERS IN EDUCATION (C)APPLICATION OF COMPUTERS IN EDUCATION

Unit structure:

4C.0 Objectives

4C.1 Introduction

4C.2 CAI [Characteristics and Uses]

      4C.2.1 Concept of CAI

      4C.2.2 Instructional Modes of CAI

      4C.2.3 Characteristics of CAI

      4C.2.4 Uses of CAI

4C.3 CAL [Characteristics and Uses]

4C.4 CBT [Characteristics and Uses]

4C.5 CML [Characteristics and Uses]

4C.6 Preparation of CAI Package

      4C.6.1 Introduction

      4C.6.2 Steps of Developing a CAI Package

4C.7 Evaluation of CAI Package

4C.8 Summary

4C.0 OBJECTIVES

After reading this chapter you will be able to:

- Explain the Concept of CAI
- Explain the Instructional Modes of CAI
- Explain the Characteristics and Uses of CAI
- Describe the Characteristics and Uses of :
  - ➢ CAL
  - ➢ CBT
  - ➢ CML
- Explain the steps of Preparation of CAI Package
- Describe the criteria of Evaluation of CAI Package

4C.1 INTRODUCTION

We are a society of technology users. Computers today have penetrated every human activity. As teachers we are catering to a class of proficient Digital Natives. The various uses of computers in education maybe classified into four broad categories:

- Use of computer programming as a developmental or 'authoring' tool.
- Use of computers as means of Programmed instruction.
- Use of computers in stimulating experiments.
- Computers as a productivity tool both in content area and area of study for future use.

Educators look at computers as a strategy that can engage students in some form of learning. Robert Taylor (1980) suggested that a computer could be used in the classroom in three different ways:

- Computer as a TUTOR: i.e an aid to the tutor.
- Computer as a TOOL: i.e. as a medium of instruction
- Computer as a TUTEE: i.e as something to be instructed or programmed.

Computers in Education refer to educational computing. It means the applications of computers in Education. The computer has created a revolution in the content of education and in the nature of the learning process. They have the capability of multiplying the human intellect beyond past conceptions and have tremendous implications in education. They are

- Computer Assisted Instruction (CAI)
- Computer Assisted Learning (CAL)
- Computer Based Teaching (CBT)
- Computer Managed Learning (CML)

4C.2 CAI [CHARACTERISTICS AND USES]

Computers are a familiar sight in classrooms in the twenty-first century, and technology has been used to streamline many educational tasks. There are different types of educational computer use, and not every use of a computer in the classroom is considered computer-assisted instruction. The educational uses of computers that are considered to be computer-assisted instruction (CAI) or computer-based instruction (CBI) are those cases in which either instruction is presented through a computer program to a passive student, or the computer is the platform for an interactive and personalized learning environment.

4C.2.1 Concept of CAI

Computer-Assisted Instruction (CAI), a program of instructional material presented by means of a computer or

computer systems.CAI is defined as an interaction between a student, a computer controlled display and a response entry for the purpose of achieving educational outcomes.CAI is a method of instruction in which there is a purposeful interaction between a learner and computer device the individual learner to achieve the desired instructional objective with his own pace and ability. "Computer-assisted instruction" (CAI) refers to instruction or remediation presented on a computer. CAI has been developed from the principles of Programmed Instruction.

Within the broad definition, computer-assisted instruction may follow different paths to the same end. One example is how computer-assisted instruction is used in relation to other teaching presentations. CAI can be used either in isolation, bearing the whole responsibility for conveying instruction to students, or in combination with conventional, i.e., face-to-face, teaching methods. In CAI there is interaction between individual student and computer, computer displays instructions and students respond to computer display.

The basic assumptions of CAI are as follows:
- CAI can be provided simultaneously for as many as 4000 students.
- CAI is suitable for all types of teaching and learning activities.
- As the learner's performance is going to be recorded automatically in computer memory, immediate feedback can be provided to the learners by the teachers and also the teachers can use the data in making the best teaching strategy for the learner in future.

4C.2.2 Instructional Modes of CAI
CAI approach is in which the computer is used as a means for transmitting specific subject matter, such as reading. The flow of information is basically from the computer to the student, with the computer presenting learning material or activities for student responses. The computer retains records of the student's progress through the course of study. Based on the degree of interaction between student and computer, researchers have identified six levels of CAI:

Tutorial: Tutorial CAI provides some information or clarifies certain concepts in addition to providing the student with practice exercises. In this sense, the computer begins to take over actual instructional functions, tailored to the student's individual level of achievement. In the Tutorial Mode, information is presented in small units followed by a question. The student's response is analyzed by the computer and an appropriate feedback is provided. This is similar to Programmed Instruction.

Drill and practice: In the Drill and Practice Mode, the learner is provided with a number of graded examples on the concepts and principles learnt earlier. The idea is to develop proficiency and fluency through doing. All the correct responses are reinforced and the incorrect responses are diagnosed and corrected. The computer continues the drill until mastery is achieved by the learner. The computer provides the student with exercises that reinforce the learning of specific skills taught in the classroom, and supplies immediate feedback on the correctness of the response. Used in this manner, CAI functions as a supplement to regular classroom instruction, and may be especially useful when a teacher does not have the time to work individually with each student. Drill and practice on the computer may also motivate students more than traditional workbook exercises.

Simulation Mode: In the simulation mode, the learner is exposed with scaled-down simulated situations bearing correspondence with the real situations. Simulations are made to avoid risk, save money and conserve time. Simulation of an aero plane in light, an experiment on titration, a nuclear reaction, collision two bodies etc. are good examples of the simulation mode.

Discovery Mode: In the discovery mode, the inductive approach to teaching and learning is followed. The learner is encouraged to proceed through trial and error approach, i.e.; by solving a given problem, realizing, where and how he / she went wrong, trying again and finally solving the complex problem.

Gaming Mode: In the Gaming Mode, the learner is engaged in playing opposite the computer or opposite another learner. The extent of learning depends upon the type of the game. Games on spellings, names of places and general knowledge are some examples of the gaming mode.

Dialogue: With this type of computer use, the student takes an active role in interacting with the computer, giving instructions in the form of a computer language so as to structure the student's own curriculum. The computer provides information, exercises, and feedback. Dialogue CAI is believed to come closest to actually substituting for regular instruction.

4C.2.3 Characteristics of CAI

The following are the characteristics of CAI:

➢ It has the capacity to initiate flexible interactions with the student.
➢ The computer is able to record and store all the responses of the students.
➢ It can use the information in deciding what information to give the student next.

➢ It can branch not just in terms of one answer but also in terms of a whole series of previous answers.
➢ It can also record the time taken to answer a question and the degree of correctness of the student's response.
➢ It uses information in planning to determine which branch to take.

4C.2.4 Uses of CAI

The following are the most important uses of CAI:

a) **Self –pacing:** CAI provides one-to-one interaction with a student, as well as an instantaneous response to the answers elicited, and allows students to proceed at their own pace. Computer-assisted instruction moves at the students' pace and usually does not move ahead until they have mastered the skill. They allow students to progress according to their own pace and work individually or in a group. Programs provide differentiated lessons to challenge students who are at risk, average, or gifted. One student can move onto more demanding educational activities before the rest of the class without disrupting anyone else's learning. Simultaneously, another student can repeat certain learning activities as often as advisable. Computer-assisted instruction improves instruction for students with disabilities because students receive immediate feedback and do not continue to practice the wrong skills.

b) **Relevance and Quality of Education:** Computer-based instruction can also enhance the relevance and quality of educational activities. This will often register as a prime concern for parents and students. Collaborating with an appropriate site for learning activities will provide the school district or classroom teacher with a wealth of choices. With educational activities organized by grade level and covering a vast array of subject material, a valuable partnering site will empower the instructor with the ability to choose learning activities to target the students' needs best. Further, if the site includes authoring tools, the teacher or parent may create new educational activities to address any under-served curricular areas. Additionally, a user community, if offered, may enable the sharing of learning activities far more easily than before. Providing instruction on the computer then helps foster increased relevance for the lessons involved.

c) **Diagnostic:** CAI can be used diagnostically, and, once a student's problem has been identified, it can then focus on the problem area. Finally, because of the privacy and individual attention afforded by a computer, some students are relieved of the embarrassment of giving an incorrect answer publicly or of going more slowly through lessons than other classmates.

d) **Re teaching and reinforcing:** Computers are particularly useful in subjects that require drill, freeing teacher time from some classroom tasks so that a teacher can devote more time to individual students. Computers offer different types of activity and a change of pace from teacher-led or group instruction.

e) **Personalized Feedback of Instruction:** Computers provide immediate feedback, letting students know whether their answer is correct. If the answer is not correct, the program shows students how to correctly answer the question.

f) **Multisensory Presentations:** Computer programs are interactive and can illustrate a concept through attractive animation, sound, and demonstration

g) **Motivation and Reward:** Computers capture the students' attention because the programs are interactive and engage the students' spirit of competitiveness to increase their scores.

CAI therefore, can be said to be an effective tool under proper conditions. The course material should be carefully prepared by persons who are knowledge by persons who are knowledgeable in the subject matter, computer technology and learning theory. The academic support required by the students must be provided by the teachers CAL course ware must be high quality, user friendly and well organized.

4C.3 CAL [CHARACTERISTICS AND USES]

Computer Assisted Learning (CAL) is used to denote the flow of information between the student and computer so as to provide instruction to the student on specific topics.CAL is used to denote a broader function of the computer in mediating the learning environment of the student in different ways.CAI is at times considered to be an aspect of CAL which deals with instruction.

4C.3.1 CHARACTERISTICS of CAL
Kemmis and his associates suggested four paradigms for Cal. They are:

1. **Instructional paradigm:** This paradigm refers to those programs which provide instructions to students on specific topics. It is analogous to CAI

2. **Revelatory paradigm:** In this paradigm, the subject matter and the underlying theory are gradually revealed to the student i.e. learning by discovery process is used .In this form of CAL, the computer acts as a mediator between the student and an unseen model of real life situation. As the student interacts with computer, he gradually discovers the rules which govern the

hidden model and gradually unfolds it. The student inputs data and computer unravels the hidden model.

3. **Conjectural paradigm:** In this paradigm the student uses computer to formulate and test ideas/ hypotheses and obtain solutions to problems. At its simplest, Computer is used as calculator to work out complicated mathematical problems and at its most complex form, CAL packages offers sophisticated tools for modeling real life situations and manipulating ideas. In this form of CAL the student is in control of the learning. Student also tells computers what to do with input data.

4. **Emancipatory Paradigm:** In this paradigm the computer is used to reduce the burden of the student by performing laborious calculations and storing information.

4C.3.2 Uses of CAL

The following are the important uses of CAL:

a) **Variety:** Computer Assisted Learning (CAL) covers a range of computer-based packages, which aim to provide interactive instruction usually in a specific subject area, and many predate the Internet. These can range from sophisticated and expensive commercial packages to applications developed by projects in other educational institutions or national initiatives to simple solutions developed by individuals with no funding or support to tackle a very local problem.

b) **Specific:** CAL is very subject specific and provides a very personalized nature of the teaching process.

c) **Viable:** CAL is run either straight from a CD or floppy disk drive or over a local network so the constraint of the internet - slow download times for multimedia materials may not apply. This, coupled with the fact that CAL technology has been around a bit longer, means that CAL packages have the potential to offer more advanced, interactive, multimedia learning experiences than it is currently reasonable to expect from the Web.

4C.4 CBT [CHARACTERISTICS AND USES]

Computer-Based Trainings (CBTs) are self-paced learning activities accessible via a computer or handheld device. CBTs typically present content in a linear fashion, much like reading an online book or manual. For this reason they are often used to teach static processes, such as using software or completing mathematical equations. The term Computer-Based Training is often used interchangeably with Web-based training (WBT) with the primary difference being the delivery method. Where CBTs are typically delivered via CD-ROM, WBTs are delivered via the

Internet using a web browser. Assessing learning in a CBT usually comes in the form of multiple choice questions, or other assessments that can be easily scored by a computer such as drag-and-drop, radial button, simulation or other interactive means. Assessments are easily scored and recorded via online software, providing immediate end-user feedback and completion status. Users are often able to print completion records in the form of certificates. CBTs provide learning stimulus beyond traditional learning methodology from textbook, manual, or classroom-based instruction. For example, CBTs offer user-friendly solutions for satisfying continuing education requirements. Instead of limiting students to attending courses or reading printing manuals, students are able to acquire knowledge and skills through methods that are much more conducive to individual learning preferences. For example, CBTs offer visual learning benefits through animation or video, not typically offered by any other means. CBTs can be a good alternative to printed learning materials since rich media, including videos or animations, can easily be embedded to enhance the learning. Another advantage to CBTs is that they can be easily distributed to a wide audience at a relatively low cost once the initial development is completed. However, CBTs pose some learning challenges as well. Typically the creation of effective CBTs requires enormous resources. The software for developing CBTs (such as Flash or Adobe Director) is often more complex than a subject matter expert or teacher is able to use. In addition, the lack of human interaction can limit both the type of content that can be presented as well as the type of assessment that can be performed. Many learning organizations are beginning to use smaller CBT/WBT activities as part of a broader online learning program which may include online discussion or other interactive elements.

4C.5 CML [Characteristics and Uses]

Computer Managed Learning (CML) is used to indicate the use of computer to perform the tedious and time consuming tasks of learning. There are four broad areas in CML in which computer provide management support to the teacher. They are:
- To construct, score and analyze tests.
- To keep record of students performance and progress through courses.
- To provide guidance to the student advising him on the choice of next course, and
- To report on the performance and progress of the students to individual students and administrators of the institution.

Basic purpose of CML is to relieve the teacher from his time consuming routine tasks so that he can utilize it for more profitable instructional work

4C.6 PREPARATION OF CAI PACKAGE

4C.6.1 INTRODUCTION

Education is a natural, harmonious and progressive development of man's innate powers. It is a medium through which the society transmits its heritage of past experiences and modifications, system of values and the modes or skill of acquiring it. It is a key ingredient in economic and social development. In the 21st century "Information Explosion" and "Population Explosion" are the major problems in the higher education. Realizing the danger of this disastrous situation, India has embarked upon a great adventure; the adventure of putting to use modern information and communication technologies for the delivery of education services. To satisfy the needs of the 21st century education must be harnessed with technology and the teachers and learners are to be made familiar with and use ICT tools in their teaching learning process. Computer is now regarded as a super teaching machine. Computer based learning systems integrate seeing, learning and doing and thus making learning more effective. CAI packages of today are much more user-friendly and entertaining, than their predecessors. Students can now work at their own pace regardless of the level at which they are supposed to be. This promotes self-confidence, as it gives the student a feeling of control over what s/he is learning. CAI forces the student to remain focused on the topic at hand. In a classroom, it is easy for the students to simply nod their heads every time the teacher looks in their direction.

However, preparation of effective CAI programmes follows a step by step process. The development of a CAI can be based on the ADDIE instructional system design model which consists of five phases: Analysis, Design, Development, Implementation and Evaluation. The ADDIE model provides a means for identifying the target audience's needs and reinforce the use of this information for the design and development of the CAI. Throughout the implementation phase, necessary feedback is obtained to determine the effectiveness of the CAI. The CAI package can be based on one individual topic or it could be a large packages consisting of several individual lessons.

4C.6.2 STEPS OF DEVELOPING A CAI PACKAGE
The CAI package can be based on one individual topic or it could be a large packages consisting of several individual lessons

DEVELOPMENT OF CAI PACKAGE FOR A SINGLE LESSON
A team of developers is utilized in the production of a CAI lesson. A typical team consists of one faculty member, who is the content expert, and a professional who is the CAI designer/programmer, and a student programmer who does the coding. The systems approach is used for development of a single

lesson CAI which consists of four phases: planning, development, evaluation, and dissemination.

Planning

In the planning phase, a faculty member identifies a need for using CAI in a course. The faculty member, in consultation with a CAI specialist writes a proposal outlining the use of CAI in a topic, identifying the target audience, defining the objectives, providing the content and flow of the lesson, and suggesting an evaluation plan.

Development

During the development phase, the CAI professional works with the faculty member to best adapt the content to the interactive computer environment. A detailed display-by-display design of the lesson, referred to as a script, is produced on paper. Interaction on every display, with appropriate feedback for correct and incorrect responses, is written into the script, along with alternative paths that the user might see, based on their responses. The script is reviewed by the faculty member, by faculty colleagues, and by a team of lesson designers. Revisions are made based on the reviewer's suggestions. When the script is approved by the faculty member it is given to the student programmer to begin the coding.

While being programmed the lesson undergoes a similar review and revision cycle. At various points in its development the lesson is reviewed by the CAI professional and the content expert. Major changes can be incorporated into the developing lesson at this stage. When the complete lesson is on the computer, it is formally reviewed by programmers, designers, and content experts. A revised lesson is then readied for student testing.

Evaluation

The lesson is usually assigned to the faculty member's students during the next semester that the course is taught. Formative data on users' responses, requests for helps, and individual branching sequences are kept by the computer for each user. The programmer and designer use this information to further refine the lesson. The improved version is used with students in subsequent semesters while the lesson enters the next phase of the systems approach.

Dissemination

The lesson is then ready to begin the publication process with a courseware company. More reviews and revisions are required, with emphasis on editing, style, format, consistency, and programming errors. When the lesson conforms to publication standards it is published by the courseware company and made available to the public.

DEVELOPMENT OF CAI FOR AN ENTIRE CORSEWARE OR PACKAGE

The system's approach to single lesson development needs to be expanded in order to accommodate an entire package of courseware. A course planning stage should precede the planning of individual lessons. Answers to many and varied questions need consideration so that a firm groundwork for the project can be established. Carefully thought-out answers at the course planning stage save much revision time later on, and give the project a clear direction. Four of the most important questions follow, with items to consider when responding.

QUESTION 1: Should a CAI course be done for this topic?

a) Identify a need for the course. Determine if there is a market for the product. Confirm that the course is not a duplication of other existing courseware.

b) State the goal of the course. If it is meant for stand-alone delivery without an instructor, the content will need to be more detailed than if the course is to be of a supplementary nature. It could be keyed to an existing textbook, or a manual could be written to accompany the CAI lessons and provide background reading material.

c) Determine the target audience. Do the users require remediation or advance topics? Remedial drills and tutorials are much different to produce than high level inquiry or lab simulation lessons.

QUESTION 2: What should be included in this CAI course?

a) Outline the content. Write behavioral objectives. If the objectives do not lend themselves to CAI, do not include those objectives in the CAI portion of the course.

b) Divide the course into 20-40 minute segments. This size allows the user to finish a logical portion of the material in one session. It gives flexibility to instructors in assigning specific topics to students.

c) Select a mode or modes of instruction for each lesson. Drills and simulations are quick to design but are also programming-intensive. Timeline adjustments may be necessary, if these modes are employed often.

d) Sequence a user's flow through the course. A linear progression from beginning to end is simple but may be restrictive. A student should be able to skip familiar material and to review difficult material. Determine which lessons are prerequisites to others; time is saved in redefining terms and reexplaining concepts, when the prerequisites are identified.

QUESTION3: How will the material be evaluated?

a)Select mastery criteria. With prerequisites and objectives written for each lesson, pretests and post-tests can be used to determine a user's mastery of the material.

b) Design the testing. Validate the test items. Match them to objectives. Use an existing computer-managed package for test item delivery, rather than design a similar package within the course.

c) Plan the plot testing. A small test group of 20 to 25 students should pilot the materials, providing detailed commentary of their experience with the lessons. Timelines should include error-fixing based on a student pilot results. Major revisions at this point are inappropriate and should be reserved for a revised edition of the package.

QUESTION 4: How should the CAI course be developed?

a) Set a reasonable timeline. Allow plenty of time for revisions. Add start-up time if developers are inexperienced in CAI. One year is not enough time to put a one-semester course onto the computer.

b) Define the roles of members in the project. Authors produce content, CAI specialists adapt the content to the computer, and programmers code the lesson. Reviewers are needed to look at the content, at the CAI design, and at the code. Editors can smooth many writing styles into a unified presentation. Managers oversee and guide the process.

c) Establish the arbitrator. This person has the authority to arbitrate conflicts, such as doing more revisions versus meeting the deadline conflicts. Having an arbitrator at the onset saves time and needless arguing.

d) Flowchart the development process. Make all members of the project aware of the steps in the development project and of their own responsibilities at each step. e) Set design guidelines. The format of each lesson should be similar - a comfortable backdrop for the user. Terminology should be consistent. Features such as glossaries and calculators should be standardized and always advertised when available to the user.

Developing a large package of CAI courseware is a major undertaking. This process can be simplified by modifying the systems approach used to develop single CAI lessons. Planning for the additional development and packaging concerns that accompany large courseware production can provide clear direction for the project and save revisions to lessons throughout the entire process.

4C.7 EVALUATION OF CAI PACKAGE

The Evaluation of a CAI Package is essential in order to ensure the instructional design and pedagogical and technological soundness In order to measure **Instructional Design and Pedagogical Soundness** the following criteria may be followed:

1. Teaching strategy was matched to students' needs.
2. Presentation did not confuse students.
3. Readability and difficulty were at an appropriate level for students.
4. Graphic fulfilled important purpose.
5. Appropriate feedback for correct answers.
6. Feedback reinforced more for correct than for incorrect responses.
7. High degree of interactivity.
8. High degree of user control.
9. Comprehensive teaching sequences and instruction was self-contained and stand alone.
10. Good documentation available on how program.

To measure the **soundness of the content** used in the CAI package the following criteria may be used:

1. The content was reliable.
2. Correct used of grammar.
3. Current and error-free information.
4. Concepts and vocabulary relevant to students' abilities.
5. Information relevant to curriculum.
6. Information of sufficient scope and depth.
7. Logical progression of sub-topics.
8. Content matches required curriculum objectives.
9. The content was structured in clear and understandable manner.
10. The structure allowed students to move around freely in different units.

To measure the **Technical soundness** of the CAI package the following criteria may be used:

1. Program loaded consistently without error.
2. Program did not halt regardless of the response from the students.
3. Online links worked as indicated.
4. Animations worked as indicated.
5. The courseware is recommended for instructional use.

4C.8 SUMMARY

Teaching is generally considered as an activity which is designed and performed for multiple objectives in terms of changes in pupil behaviour. Pupils on the other hand have multidimensional personalities having different styles. The common implication of both these facts is that the teacher should use different strategies of teaching which match the objectives of teaching on one hand and pupils learning styles and personality dimensions on the others. CAI package have revolutionized the whole teaching and learning process by adapting to individual learning needs.

Unit End Exercises
1. Explain the Concept of CAI
2. Explain the Instructional Modes of CAI
3. Explain the Characteristics and Uses of CAI
4. Describe the Characteristics and Uses of : CAL, CBT and CML
5. Explain the steps of Preparation of CAI Package
6. Describe the criteria of Evaluation of CAI Package

FEEDBACK
QUESTION NO   GUIDELINES

QUESTION NO	GUIDELINES
1	4C.2.1
2	4C.2.2
3	4C.2.3 and 4C.2.4
4	4C.3, 4C.4 and 4C.5
5	4C.6.2
6	4C.7
7	

SUGGESTED READINGS AND REFRENCES
Vanaja,M. and Rajasekar, S. (2010): Educational Technology & Computer Education

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5

INTERNET IN EDUCATION

Unit Structure

5.0   Objectives

5.1   Introduction

5.2   Internet tools, Search Engine and Browsers

5.3   Application of Internet resources to Education

5.4   Synchronous and Asynchronous Modes of Internet Communication

5.5   Educational Portals

5.6   Online learning and online evaluation

5.0   OBJECTIVES

After reading this chapter, you will be able to..

- Explain the concepts related to Internet tools and resources
- Understand and apply different internet resources in Education
- Differentiate between Synchronous and Asynchronous Modes of Internet Communication
- Explain various educational portals
- Explain various modes of Online learning and Online evaluation

5.1   INTRODUCTION

Information and Communication Technology (or ICT) has come a long way since its inception which is parallel to the evolution of human kind. The need to communicate or share own viewpoints, feelings gave birth to this technology in the form of script, gestures and body movement. As man started his journey towards modernization ICT too became enriched with the newer technologies ranging from print media, simple audio, video gadgets to the latest one, that is computer technology. This advanced Technology is fast becoming an integral and inevitable part of every aspect of life. A very important and core element of Computer technology is INTERNET.

Internet is a system connecting computers around the world using **TCP/IP,** which stands for Transmission Control Protocol/Internet Protocol, a set of standards for transmitting and receiving digital data.

The Internet consists primarily of the collection of billions of interconnected web pages that are transferred using **HTTP** (Hypertext Transfer Protocol), and is collectively known as the World Wide Web. The Internet also uses **FTP** (File Transfer Protocol) to transfer files, and **SMTP** (Simple Mail Transfer Protocol) to transfer e-mail.[1]

1. http://www.apdip.net/publications/iespprimers/eprimer-edu.pdf
Imagine you are connected to the Internet and are on the Google Home page. You want to find out the information on the topic of your choice. You would type the name at the Search box and you find thousands of web addresses appearing on your monitor screen. This becomes possible due to HTTP. These are standard set of rules universally applied for sharing information.

For Example Whenever you want to surf a particular site you need to type at the URL bar beginning with. http://www, i.e. http://www.apdip.net   where http://www.are standard rules and remaining part is a specific desired type of information.

The Internet thus is the interconnected network of the web pages which could be surfed through different search engines like, Google, Yahoo, Hotmail etc. They are called Search Engines.

Historical Background of the INTERNET
The US department of Defence developed the first version of Internet during 1970s to allow quick communication among researchers working on the department projects in about 30 locations. The department also saw as a way to continue communications among these important defence sites in the event of a worldwide catastrophe such as nuclear attack. Since these projects were funded by the department's Advanced Research Projects Agency(ARPA), the Network was originally called **ARPAnet.**

In the 1980's just as Desktop computers were becoming common, the National Science Foundation funded a high speed connection among University centres based on the ARPAnet structure. By connecting their individual network, Universities could communicate and exchange information in the same way. However, these new connections had an additional, unexpected benefit. A person accessing a university network from home or school could also get access to any site connected to that network. This is how the Internet was born. It is also called as information superhighway

or cyberspace.

Internet in education:

There are many uses of Internet in Education which can be as follows:

- Instructional materials can be made available to students online. E.G. Written material, Various presentations, assignments can be given to students. Even the instructions too can be conveyed to students via internet.

- The learner gets the scope of learning desired course anywhere anytime thereby making learning more flexible, interesting and meaningful.

- Internet also helps in removing the age restrictions. The learner ranging from young lots to the adults can enhance their learning as per their needs.

- Online conferences can be organised online for the learners from distant places having common interest. The learning that requires prior preparations also can be provided through internet with the loads of instructional material available online.

- Research work also can be carried out by both the learners as well as teachers with the help of e-library, topical data bases on World Wide Web.

- Individualised as well as group methods can be applied online with the help od varied internet tools like e-mail, discussion forum, Chat rooms, WWW etc. which are discussed in detail in the next segment of this unit.

Thus the Internet is a revolution in the field of technology that has changed the entire pattern of education and has provided a storehouse of knowledge for the learners to explore for enriching learning experience.

5.2: INTERNET TOOLS, SEARCH ENGINE AND BROWSERS

Internet related technological terms and tools need to be understood well before applying them in education. In this sub-unit we shall focus on the term Web Browser and Search Engine. Other Internet related tools will be discussed in the proceeding sub-units in the context of the sub titles.

WEB-BROWSER

If we consider literal meaning of the two terms , Web implies 'Network ' and Browser means 'Look through'. In this context, Web Browser together implies 'looking through the network of something'. This meaning, if applied in the concept of internet, then it roughly implies looking through the network of the information

pages on available internet. Let us elaborate the concept in detail.

A browser is an application that provides a way to look at and interact with all the information on the World Wide Web. Technically, a web browser uses HTTP to make requests of web servers throughout the Internet on behalf of the browser user. In other words, a web browser is a software application that allows one to view pages on the World Wide Web.
http://www.selfseo.com/story-19167.php

It is a program installed on the personal computers(PC) locally (e.g. firefox , safari, Internet explorer etc.) that is used to access the Internet, to view 'what there is, as it were'. A search engine is a program that in varying ways aggregates reference data so that when you type in a phrase it can point you in the direction of a website that relates to the words you type in.

The browser is used to get to a search engine (Which is described later) such as typing www.google.com that takes the user to the google web page which allows to enter information desired. It allows the reader to read encoded document in the form suitable for display on the world Wide web. A web browser such as Microsoft Internet Explorer, Mozilla Firefox, Apple Safari, Netscape, and Opera is a software application that enables a user to display and interact with text, images, and other information typically located on a web page at a website on the World Wide Web or a local area network. Web browsers allow a user to quickly and easily access information provided on web pages at websites by traversing these links.

The history of the web browser can be traced back to 1991, when a computer guru named Tim Berners-Lee invented the very first web browser. It premiered on February 26, 1991, and ran on NeXSTEP. It was called WorldWideWeb, but was later renamed Nexus in an effort to avoid confusion with the World Wide Web.

There are different web browsers that are available and in use today and they all come with a variety of features. Some of the available web browsers include iCab, Internet Explorer, Internet Explorer for Mac, Lynx, Maxthon, Mosaic, Mozilla, Mozilla Firefox, Netscape, Safari, Opera etc. Most of these web browsers are fre.

Features:
Some common features are spell checkers, search engine toolbars, download managing, password managing, bookmark managing, as well as form managing. Accessibility features include page zooming, ad filtering, pop-up blocking, tabbed browsing, incremental finding, HTML access keys, voice controls, mouse gestures, spatial navigation, text to speech, and caret navigation.

A web browser is a powerful tool, used for personal

computers. Today such web browsers that can be used on mobile phones, handheld game systems, as well as pocket PC. Web browsers can also be personalized to an individuals needs by utilizing web browser accessories that are not included with the initial browser software. E.g. Adobe Acrobat Reader which allows access to PDF files on the World Wide Web.

Learning Activity:

Find out what Browser id uploaded on your PC and note the steps to connect to the Internet using it.
http://www.selfseo.com/story-19167.php

SEARCH ENGINE:

As we analysed the literal meaning of Web Browser, similarly the term Search Engine too can be checked for better understanding. Search implies 'Explore or investigate' and Engine means 'the device that leads the investigation'.

In the context of internet, **s**earch engine is a program designed to help find information stored on a computer system such as the World Wide Web, inside a corporate network or a personal computer. The search engine allows one to ask for content meeting specific criteria (typically those containing a given word or phrase) and retrieves a list of references that match those criteria. Search engines use regularly updated indexes to operate quickly and efficiently. Search engine usually refers to a Web search engine such as Google, Yahoo! Search, MSN Search, and Ask.com, which searches for information on the public Web. Other kinds of search engines are enterprise search engines, which search on intranets, personal search engines, which search individual personal computers, and mobile search engines.

For example, i we take the anology of a car, a web browser is like the windshield and the search engine is like the steering wheel. Thus the Search Engine is a place, on the Net, where one goes to find sites about specific information.

Similarly, When you have a Web site and you want people to be able to find it you must go to the search engines and submit your site to them so they will list it. After you submit your site to them it still may take as long as 3 months before they list it.

Search Engines have become the most important tools in locating information, so it is important to know how to use them effectively. Search skills can be developed through practice in using the search engines and by reading the help pages provided by the search engines themselves.

Some Major Search Engines: There are many search engines and internet directories. The main search engines are Yahoo,

Hotmail, Google etc. which are actually large directories. search engines and directories help to get the right webpage that contains the information users are looking for or to a website that contains links to other sites containing information on desired subject.

Guidelines for the right use When searching, there are some simple rules to keep in mind. Generally specific keywords used in the search the more specific and accurate results will be. For example, a search for 'History lesson plans' can bring the expected result than using just the term 'lesson plans' which might bring up links to websites containing references to plans of many other subjects also. Therefore, fine tuning the search as much as possible can bring the accurate and quicker.

An easy way to simplify a search on many of the search engines is to place quotes around the topic, for example "History lesson plans" "Student Contests." This way, the search will focus on the word combination and not bring up all the pages that contain the word History or lesson or plan or Student or Contests.

Some search engines also perform this same function when + sign in front the keywords such as +Student +Contests is placed.

Uses:

10. Search engines are the source for accessing the information from different web sites.

11. In addition to searching text, search engines will also let you search for graphics, sounds and other kinds of files.

- Search engines will also search through the latest news stories from recently released press releases to news stories in national newspapers which is very useful if you are looking for the absolute latest information on your search topic.

- Search engines can also be used to search newsgroup postings, online and offline events and perform services such as chat, instant messaging and product searches for online shopping.

- Search engines also provide search access to databases of third parties which allow you to search through corporate reports, telephone listings, yellow pages, zip codes and numerous other information databases.

All this variety of data can be used in education.

Check your progress.

1. Reena wants to get information on methods of teaching. How would she access the related information on Internet?
2. What is the difference between Search Engine and Browser?

http://www.writerswrite.com/journal/may98/gak5.htm

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5.3: APPLICATION OF INTERNET RESOURCES TO EDUCATION

The computer technology is fast being adapted widely in the educational institutions. E-learning is the concept used in education related to the computer technology. According to Brandon Hall[1] "e-Learning is the instruction that is delivered electronically, in part or wholly via a Web browser, through the Internet or an intranet, or through multimedia platforms such as CD-ROM or DVD."

There are two forms of e-learning, that is online e-learning and offline e-learning. These two forms are categorized on the basis of the Internet. In this context, online learning can be facilitated when the computer is connected to Internet. On the other hand when the learner studies with the help of computer Technology in the absence of Internet connection, then it is offline learning.

The present sub-unit, we focuses on the online learning, that is, learning through Internet. Having understood various resources of Internet, it is essential to be aware of the application of these resources in the field of education.

1. http://en.wikipedia.org/wiki/E-Learning

a. WWW

Worldwide Web as discussed earlier, is an e-library on computer having billions of web pages well placed by setting standard set of rules to be navigated by thousands of web users. It is the computer based network of information resources that a user can move through by using links from one document to another. Information on the WWW is spread over computers all over the world. It is that portion of the Internet having a collection of text, pictures, sounds, video clips, graphics and other information

arranged in pages and linked together via the Internet.

It offers a wide range of educational opportunities for self learning. A vast amount of educational data can be accessed through WWW. The students and teachers both can use WWW in different ways for the education purpose.

Accessing and storing Educational Information:

The learners can use the web pages to get the desired educational information in the form of text, images, graphics and videos. This information can be used for the following purposes:
- Reference Work by accessing, downloading e-books, notes essays and other similar documents.
- Educational Presentations
- Projects
- Assignments
- Research work

In this way, students can apply Internet to have access to a wide range of ever updated knowledge. Let us discuss in detail through illustrations:

Real time online learning

There are many educational sites which offer online courses or other educational activities to be carried out on the spot. The learner can attend virtual lectures and classrooms, view video clips or films as part of their academic activities.

According to Vyagotsky, a Russian Psychologist[3] WWW can become a social environment for learning. Students not only can learn information from others but also can share their ideas with other learners. For example, schools can create their own sites and carry out educational exchange programmes by allowing students through passwords to have access to these sites and share ideas. They can learn about other schools' learning styles and study programmes on the WWW. This has resulted in the creation of Global education and students are fast becoming the global learners having fellow students from different parts of nation and also from different countries.

There are many sites having educational games in different subjects. Students can learn the desired content by playing these games. Similarly interactive activities too can be used for the same purpose.

For social studies students, there are sites like Webmuseum which provide multimedia view and allow the students for virtual visits to different historically or geographically important places. E.g. Netlogo is one software that allows students to work on various thematic models by playing with the variables.

Mathematics and Science students can carry out virtual experimentations provided in different educational sites. e.g. WWW allows students to free download the Geogebra software which provides them the platform to practically learn different geographic concepts and constructions.

Learning methods like, Journey method, Source method, Cooperative learning also experts' lecturing Multimedia presentations are freely used on various educational sites that motivate students for self learning. Similarly thematic approach also can be used to learn concepts and their application in different subject areas. E.g. Evolution can be learnt in the light of its Historical, social, economic, scientific and Geographical dimensions.

Students can explore Government sites to enhance their understanding the actual working of Government. This direct connection also can result in making Government more transperant in its working.

The online tests too can be attempted by students after completing the learning activities. The educational Institutes can develop such tests on their sites and member students can attempt these test. There are many educational sites having tests on different subject matter developed by educationists. Students after self learning on the subject matter can test their knowledge by attempting these tests.

Teachers also can use WWW for the following purposes:
- As a support system to the teaching – learning process
- For professional growth
- For their personal research work.

As a support system to the teaching learning Process:
WWW provides thousands of sites that help teachers to develop good lesson plans, presentations, instructional modules etc. These sites also can prove to be very good source of references for better understanding of the subject teaching. Good teaching learning tips, model lessons, experts' views, essays on the effective teaching learning strategies are some of the highlights of WWW for the teachers.

There are some sites which offer teachers a platform to carry out the entire teaching learning process virtually. E.g. WWW.WIZIQ.com is one such site where teachers can register themselves for sharing each other teachers' documents, presentations. Teachers also can attend the online sessions of other teachers. They can arrange for their own virtual classroom sessions, video conferencing sessions for students. They also can

develop online tests with the help of the programmes provided.

Similarly, there is Open Learning Source Software that is WWW.moodle.com which is fast gaining popularity. It allows the user to free download, use the features as the educational platform, modify them as per own ideas and make this modified version open for free use by others. The features of the Moodle allow teachers to develop the entire Instructional package for students' self learning.

For professional growth

Every teacher has to be a constant learner in order to be abreast of ever increasing knowledge. The present generation technology savvy students are much more exposed to newer technologies and are knowledgeable than their previous generation counterparts. They are well aware of the current happenings and are very curious to know many things which are beyond the text books of their school syllabus. In this scenario, the teachers have to be well equip to handle such smart students. They have to be on their toes continuously to enrich their knowledge not only in their subject areas but also in educational technology on the whole. WWW can help them in this direction.

Teachers can become the members of the e-libraries available on WWW. Such libraries work on the similar lines of the print libraries. These sites can offer wide range of reference material in education. Similarly there are sites which provide updated information on every subject included in the school syllabus.

Registering oneself through WWW for the National and International e-magazines is another way to grow professionally which contributes in enriching teachers' knowledge. They give detailed information about the latest strategies, techniques and methods of teaching learning. Today, in the child centered education system, self learning is more focused than teaching. The teacher therefore has to play the role of a facilitator of learning than just a teacher. WWW provides ample opportunities to the teachers to understand their new role effectively. Knowledge of the strategies like, Thematic learning, Scenario based or Situation based learning, collaborative learning, Technology based learning etc. has become imperative to carry out the new role efficiently. Teachers can learn about these innovative learning methods with the help of WWW.

Similarly, there are e-forums of subject teachers where the teachers can share their experiences and expertise on such innovations.

Collaborative work is another option that can be availed by teachers through some profession specific sites. Ask question, comment on the current educational issues are some of the Blogging sites wherein the teachers can contribute by sharing their

views.

Research work:

The teacher who is research minded generally indulges in innovative and creative working. experimenting on newer technologies and methodologies, constantly in search of solutions for the educational problems, always ready to face challenges are some of the characteristics of these teachers. Secondly due to the technological advents and students' changing attitude towards education, teachers have to explore every possible ways to make education more need based, meaningful and functional. Even educational Institutions are taking up research projects and encouraging and making research mandatory for their teaching staff. In this direction, research work via WWW has become a very convenient and time saving activity. Online Library searches, mining of internet accessible resources, exchange of research abstracts by teaching community all over the world are some of the opportunities the research oriented teachers can get due to WWW.

Thus World Wide Web is that integral part of Internet which makes online education a convenient and powerful means of self learning.

b. Chat:

It is a text-based or voice communication via computer between two or more people, typically in real-time. People in online chat sessions type messages to each other using their keyboards or by speaking. The text message appears on the screens of all the participants. People can also talk to each other through voice chats and if there is a provision of web cameras attached to the interconnected computers, they can see each other while chatting. Chats can involve two or more people. It can be one to one or one to many or many to many. When it is one to many or many to many the chat rooms are created.

A chat room is a space where a group of writers meet to carry on conversation. Chat rooms demand a participants' constant attention through ongoing discussion (much like a conversation). Instructors use chat rooms mainly to engage students' thoughts on a topic, and to generate ideas. The teacher and learners can create their own chat room by either registering on the sites specially dedicated to it; like; http://chatroll.com. Or by opening their e-mail accounts and downloading the messenger software like google talk, yahoo messenger one can create the chat room.

Application of Chat in Education

The internet offers virtual real time interaction facility to the learners. When students need to discuss the content matter as part of their learning process chat is the best option for using Internet in education. This can be illustrated in the following ways:

Students can group chat to discuss the points for preparing for the activities like e-seminar, Multimedia presentations or in the process of Cooperative learning.

In case of Exchange education programmes, students from different places can chat with each other to prepare the online video or Audio conferencing sessions or act as primary sources to share their first hand learning experiences with other, e.g. Geographical features, Historical events etc.

The students can chat with the experts or teachers to satisfy their queries or doubts they may face in the process of learning. This can be possible through one to one chatting or through group chat. The students from remote areas can get an opportunity to have a real time dialogue with expert subject teachers.

Text chats are best suited for Collaborative learning method where participants express their views on the topic presented and initiated for discussion. This helps in developing divergent thinking ability as well as widens learners' perception on the topic under study.

This Internet source can be used to brain storm on the puzzling situation presented on the basis of the content.

c. E-mail:
(electronic mail) is the exchange of computer-stored messages by telecommunication. It allows for the transfer of information from one computer to another, provided that they are hooked up via Internet. e-mail addresses a unique name that identifies an e-mail recipient. E-mail addresses take the form username@hostname. Wherein the host name is the Webmail service provider. E.g. Hotmail, yahoo, gmail etc.

The teacher can use the Email facility in various ways.

Uses:
Email allows communicating writing the message and sending it any time. The teacher can send instructions, announcements, and assignments to students through Email.

Information Exchange

Information can be exchanged between learners through Email. Educational Institutes can create its e-mail for the students with a common password. This e-mail can be utilized to exchange notes, opinions and also replying to students' queries. Group contacts make it faster and convenient to carry out such tasks quicker and efficiently.

Brainstorming and Problem Solving

Although brainstorming and problem solving typically occur in face-to-face meetings, the teacher can use email to help with these activities. For instance, teacher can ask students to send their views on the problematic situation related to the subject matter and two or three possible solutions over email. This becomes more useful especially when it is difficult in terms of availability of time.

Record Keeping

By saving a copy of the messages sent, the teacher can keep track of exactly what was asked for and when. Many email users keep their email archives organized by project or topic to help themselves remember to follow up on certain tasks.

Group Work

Groups use email to send messages to one another and produce documents together. For example, suppose a study group has a question about the material in a class. Instead of four or five students calling the professor, one person can send an email message and distribute the answer to the study group. Similarly the message once written can be forwarded to many students at one time. Teachers, or students, can type a message once and send it to every person in the course.

Staying in Touch Professionally

E-mail "list-serve" functions are an increasingly common way to keep track of recent developments and current trends in a field. A member of a group--teachers with a particular interest, sets up a special email routing service on a host computer. As interested people decide to join the group, they send a message to the computer which automatically adds names to the email list. Whenever any member sends an email message to the list, all members get the message.

Voice Mail.

Def:

Voice mails are essentially digital recordings of outgoing and incoming voice messages that are managed either by an on-site or off-site system.

It is a system of electronic transmission of voice messages over the Internet. The messages are stored on a computer until the recipient accesses and listens to them.

For **the internet user**, using voice mail usually involves setting up a "mailbox" or account. This mailbox creates a space for the messages on the server. It opens a file where these digital messages can be stored. Users can retrieve messages at their place of convenience. This facility can also be used like the e-mail as mentioned above.

d. Discussion forum:

It is an area within a Web site where an internet user can contribute in the thread like discussion on any aspect of a particular topic with other online users around the world. Such discussion often results in the formation of in-depth information on the topic. It is a form of collaborative learning where every learner provides his/her inputs in the learning process. One of the online forums being widely used is BLOG.

Blogs: Blogs are very similar to that of on line Chat rooms with the difference of time factor. Unlike chat the blogs are asynchronous where the participants share thread text messages.. Blogs can be created through different E-mail service providers that provide space for the Bolger's use which is limited and restricted and is controlled by the service provider. In order to enjoy full freedom one can create own website which will allow the person all the freedom ,like, earning money on advertisements, marketing the website in various ways, use as much space as required.

Application of BLOG

- The teacher can use it for blended learning. She can continue an incomplete class discussion on discussion forum.

- Students can generate ideas on a topic or on a reading that the teacher will address in class.

- Students' community can be built by creating an informal discussion space where students can raise questions and exchange thoughts in continuation.

- Teacher can ask students to post their writing to a discussion forum for other students to read and reply to it in order to learn collaboratively.

- Brain storming sessions can be conducted in connection with

any topic having debatable issues.

- Educational Institutes can create their own Blog site which can provide a good platform to the staff members and students for fruitful discussion sessions.

- To generate ideas on the content matter under study. Students can be given the assignments that would need thorough discussion among fellow students by using text chat or voice chat. Internet provides such

- To have a peer a discussion centered on the main ideas from an assigned learning or reading.

- The hold conversation between the teacher and students on the subject matter.

Precautions:

- It should be purposeful activity.

- The number of students participation in the chat room should be just enough for each student to be actively involved in the fruitful conversations.

- Chats are informal, if the instructor isn't involved. Also, one may run into students who offer unprofessional or offensive comments. To help prevent this, teacher should establish class rules for participating in chat before.

- Every member should be well known to other members of the group so that each one feels worthy of being in the chat room.

5.4   SYNCHRONOUS AND ASYNCHRONOUS MODES OF INTERNET COMMUNICATION

Meaning
Different modes- advantages and limitations in education, role of teacher

Introduction:
We have in earlier sub-units discussed about the different resources of Internet like chat, e-mail, WWW, Discussion forum etc. We have also discussed about the application of these resources in education. In the present sub-unit, we will focus more on the use of Internet as a medium of communication in education. Hence it is essential to brief the readers about the communication Process in education.

Communication is the process of transmission of information of an originator to a receiver by means of the use of a message that

it goes from one to another across a channel.

The function of communication is to ensure that every member involved in communication knows what is expected. Good communication is critical in ensuring coordination and control of individuals and groups. Good communication ensures a person to know what is expected of him, that the appropriate person receives the correct information and that there is coordination within the group.

Process of Communication:

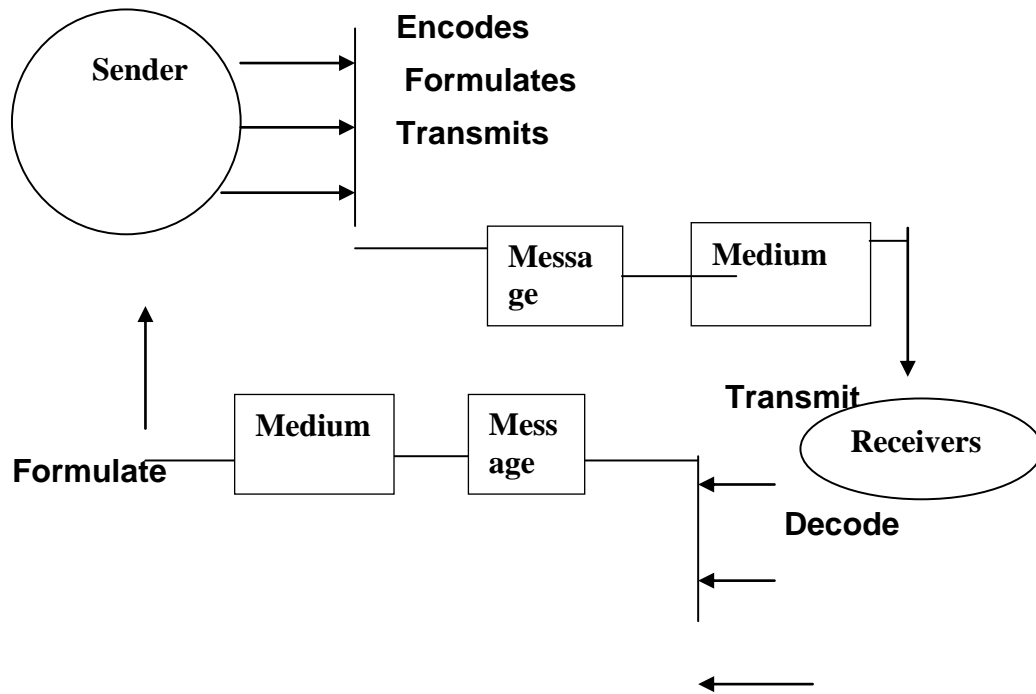There are five elements involved in the process of communication as follows:

The source (encoder or sender) prepares and sends a message to the receiver that can be accurately decoded. **The message is** the actual product of the source or encoder. **The channel** is the medium that conveys the message**. The receiver (decoder),** upon receiving the message, translates it into meaning. **Feedback** is verbal and nonverbal evidence that the message has been received.

In education it can be explained as follows:

The teacher (the source) Prepares the educational information by encoding it and converting it into the message (treated content matter) and sends it via a medium (Verbal words or non verbal means like pictures etc) to the receivers.(Students). Students after receiving the message decode it or translate it into meaning which is sent back to the teacher as a feedback.(answering the question or nodding etc)

http://www.stfrancis.edu/ba/ghkickul/stuwebs/btopics/works/comproc.htm

Symbolic representation of Process of communication is as follows:

Sender — Encodes / Formulates / Transmits → Message → Medium → Transmit → Receivers → Decode → Message → Medium → Formulate

Internet if considered as a channel of educational communication, other four elements of the communication process have to be moulded to suit the channel. Sender has to be the facilitator of learning than the teacher. Message can be in the form of digital language or the multimedia audio, video clips, software etc. The receivers are learners not restricted to only one place bound by four walls but from all over the world. The feedback again would be digital language, software etc.

Let us discuss each mode in detail.

Synchronous e-Learning Synchronous is defined as "occurring at the same time".

Synchronous e-Learning infers that the instructor and the learner interact with each other and the course content simultaneously even if both are at geographically dispersed locations. Such virtual presence is the major feature of synchronous online mode of Communication. Virtual presence stands for the presence through images or through hearing or through texting but not physical presence in the face-to-face situation.

In this digital mode, learners and instructor make comments and ask/answer questions, Comment or discuss that can be viewed by all participants virtually present at geographically different places. Just as in the face-to-face situation, the use of different instructional materials, techniques like Broadcast of learning with slide shows, audio, and video capabilities is possible online.

Learning activity:

In the sub-unit 5.3 we have already discussed online learning sources. Which of them can be termed as Synchronous mode of online learning?

In this section, apart from the sources you would have found out, there is a Group learning method in this form of e-learning that can be applied for effective communication. It is termed as Teleconferencing which we will discuss here.

TELECONFERENCING

As a result of population explosion as well as knowledge explosion the newer ways are being explored to make education available to the growing number of learners across the country. In this direction the two-way interactive electronic medium has received attention, which is a viable option for distance learning, especially to the learners in the areas where educational resources are scarce. This has contributed to a great deal to bring the world closer. Students from one place can learn through the interaction with the fellow students from another place. This electronic medium is Teleconferencing.

Definitions:

"Teleconferencing is electronic communication between two or more people at a distance."

"Teleconferencing is a means by which individuals or group located at different places can exchange data, speech, visual materials like graphs or diagrams or moving pictures of themselves and any other relevant information."

Teleconferencing is a two-way communication between three or more people in separate places."

"Telecommunication refers to any kind of multi-way communication carried out in real-time using telecommunications or computer networks and equipments."

Characteristics:

- A system for exchanging information.
- Real-time communication
- Two-way communication.
- Holistic system of communication since it integrates the electronic media and communication to work in real time.

Objectives:

- To provide access to educational resources for people separated by long distances.
- To provide access to subject matter experts not available at one place.
- To provide interactions and opportunities for joint activities with students in other schools and locations.
- To provide opportunities for staff development.
- To promote school linkages.
- To provide opportunity of E-Learning to the students.

Teleconferencing may connect multiple locations and can be divided into three major types:

Audio conferencing,

Computer/Data conferencing

Video conferencing.

These types can be combined for an almost endless set of applications.

E.g. Audio-video conferencing, Data audio conferencing etc.

WHAT IS AUDIO TELECONFERENCING?

Audio conferencing is actually telephone conferencing because telephone technology makes up the network that interconnects the conferees.

"It is a live two-way conversation among groups at different locations connected by telephone lines or satellite which requires a special microphone, amplifier device (voice activated) at each location."

It is a glorified telephone, which offers much higher quality audio than the conventional telephones and enables more than two sites to be linked together and enables communication between the groups of participants rather than just individuals.

The audio conferencing systems consist of a tabletop console containing the audio processing functions and alphanumeric keypad for dialing. Sensitive microphones can be attached to this. These systems work over conventional Public Switching Telephone Networks or through satellite.

In audio conferencing the interaction takes place through the telephone system where the group of listeners uses amplifiers.

The device picks up the voices and amplifies (receives) them at the listening end. The presence of a '**Bridge**' joins together the calls from all participating locations, equalizes the sound levels, and filters out extraneous noises.

The bridge is an Electronic system, which may be supplied by the telephone company or rented for the occasion from the commercial company.

Utility in education:

Audio teleconferencing uses long-distance telephone lines and a centrally located bridge to link as many as 96 class sites at a time. A bridge operator monitors each class and the equipment. Each site is equipped with speakerphones and microphones so students and the instructor can talk to and hear each other. Students typically view videotaped lectures at their own locations and then gather to discuss the materials via the telephone conference.

Audio teleconferencing has the potential to be highly interactive educational medium in which it is possible students to communicate with their peers in other locations as well as with their instructors. It is a real time linkage between the professor and the students scattered at different locations.

The educators must prepare well ahead of time to pull off an

audio teleconference. The learners should review the subject matter at least a week before to be well equipped for the conference. This is necessary in order to avoid any kind of confusion, delay or communication gap or drifting away from the main theme.

The following audio teleconferencing options are available:

Dedicated Conference Networks

A dedicated conference network permanently wires preselected locations together. To conference, callers need only to pick up the phone at each location. These systems can be very large.. Dedicated networks generally have better sound quality than dial-up networks and are cost-effective when usage is high.

Dial-Up Networks

Dial-up networks use the public switched telephone network. In the Telco operator-assisted mode, the operator calls and connects all participants. This system works well for a few locations, but difficulties occur when numbers increase.

Meet-Me Conferencing

To overcome these difficulties, several private telephone conferencing companies have formed to offer a new type of service, "Meet Me" Conferencing, in which each participant calls the conferencing center from any convenient location. If everyone is prompt, a large number of locations can be interconnected for conferences in five minutes or less. The sound quality is superior to that of Telco conferencing and is generally unaffected by numbers of participants. Telephones anywhere can be connected, in contrast to limited locations in dedicated networks. Meet-me systems are now available for in-house installation where usage makes them cost-effective.

Direct Dial Conferencing Systems

Direct Dial Conferencing System is an innovation that makes it possible for one caller to set up a telephone conference with up to six additional participants by using a touch-tone phone.

Advantages:

the medium's advantages include the following:

- Use of familiar technology--the telephone. Most of the people know how to use telephone.
- Accessibility (400,000,000 telephones worldwide). Telephone technology is widely accessible to most parts of the world.
- Teleconferencing is compatible with existing telephone system. It does not require any special connections between the source and the destination.
- Ability to set up conferences on short notice. Hence the Ad-hoc conferencing is possible as per the requirements with not much delay.
- Comparative low cost., because it uses existing telephone network and hence does not involve very expensive initial set-up.
- More sophisticated speakers are available for larger groups. Students get the opportunity to interact with the experts whom they may not be able to meet in person.
- The learners and the teachers separated by distance can communicate in real time and hence can avail the latest and timely learning experience.

Disadvantages:

- The learners need to prepare for the study material well ahead of the actual conferencing time. This may lead to the creation of confusion and misleading perceptions about the subject matter.
- Learners not in physical contact may feel a little reluctant to ask questions or may loose interest.

WHAT IS DATA/COMPUTER/ TEXT CONFERENCING?

"Data conferencing is a system whereby the participants at two or more sites share the workplace on their computer desktop."

It facilitates and mediates communication between individuals or groups of people at a distance. This is done through software in the computer, which can be run and controlled by both users at two different places. Hence the data conferencing uses the computer technologies to allow individuals to share computer files or programmes and to work and learn together. This sharing is mainly of the text or the data and hence it is called as data conferencing.E.G. Msn/E-Mail, reports, newsletters etc.

The data sharing can be done through:

Application sharing

Whiteboard

Application sharing:

Students can receive text via mail through common files assigned to a class that each student can access. This is accomplished through computer networks, that are, Sets of computers connected to each other through:

Telephone wires

Fiber optic cables

Microwave antennas

Satellite.

These connections allow the transmission of data, messages, database, and graphics to pass back and forth across a room or around the world. This type of data conferencing allows software running on one computer to be viewed and controlled from other computers connected to it in a data conferencing call. These computers do not need to be running the software at their site. (E.g. PowerPoint, word etc. This type of sharing is useful for collaborative work on documents.

Whiteboard sharing:

An electronic version of a dry-erase board that enables

learners in a virtual classroom to view what an instructor, presenter, or fellow learner writes or draws. Also called a smart board or electronic whiteboard

This technology requires a computer, a projector and the whiteboard itself. The computer is connected to the projector and whiteboard, and the projector displays the computer screen image on the board.

VIDEO TELECONFERENCING

It is the highest form of teleconferencing in which a two-way exchange of moving pictures is possible in addition to audio and data.

"It is a real-time communication over a distance by allowing people at two or more sites to communicate with each other, not just by hearing each other's voice but also by seeing a video picture of the people at other sites."

Characteristics:

- A real-time communication over a distance that provides an opportunity for live discussion and immediate feedback.
- An effect of virtual presence where a person at a distance site appears to be in the same room.

Technological aspects in videoconferencing:

Bandwidth:

It refers to an amount of information in bits that can be transmitted along a carrier every second. Video conferencing along with Audio conferencing requires wider bandwidth because information transmitted in the form of sound it has to be carried at the same speed as the normal speech for the conference to possible in real-time. And the moving images too require high bandwidth as pictures contain lot of bits.

Video Compression: In digital communication information is transmitted using bits. Otherwise it is transmitted through analog

signals (currant and voltage) for which video compression is required. This is achieved by removing as much 'useless' (extra) information as possible. Even digital information needs to be compressed if the existing bandwidth is comparatively less. E.g. Moving picture is made from the sequence of the still picture frames. The difference between the two frames is very small. Here instead of sending the next frame as a whole only the change is transmitted so as to fit the information in the available bandwidth.

Channels for delivering video conferencing:

By standard telephone lines:

Through existing telephone network the required information is transferred in video conferencing**.** This is the simplest and the most accessible of all channels. However it has very less transmission rate due to the more no of subscribers. In other words it has very low bandwidth and hence the picture and the sound quality will be poor. **E.g**. MTNL.VSNL, MODEM.

BY ISDN(Integrated services digital Network)

ISDN, Integrated Services Digital Network is a network of swift and highly reliable connections that brings voice, fax, data and video on one digital line Unlike the analogue telephone line, the digital ISDN line is safe from noise interferences and provides a fast and high quality transmission.

With SERVIHOO - ISDN, you can have access the Internet at high speeds It is basically used for the group conferencing because of the availability of the high bandwidth. The information can be transmitted through fiber optics or telephone where the lease line facility can be availed from the telephone co. that allows the required bandwidth for the video conferencing. It facilitates the two-way transmission of voice, data, and graphics simultaneously over the telephone network. It is relatively inexpensive.

By Satellite:

In the satellite there is the "channel mechanism allocation" through which satellite identifies the receiver of the data through information that it receives from the sender that includes the address of the receiver.

Sender

| 0 1 0 1 0 1 0 1 | → | MTNL | → | VSN L | → | Satellite |

| 0 1 0 1 0 1 0 1 | ← | DTNL | ← |

Receiver

| VSNL |
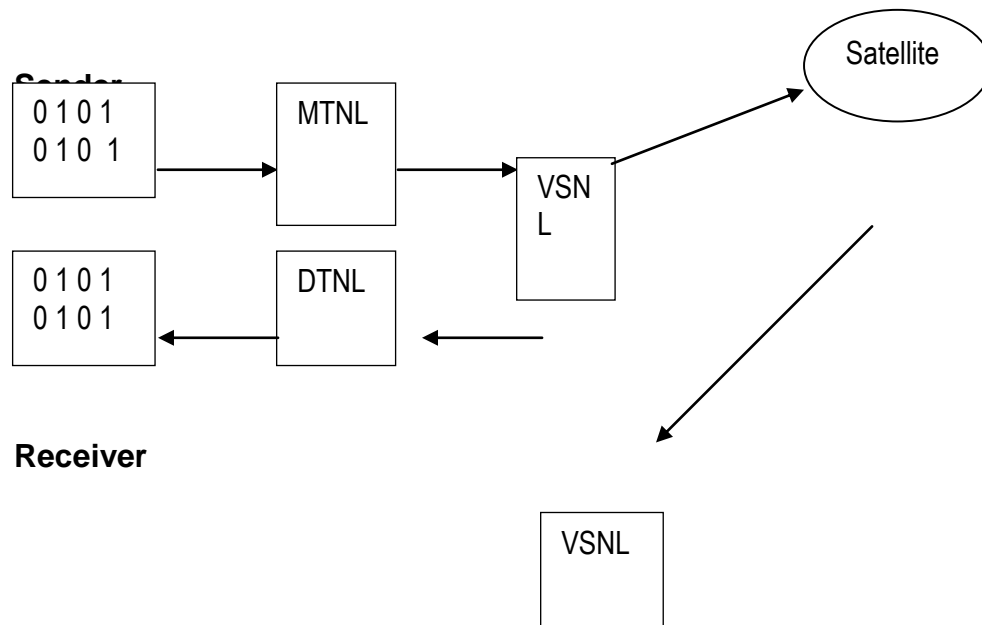
Kinds of Video conferencing:

Desktop System:

One or two people at each site design desktop video conferencing systems to diliver data along with video and audio for use. They are installed on a standard PC, and consist of a card that goes inside the PC, a camera, a sound unit and software.

Group systems:

These are more appropriate if working on a larger group and are more efficient than the desktop systems as they offer higher audio and video quality and a wider field of view. This system requires CODEC unit, Camera, Very large monitor, Microphone, U.V. Control unit that controls the movement of the setting of the camera. Other A.V. equipments too can be used as the support system, like, whiteboard, 3D imaging devices.

Procedure:

PREPARATION

More preparation is required for video conferencing than the preparation for face-to-face teaching. This presentation needs to contain more variety than the traditional one because the attention of the remote audience has to be retained. Hence, the following aspects have to be planed well before hand.

1.) **Room set-up:** Avoid outside noise disturbance. The room has to be large enough for all to be accommodated comfortably. It should be well air-conditioned. The seating arrangement should be in V-shape allowing remote groups to be involved and hence the monitor can be thought of as another person in the group. The camera should be placed above or below the monitor to achieve eye contact. Lighting should follow the same guidelines, as does photography.

2.) **Checking of the equipments**: All the required equipments should be well checked and tried out before starting the session so as to avoid any king of disturbance.

3.) **Pre-prepared documents:** For video-conferencing to be clearly structured and coordinated, it is required for the organizers involved in video conferencing at different sites to have a standard pre-prepared document to act as a check-list. It should contain the following information:
   a.) Start and finish time of session.
   b.) Approximate number of participants at each site.
   c.) Brief introduction of the topic of the session.
   d.) Number of locations to be linked in.
   e.) Names of the facilitators.

This document can be circulated either in paper-form or through web sites.

Even the student participants with their Environment-Mail accounts can exchange messages in a week before the conference, getting to know each other and gathering information for reports or projects. They can also list questions they may ask during the teleconference and anticipate questions they may be

asked by other students

4.) **Prior practice**: In order to familiarize with all the controls and to avoid any kind of bad mannerism proper practice is essential before starting the actual session.

STARTING THE SESSION:

Clear instructions should be given about the proceedings. As the session is interactive in nature the teacher and the students from different sites take part in the form of group discussion, group activity and question answer session. Hence such variety of methodology and technique should be introduced throughout the session so as to retain the attention of the participants of remote sites.

While asking questions address the participants by using their names. This helps in building a good rapport between the teacher and the students and also they become more attentive.

Since every participant can see each other non verbal communication too should be used in the form of acknowledgement by nodding, pointing or other natural hand movements etc. This helps in giving the feeling of Virtual presence or the face to face learning.

Use of supplementary aids like Whiteboards can be helpful in making learning more meaningful.

The organizers from each site so as to make sure that the session runs smoothly should control the participants from different times. E.g. taking turns to speak, giving enough time to think and answer, participation of each student etc.

An Example:

If two sites want to video conference, Each one attach a video to their computers, make connections between them over an

internet and begin watching and listening to each other, sharing their information, interacting, doing some group activity. When connected the video signals from the camera and its audio are compressed by the computer and then immediately frame-by-frame, sent over the internet directly to the receiver's computer screen. With the solid bandwidth connection the video is clear and transmission is quicker.

RECORDING:

Recording of the proceedings of the entire session has to be done so that the compilation of it can be made in the form of the textual notes for the benefit of the students or can be made available to the non- participant students through the web sites.

Advantages:

5. Accessibility: Video conferencing ensures large audiences. More people can access the latest learning materials; particularly the students from remote or rural areas can avail the guidance of the expert teachers from the established institutions.

6. Unity: It provides the shared sense of identity where the participant feels more a part of the group who can avail the advantages of the group activities.

7. **Timely Information**: For 'time critical information' video conferencing helps in reaching it to different sites in real time.

8. **Active participation:** Video conferencing requires an active participation of each student. Hence it enhances personal communication, concentration resulting in meaningful learning.

9. **Cost-Effective:** Video conferencing is the sustainable transportation that saves the traveling and lodging expenses and yet get the chance to interact with the experts, fellow participants in the from other cities or countries form of Virtual presence.

10. **Saves time:** Video conferencing makes the best use of the limited time in which the participants get the wider dimension of practical knowledge sitting at their home place.

Barriers:

- Intercommunication Delay: Can cause collaborative work

ineffective.

- **Interpersonal Interaction:** If not coordinated properly the student's contact cannot be established as in the face-to-face interaction.

- **Managerial problem:** More the sites the greater the problems of managing the communication and educational process.

- **Lack of preparedness:** can lead to the ineffective way of handling the electronic gadgets, confusion and bad mannerism in the presentation.

However the proper precautions and the proper planning can help in minimizing these barriers and make the learning more meaningful.

What can students study through video conferencing?

Few examples:

- Study water and air quality and compare with the quality from the respective geographical areas of each site. Why are some places more polluted than others? What are possible remedies?

- Collect and tabulate data about local geographical features and share the outcome.

- Collect leaves of indigenous trees and compare the characteristics. Show the specimens.

- Compare the social, economic a-, political conditions of different countries at a

Particular age and find the joint solution for the present related crisis.

Thus teleconferencing is an effective way of to use one teacher who teaches to a no of sites enabling more students to interact with each other though in different places. Such Environment-Learning has become the essential technique in present more complex world.

Advantages of Tele-Conferencing:

11. **Accessibility:** It ensures large audiences. More people can access the latest learning materials; particularly the students from remote or rural areas can avail the guidance of the expert teachers from the established institutions.

12. **Unity:** It provides the shared sense of identity where the participant feels more a part of the group who can avail the advantages of the group activities.

13. **Timely Information:** For 'time critical information' Tele conferencing helps in reaching it to different sites in real time.

14. **Active participation:** Tele-conferencing requires an active participation of each student. Hence it enhances personal communication, concentration resulting in meaningful learning.

15. **Cost-Effective:** Tele-conferencing is the sustainable transportation that saves the traveling and lodging expenses and yet get the chance to interact with the experts, fellow participants in the from other cities or countries form of Virtual presence.

16. **Saves time:** Tele-conferencing makes the best use of the limited time in which the participants get the wider dimension of practical knowledge sitting at their home place.

http://www.at.northwestern.edu/ctg/videoconf/Definition.html

Asynchronous Learning

Asynchronous means not occurring at the same time. Asynchronous e-learning is the learning in distance in time where trainers and trainees never meet. For example, courses are distributed via the internet and communication via e-mail only, taking a self-paced course, exchanging e-mail messages with a mentor and posting messages about a topic to a discussion group. We have already discussed about these Asynchronous modes in detail in our earlier units. Here we will focuss on the concept of Asynchronous learning as a mode of communication.

It is a type of two ways communication that occurs with a time delay. It allows both originator and recipient of communication to respond at his own convenience. Electronic bulletin boards like newsgroups; forums etc are good example of asynchronous communication.

Asynchronous learning utilizes asynchronous communication to deliver learning materials. It is a type of formal learning in which students and teacher have regular interaction but the interactions are not real time (i.e. at the same time). Interaction occurs with a time delay. This delay can be of hours, days or sometimes weeks. With the advent of the internet, the turn-around time for teachers' response has reduced to minutes, hours or few days rather than weeks.

Asynchronous learning is generally associated with distance education and online programs. Traditional Courses may selectively employ asynchronous learning. Asynchronous learning is self-paced as students can complete the course at their own speed and time availability.

Earlier distance education courses delivered through post were the only form of Asynchronous learning. With the advent of the internet, asynchronous learning has developed into a new form. Now it combines online coursework or coursework delivered via CD-ROM with classroom instructions which gives students a hybrid learning (blended learning) form. From elementary schools to post-secondary colleges and universities are incorporating asynchronous learning.

Through Asynchronous learning, classroom learning can be supplemented with additional information like online lecture notes, multi-media presentation of course material, links to the websites related to the course material, anytime query to teachers or feedback from teachers, ease to access information at once convenience, online group discussions with other students or faculty members etc. Biggest advantage of Asynchronous learning is that, students don't need to gather at some place, at some particular time to acquire education. They Can choose there own instructional time frame and place and acquire learning materials according to their schedule and learning ability.

University of Phoneix's FlexNet program is a good example of asynchronous learning. Under this program students can attend classes on campus, submit there assignments and get feedback from teachers electronically. Such types of hybrid programs are very beneficial as they provide both face to face interaction with the teachers and the flexibility of online learning like self-paced learning.

Learning activity:

Rajesh is a teacher in a school that practices e-learning approach for all the curricular activities. As a History teacher he has decided to use **group learning method** for an assignment to be done by e-learners. How would he combine synchronous as well as Asynchronous online resources for the students to work in groups?

Read the unit 5.3 and categorize the Internet sources discussed in it into synchronous and Asynchronous forms of online learning.

5.5 EDUCATIONAL PORTAL

he term Portal literary means Gateway or entrance. Educational portals by this meaning implies a channel to access education related different resources. This term is popularised mainly in Internet based education.
Educational Portal is defined by a few key characteristics.

It servse as search engines or that categorise information into various meaningful groups as per the educational needs.

It assists a user searching for a particular item sift through the endless sources of information. E.g. like Yahoo, Google initially started initially as Search engines. But as time progressed they have included e-mail, chat functions, instant messaging, and even personalized service.

Worldwide Web site too can be termed as a can be a major starting site or the gateway or the portal for users when they get connected to the Web to visit site of their choice.. There are **general portals** and **specialized or niche portals**. Some major general portals include Yahoo, Excite, Netscape, Lycos, CNET, Microsoft Network, and America Onlineís AOL.com. Examples of niche portals include Garden.com (for gardeners), Fool.com (for investors), and SearchNetworking.com (for network administrators). Education.com (for Educationists and learners) A number of large access providers offer portals to the Web for their own users. Most portals have adopted the Yahoo style of content categories with a text-intensive, faster loading page that visitors will find easy to use and to return to. Typical services offered by portal sites include a directory of Web sites, a facility to search for other sites, e-mail, and sometimes a community forum.

This term as is obvious from this description, originated in commercial circles. An Educational Portal too has been developed to address the needs of the educational community and to foster the adoption of Information Society Technologies which is the need

of the time. It provides various online community facilities and access to educational resources for supporting collaboration, assistive or self learning and teaching practices or in short e-learning.

Most of the users view WWW as the only portal. But it is not limited to WWW as viewed by most of the internet users as it can be expanded to included e-mail services, chat rooms, and other Internet applications which are not dependent on the Web. The Objectives of Educational portals can be as follows:

Objectives:

- To bridge the gap among students, educators, parents and administration, in order to increase interactivity and communication and to facilitate collaborative work and research

- To enhance students' awareness and exploration of educational resources available in the Web, and thereby create opportunities for the students to increase their learning potential

- To increase the use of the Web by students and teachers and thereby foster further adoption of Information Society ideals within the educational community.

  These objectives of educational portal can be achieved effectively with the help of its target groups.

- **Students and Teachers** – Educational portals can be of great help in Learning and teaching through the available educational to enhance cooperative, collaborative as well as individualised learning. Communication portal facilities can be used effectively for this purpose.

- **Parents** - The Educational Portal provides parents scope to access information related to educational activities, school contact information, courses curricula and schedules, etc. They also can communicate with other stakeholders within the local educational community.

- **Administrations of Schools and Educational Services** - The portal provides facilities for the management and structured presentation of information regarding all schools and educational services.

Uses of Educational Portals:

- **Digital Library**

  Through the Digital Library of the educational portal, users may gain access to various educational resources The provided educational resources can include, but articles and publications, tests and exams, teaching instructions and guidelines, and in general useful and practical educational material. Every

educational portal as per its set objective create, access provides information to its target users.

- **Special Interest Forums**
  A number of online Educational communities of special interest can be established through the portal's forum facilities as a means for collaboration and communication among the portal users. Users can propose discussion topics and participate in evolving discussions via synchronous or Asynchronous modes of e-learning. BLOGS, Group Chat rooms, Tele conferencing etc can be used for group activities. In this way, the portal provides the opportunity to specific groups of users to participate in private exchanges of ideas, opinions and experiences related to intended course content.

- **Announcements board**
  This facility allows wide dissemination of latest news and information on educational topics, as well as access to the archives of all past announcements.The learners also can be informed about the coming educational activities. Time table for the course of action, Lecture announcements, assignments etc can be conveyed to learners through such announcement Boards.

- **Advanced search facilities**
  Users can use various search facilities which can be keyword-based or parameter-based to retrieve information regarding all the available portal content like digital library resources, posted messages, announcements, etc. The learner can be directed to use these facilities in the form of assignments or some individual or group activities.

- **Administration tools**
  The portal provides an integrated content management system for organizing and facilitating the collaborative creation and update of ever changing content. Maintenance of each learner's study record, Generation of study material and managing testing and reporting procedure as per individual difference are some of the features provided by educational portals.

- **Learning Activity:**
  Find out the Some General Portals and Niche Portals and collect information about the typical characteristics of these two types of educational portals by identifying the common features.

  - Connect to moodle.com, wiziq.com educational portals and find out what facilities they provide to Teachers as well as Learners.

5.6   ONLINE LEARNING AND ONLINE EVALUATION

We have already discussed about the online learning in the earlier chapter Once the learning is completed, the test is given which the computer as per the student's capacity generates.

Let us discuss on various aspects of online evaluation system.

An Online Examination is one wherein a student answers his/her exam on the computer and submits his answers. The submitted answers are evaluated by the examination software and the results are available immediately. This saves the evaluation time. Besides this a large amount of details like examination trends can be made available immediately if required. Let us understand how it works.

The Online examination Software has several modules in it. E.g. students' details module, student authorization module, subjects and questions management, question paper management, evaluation system and generation of results as well as student answer books.

All these modules are sub –programmes of the entire online evaluation system. An illustration can make it clear.

- **Programme to prepare a question bank:** In this programme, as many questions as possible are formulated on the subject matter and then they are selected and organized into categories as per the difficulty levels, topics, objectives etc. This programme takes care of the following aspect:
- questions are categorized according to topic, types, etc.
- It makes provision for difficulty levels of items.
- A "serial number" is provided for each question according to topic, etc. which can help to search or select questions.
- A printed paper and a memorandum can be compiled.
- Different papers (shuffle code) and memoranda can be compiled.\
- Export question papers and memoranda to .txt or .doc file

- **Programme to scrutinize the test items:** The selected question are analyzed and then modified or changed as per the requirement. The teacher can do this after discussing with her colleagues.

  The test can be compiled with questions from different topics/libraries and can be created on a random basis per student.

- **Programme to actually generate the test paper:** Once the test items are analyzed and validated then the computer can prepare the final question paper which would include all the instructions and provision for typing the personal data like, name, roll no. class etc.

  This programme helps in automatic marks allocation for each question to determine the total mark for the test.

- **Reporting the results:**
  The feedback of the responses is immediate. Mistakes are shown to the student and remedial instructions are provided thereafter. This scoring can be shown graphically like print based test scoring.

  The Online Examinations are well suited for multiple choice type questions. Here a question is given and the student has to select the correct answer out of the given choices. After the student finishes answering the question paper, submits it by clicking on the submit button. The software then processes the answers and awards the marks depending on the marking scheme of the software. As soon as the student submits the answers, the administrator of the system can get the results instantly and depending on the features several other data as well. This may include the overall trends of the examination, the time taken by the student to answer, the number of students passing in each section of a particular subjects and so on.

  There are different versions of online evaluation made available as per the requirement of the course content.

Summative Evaluation.

When the child completes the learning of the subject matter, the performance is tested online by making the student answer the question paper as discussed above. The time factor can be made flexible as per the purpose of the learning. The student can answer the test as per convenience or once he/she is well prepared. Online summative examination has the scope for following features

- A time limit can be set for the test.

- The sequence of questions can be randomized.

- Online Examination System allows jumping to specific questions based on the previous answer.

- The distractors/options per question can be randomized.

- The online examination system limits the number of times a student can write a test.

- Students can navigate within a test (i.e. backwards and forwards). Can be set. Navigation tools/buttons can be selected for a test, and these buttons can be switched.

- on/off per question/test, e.g. backward/forward buttons.

- Students can be forced to go through all the questions at least once, before exiting the test.

- Students can be allowed to exit the test before completing all the questions.

- After exiting a test, students can continue the test from the last question they answered.

- A specific date for a test to be active can be set.

The feedback for such tests can have following online Feedback system:

10. Feedback on test results can be immediate or can be customized as per the purpose of the test.

11. The feedback can be se. after all the questions/after each question/ after a section or library/not at all.

12. The examination system indicates what the student answered as well as the correct answer.

13. Extra time can be set for students to work through the feedback after test completion.

14. Score per question can be displayed in the feedback.

Question can be of different types for the Online Summative Examination System

- **The following question types are essential:**

Multiple Choice
This question type allows the user to select ONE correct answer
Multiple Response
This question type allows the user to select more than ONE correct
answer
Fill-in the blanks
This question type gives the user the opportunity to type in short
text answers
Hot-Spot
This question type gives the user the opportunity to identify an area
on the screen (graphic/text)
Matching
This question type gives the user the opportunity to match data in
columns
Free format
**This question type gives the user the opportunity to type an
open ended answer**

The test can be designed with following extra features:

-Graphic(s) can be included as part of a question.
- Sound can be included as part of a question.
- Video can be included as part of a question.
- Animations can be included as part of a question.
- Scoring per option should be possible.
- Negative marking should be possible in all the question types.
- Preview of a question is available while setting up questions.

Following Security measures ensures the secrecy of the tests:

- Only registered students are able to access a test.
- The test can be made available on specific dates.
- The test can be made available at specific times.
- The number of times students access tests can be set.
- The login time per student is available.
- Logoff time per student is available.
- The online examination system can limit logins to a specific subnet.
- Text files with students details (i.e. names and student numbers) can be used to give students access to tests.

Reporting of the results of these tests:

- The following results on student performance can be obtained:
    - Student number, name and mark in Excel, Word and txt format.
    - Results per topic per student
    - Average of group
    - Average time used by the students
    - Date and time of test taken
    - Time taken for each individual student to complete the test.
- Full report per question is available, and includes:
    - The difficulty value of a question
    - Discrimination index
    - Standard deviation
    - Graphical presentation of results
    - Number of times a distractor has been selected
- Answers can be saved in real time (if a power failure occurs the answers must be saved up to that point).
- Papers can be remarked after editing a test, e.g if a question is deleted.

- Results must be presented according to the original question/id numbers.
- Report of each individual's answers

Formative Evaluation:

In the online evaluation system, the learner can be tested in short intervals before the completion of the entire portion in the form of actual testing by giving the question paper, or he/she can be given assignments like projects, writing a research based answer by interacting in groups via online discussion forums, chat etc.

Scenario based evaluation:

Such kind of evaluation is best suited to test students' applicability of the learnt content. The student, with the help of the learning material provided online would try to solve the problematic situation presented. The situation can be hypothetical or real fact which the student needs to understand in the light of the course content and resolve the issue involved in it.

How to Prevent Cheating During an Online Evaluation

Online testing presents new challenges for teachers; notably, how to prevent students from cheating. While cheating is problematic in a conventional classroom, the anonymity of the online environment and the lack of supervision makes it easier for students to attempt to cheat during online exams. Since most online evaluations are meant to be taken at home, students can have many alternatives for cheating.

Using Textbooks

The most common way for students to cheat is by looking up the answer in a textbook. The single most effective strategy for eliminating it is to assign time-limits on tests. A timed evaluation requires students to answer the questions in a certain amount of time. If the time-period is aggressive enough, students won't have time to look up all the answers. On average, you should allow 30 seconds per multiple-choice question and 15 seconds per true or false question. Essay-type questions should be timed based on the complexity of the topic and the expected length of the answer.

Asking students to apply their knowledge to a unique situation not covered in their textbook is also effective. Application questions can't be looked up. Students truly have to understand the material in order to properly answer the question. While they may take the time to read the textbook, they will still need to truly understand what they've read in order to successfully answer the question.

Working with Classmates

If students know each other, they may get together (offline or online) and try to take the test together. To eliminate this problem, randomize both the questions and answers on your quiz. Additionally, only select a subset of questions from a larger bank. Presenting different screens to the students makes it very difficult for them to cheat. This strategy coupled with a timed quiz makes it virtually impossible.

Test given by someone else:

Students may sometimes take the help of more knowledgeable person to answer the test online for them or ask the intelligent classmate to take the test on his/her behalf.

To prevent this, use of the randomized question/answer strategy can be helpful. If the former classmate hasn't taken the test in a few months and the questions/answers are different than those he/she last took, chances are this cheating strategy will not be successful. Identity code is another solution for preventing such mal practices.

There might be many more ways through which students can cheat during online tests. However, along with the best made programmes, developing values like sincerity, honesty , creating the atmosphere of trust and accountability to one's behaviour too are the essential factors for any type of learning to take place.

Learning Activities:

Read the unit carefully and find out the advantages and limitations of such tests.

Compare the Summative online examination system with that of regular conventional summative test.

http://elearning-ottawa.org/2008/07/19/how-to-prevent-cheating-during-an-online-evaluation.aspx

Conclusion:

The Internet technology is here to stay and every stakeholder in the education field is expected to master it in order to sustain in the knowledge society and fast pace of the world of work. The teacher's role too has changed to that of a facilitator of learning. Self learning is fast becoming inevitable. Educational institutions are equipping themselves to match the fast changing pattern of education system. They are becoming technology savy. Parents too need to provide all the technological support to their wards in order to enable them to learn by using online learning resources from the places of their convenience.

REFERENCES:

1. Malhotra Abhishek (2007) 'Issues in WEB-BASED EDUCATION' S.S. Publishers, New Delhi 110031

2. Thamarasseri Ismail (2009) 'Information and Communication Technology in Education' Kanishka Publishers, Distributers New Delhi 110002

3. Verma Mahesh (2006) 'Online Teaching Tools and methods' Murarilal & Sons Ansari Road, Darya Ganj New Delhi 110002

4. Verma Mahesh (2006) 'Technology in Digital Education' Murarilal & Sons Ansari Road, Darya Ganj New Delhi 110002

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6

MODULE V: DEVELOPMENT OF SELF LEARNING MATERIAL AND RESEARCH IN ICT

CONCEPT AND PREPARATION OF SELF LEARNING MATERIAL (SLM)

Unit structure:

6.0 Objectives

6.1 Introduction

6.2 Concept of Self Learning Material (SLM)

6.3 Concept of Programmed Learning Material (PLM)

6.4 Historical overview of SLM and PLM

6.5 Types of PLM (Linear, Branching, Mathetics)

6.6 Preparation of SLM

6.7 Evaluation of SLM

6.0 OBJECTIVES

After reading this chapter you will be able to
- Explain the concept of SLM
- Explain the concept of PLM
- Describe the Historical overview of SLM and PLM
- Discuss the different Types of PLM (Linear, Branching, Mathetics)
- Describe the steps involved in preparation of SLM
- Evaluate a SLM

6.1 INTRODUCTION

Till now you have studied about various communication technologies like e-learning, virtual learning, satellite communications, CAI, CAL, CBT, CML and other synchronous and asynchronous mode of internet communication.

In this unit you will be acquainted with educational facilities designed for student learning that is fully self-directed. This unit will also provide insight for those who want to know how to develop self learning materials for distance learners and how to revise those materials periodically. In this unit we have tried to explain the functions of a course writer. Our intention is to show you how the

experience you have gained in face to face teaching can be utilized effectively for the new assignment of writing for distance learners. The broad objective of this unit is to help you acquire reasonable skills / confidence to write self - learning materials and revise those materials.

It is a fact that the success and effectiveness of distance education systems largely depends on the study materials. Thus, in developing self learning study materials, the course writers have a crucial role to play. Writing for distance education is a more challenging task and quite different from that in face to face teaching or writing for a book or a journal. Self learning materials depend on exploiting the various means and ways of communication to suit it to the needs of learners. But based on our own experiences and the experiences gathered from other distance education institutes and open universities, we should be successful in developing a viable, effective and manageable model / format to suit our Indian conditions. The format, of SLM should be flexible to accommodate further improvements. Use of SLM facilities and the pedagogical theory they are based upon has its advantages and disadvantages. Proper use can result in a feeling of empowerment and better learning outcomes.

6.2 CONCEPT OF SLM

The Self Learning material (SLM) is different from a chapter in the text book or an article of a journal. The chapters of a textbook usually present information in a very compact form. They are closer to reference material than learning texts which acts as an aid to the teacher rather than the learner. SLMs are instruments of learning. Learner centeredness of distance mode requires development of self learning processes. The following are the **Basic characteristics of SLM**

Self –explanatory:
The content should be presented in a style so that learner can go through the material without much external support. The content should be self explanatory and conceptually clear. The content is analyzed logically before it is presented. Continuity and consistency of the content is maintained. Thus self learning is promoted

Self contained
Efforts should be made to make the text self sufficient so that a learner does not hunt for the additional source, of even a teacher. Scope of the content should be visualized in detail. Only relevant details should be presented so that the unit is thoroughly covered.

Self directed

SLMs aim at providing necessary guidance, hints and suggestions to the learners at each stage of learning. SLMs should include easy explanations, sequentially developed ideas, illustrations, learning activities etc. Self Learning Material performs the role of a teacher who can guide, instruct, moderate and regulate the learning process in classroom situation.SLM should direct the entire process of learning.

Self Motivating

In distance education systems, the learners remain off the campus for most of their study time. The study materials like a live teacher should encourage the learners. Material should arouse curiosity, raise problems, relate knowledge to familiar situations and make entire learning meaningful for them. The sense of reinforcement should be strengthened at every stage of learning and retention.

Self evaluating

As learners remain separated from the distance institution and the teachers, the study material should make provisions for feedback as well. To ensure optimum learning the learners should know whether they are on a track. SLMs should have self evaluation in form of self check questions, exercise, etc, provides the learners with the much needed feedback about their progress, reinforces learning and motivates them for learning. SLMs should have in built evaluation

Self Learning

SLM follows principles of self learning. Besides content related information SLM provides the learners study guidance, direction, hints references etc to facilitate independent learning
Content is made comprehensible by simple explanations, examples, illustrations, activities etc.

Special features of SLM
Some of the special features of SLM are as follows:
- Clearly stated objectives
- User friendly you and I style of writing
- Shortish, manageable chunks of learning
- Plenty of helpful examples
- Reference to the learner's experience
- Use of illustrations where they are better than words
- Headings to help learners to find their way around
- Links to other appropriate media
- Obvious awareness of different learner needs
- Exercise that get the learners to use the material
- Space for learners to write down their own ideas
- Feedback to help learners to check their own progress
- Suggestions about getting help from other people

Illustrative model of a unit in SLM
A model unit structure is given below for illustration:

Three parts of a unit are:
1.   The Beginning : includes
   i.   Title
   ii.   Unit structure
   iii. Objectives
   iv. Introduction

2. The Main body: contains
   i.   Headings & subheadings
   ii.   Activities
   iii. Illustrations/graphics etc
   iv. Tables
   v.   Photographs
   vi. References

3. The Ending Section: includes
   i.   Summary
   ii.   Glossary
   iii. Possible Answers
   iv. Further Readings
   v.   References
   vi. Model Questions

Example of Unit Structure:

UNIT STRUCTURE
X.0 Introduction
X.1 Objectives
X.2 Section 1 (Main Theme)
       x.2.1 Sub-section 1 of Section 1
       x.2.2 Sub-section 2 of Section 1
Check Your Progress
X.3 Section 2 (Main Theme)
       x.3.1 Sub-section 1 of Section 2
       x.3.2 Sub-section 2 of Section 2

Check Your Progress
X.4 Let Us Sum Up
X.5 Answers to Check Your Progress
X.6 Suggested Readings
X.7 Question Pattern

Check Your Progress

1. Define SLM

2. Write any five characteristics of SLM

3. Suggest some distinctive features of SLM

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6.3 CONCEPT OF PROGRAMMED LEARNING MATERIAL (PLM)

Teaching in Distance Education system is generally considered an activity, which is designed and performed for multiple objectives, in terms of changes in learners' behaviours. The distance education organizers use different strategies of teaching which match the objectives of teaching on the one hand and learners' style and personality dimensions on the other.

The organizers of Distance Education have to deal with large and diverse groups of learners very different from those in conventional stream. They have to organize the learning experiences, and adopt techniques of teaching to which learners can respond as matured individuals. The choice of educational objectives and the methodology must be suitable. Programmed learning is learning through an arrangement of the material to be learnt in a series of steps designed to lead the learners from the known to the unknown. In the discussion of the possible combination of correspondence teaching with programmed learning , the term programmed learning is used to mean the process of learning through the arrangement of the material to be learnt in a systematic, sequential order. Mechanical, electronic or printed books in several formats are merely devices which put programmed material before the student. The actual instrument of teaching a not the machine but the arrangement of material .

Printed materials present the student with a degree of learner control, since they are portable. The well-structured information in a compact format, of a book can be accessed at a place appropriate to the individual learning pace and place of the student. The potential instructional efficiency of this traditional

medium is further enhanced by its usability since it does not require have power supply, like the range of electronic media. The quality of lessons therefore should have high academic merit and should stimulate interest of the students to go to original texts in the subject concerned.

Programmed Learning involves instruction with carefully specified goals and skillfully arranged learning experiences, which are self instructional and self corrective. Hence Programmed Learning is also called as Programmed Instruction. Thus programmed learning is a new path towards automation and individual learning/instruction.

Definition of Programmed Instruction

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

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

Characteristics of Programmed Learning

- It is a process of constructing sequences of instructional material in a way that the rate of learning is maximized, understanding is fostered and the motivation of the student is enhanced.

- Assumptions about the learner are clearly stated and put in definite terms in a programmed learning type of situation.

- The objectives underlying the programme are defined in explicit and operational terms.

- The subject matter is broken up into small steps in a logical sequence.

- Programmed Learning emphasis the interaction between the learner and the programme.

- The learner is made to respond actively by asking to fill in the blank, count the number of coins in a row or complete a series of numbers.

- A programmed learning sequence takes into account the initial behaviour of the learner with which it starts and the terminal subject matter competence which the learner is to achieve.

- Programmed Learning system has an adequate provision for immediate feedback which is based on the theory of reinforcement.

- The learner progresses at his own pace.

- It takes care of the fact that there are even differences in the rate at which an individual learner learns various kinds of subject matter.

- It enhances the capability of the learner to discriminate or to generalize by frequent application and thus offers the learner an interesting and challenging prospect.

- It has the provision for continuous evaluation which may help in improving the student's performance and the quality of programmed material.

- It is based strictly on the behaviouristic principles of psychology. A fair amount of stress is given to the explanation and development of understanding through the handling of various cues in the learning process.

- A learner moves in a very specific way as opposed to the traditional procedures of teaching where the learner moves in a general way.

Principles of programmed instruction

A good programmed learning material incorporates good principles of learning. The basic idea of programmed learning is most efficient, pleasant and permanent learning must take place. The five basic principles of programmed learning is depicted in Table 4.1

Table 4-1: Five principles of programmed learning

Principles	Explanation
Active learner response	To what extent a learner can understand is judged by making him /her answer questions. The extent of a learner's understanding is ascertained from what is demonstrated in the responses.
Immediate feedback	Let a learner know whether his/her answer is correct or incorrect immediately. Give the learner the subsequent question after he/she knows whether his/her response is right or wrong
Small steps	Set small steps in order to prevent a learner from stumbling as much as possible. When he/she makes a mistake, there is the risk of being labeled a failure.
Self pacing	Let the learner decide the speed of learning so that he/she can learn at his/her own pace. Consider that an appropriate speed varies from learner to learner.

Learner verification	Whether the program is good or bad is judged not based on a specialists' opinions, but whether learning is actually established or not. To that end, get learners who have yet to learn the subject matter to try the program under development. Based on the trials, improve the material as necessary.

Check Your Progress

1. Define PLM
2. Write any five characteristics of PLM
3. Discuss five principles of PLM

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6.4 HISTORICAL OVERVIEW OF SLM AND PLM

Originally introduced in the mid-1950s by behaviorist B.F. Skinner, programmed instruction is a system whereby the learner uses specially prepared books or equipment to learn without a teacher. It was intended to free teachers from burdensome drills and repetitive problem-solving inherent in teaching basic academic subjects like spelling, arithmetic, and reading. Skinner based his ideas on the principle of **operant conditioning**, which theorized that learning takes place when a reinforcing stimulus is presented to reward a correct response. In early programmed instruction, students punched answers to simple math problems into a type of keyboard. If the answer was correct, the machine would advance to another problem. Incorrect answers would not advance. Skinner believed such learning could, in fact, be superior to traditional teacher-based instruction because children were rewarded immediately and individually for correct answers rather than waiting for a teacher to correct written answers or respond verbally. Programmed instruction quickly became popular and spawned much educational research and commercial enterprise in the production of programmed instructional materials. It is considered the antecedent of modern computer-assisted learning.

6.5 TYPES OF PLM (LINEAR, BRANCHING, MATHETICS)

In programmed learning the presentation of the instructional material or subject matter to the learner in a suitable form is called as programming. Some of the programming types or styles are the following:

- Linear programme
- Branching programme
- Mathetics
- Ruleg system
- Computer assisted instruction
- Learner controlled instruction

In this unit you will be learning only about first three styles of PLM i.e linear, branching, mathetics

Linear programme

Skinner and his associates are the originators of the linear or extrinsic promamming. It has been defined by psychologists as "A programmed material sequence in which each student proceeds in a straight line through a fixed set of items." This type of programme is called Skinnerian type of programme as it is directly related with his theory of operant conditioning and is based on the assumption that human behaviour can be shaped or conditioned gradually, step by step with suitable reinforcement. Skinner's approach involves the following features:

- Learners are exposed to small amounts of information and proceed from one frame or one item of information, to the next in an orderly fashion (this is what is meant by linear)

- Learners respond overtly so that their correct responses can be rewarded and their incorrect responses can be corrected

- Learners are informed immediately about whether or not their response is correct (feedback)

- Learners proceed at their own pace (self-pacing)

All students work through the same sequence, and a low rate of error is necessary to ensure continued positive reinforcement of correct responses.

Features of Linear programme

1) Linear means proceeding in a straight line. In linear programme generally, information is broken into small steps of 40-50 words in length which is called a frame. The learner must respond to each frame in succession by filling in word or phrase in a blank.

2) Linear Arrangement: In such type of programme, the learner advances in a single series of shorts steps which are designed

to ensure high rate of correct responding to the questions (frames). Same path is followed by each learner. The learner starts from initial behaviour to the terminal behaviour following straight-line sequence. All learners pass through the same path.

| Question 1 | → | Question 2 | → | Question 3 | → | Question 4 | → |
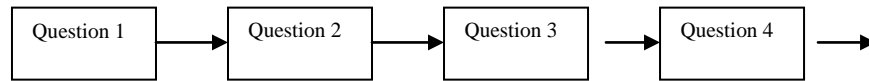
3) Responses are controlled. In a linear programme, responses are controlled by the programmer. The responses and their order are fixed. The learner has no choice to respond in his own way.

4) Response is emphasized. In linear programme, the emphasis is laid on response. The learner must respond to each and every in order the learning to occur.

5) Feedback is quick. As soon a s the learner responds to the frame he can immediately compare his response with the response f the programme.

6) Provision for prompt. In the beginning, prompt or cue can be supplied to facilitate learning too occur.

7) Cheating is discouraged by not revealing the answer to the learner.

8) Learner can skip certain frames.

9) Responses are self constructed.

Limitations of Linear programme

1) Lack of motivation: It is alleged that learning becomes dull and learner experiences monotony and boredom. It takes too much time to teach a few points.

2) Freedom of choice is curtailed. The learner has no choice of his own to respond, thus it s alleged that creative imagination of learner is inhibited.

3) Costly: It has been found that preparation of programmed material requires too much paper and time.

4) Rothkopf is of the opinion that in many programmes, the learners find out the cues as to what is to be filled in blanks and key terms are guessed

5) It can be used in limited areas where the behaviour is measurable and observable such as Maths and science.

6) S.L Pressey and his associates have questioned the value of linear programming format on the following grounds.

   a) Serial order:The frames are presented in serial order.

   b) Searching of material is not permitted as in a textbook. Judgmental learning is not practiced.

c) Linear programming does not permit differentiation among responses.

7) Students do not contribute for discovery of answers except to follow a rigid line prescribed by the programmers.

8) Programmes are generally designed with a view that learner has no previous background of the subject matter. It is very difficult to find out exactly the background of each learner.

9) In case of book form presentation, learners are expected to be honest but from all learners we cannot expect honesty. They can see the correct response without reading the frames.

Figure 4.1 Linear and Branching Program
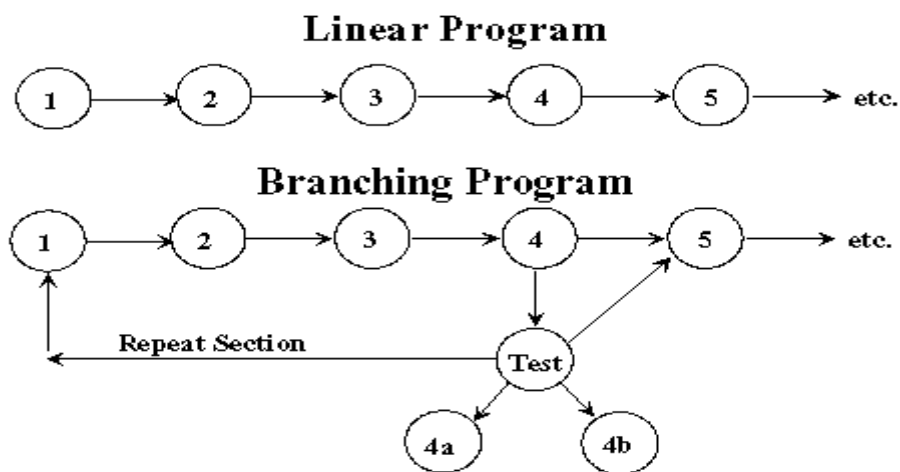
Branching programme

The branching or intrinsic programme was originated by Norman Crowder and hence it is also known as Crowderian Model. He has given its definition as "It is a programme which adapts to the needs of the students without the medium of extrinsic device as a computer." It is called intrinsic because the learner within himself makes the decision, to adapt the Learning to his/her needs.

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

In branching programme, the learning material is divided into 'units' of material called 'frames'. Much information, one or two paragraphs or even a page, is provided in a frame. Thus each frame is quite larger than that employed in linear programme.

The learner goes through the frame. After that he is required to respond to multiple choice questions associate with the learning material of the frame.

The learner moves forward if he answers correctly but is diverted (branched) to one or more remedial frames if he does not. These frames explain the matter afresh, ask him questions to elicit

the right answer and reveal his previous mistakes, and then return him to original frame.

This cycle goes on till the learner passes through the whole instructional material at his own pace.

Each Content frame includes the following:

a) Repeating student response
b) Positive confirmation
c) New information'
d) Question
e) Alternatives followed by page numbers, where the student should go next.

Each Remedial frame includes the following
:

a) Repeating student response
b) Negative confirmation
c) Reasons why he is wrong
d) Further explanation in simple language
e) Directions as to where the student should go next

Features of Branching programme

1) Material in a frame is larger; much information is presented at each step. A step may consist of two or more paragraphs and sometimes a full page.

2) The method of student response is different than that of linear model; student has to make choice out of several choices. Multiple-choice question are asked. Each response to the question is keyed to different pages. If the learner selects correct response, his response is confirmed and in case he selects wrong response, then he routed to material which explains as to why he is wrong.

3) Crowder holds that teaching is communication and so he concentrates his attention upon the improvement of communication.

4) Learner has freedom to choose his own path of action according to the background of subject matter. The learner controls the exact sequence that he will follow.

5) The programmer has ample opportunity to exploit the literary style.

6) Student is more alert and concentrates on the subject matter more carefully.

7) Detection and concentration of errors is important. Crowder holds that making error is basic to learning. He permits 20 percent errors in his model. In such a model first the errors are detected and then corrected. The learner knows why he is wrong. Crowder says that it is impractical to eliminate errors in the process of learning

8) The crucial and identifying feature of branching model is the fact

that the material presented to each student is continuously and directly controlled by the learner's performance in answering questions.

9) Intrinsic programmed material when presented in a book form,

the book is called scrambled book because the pages do not follow in a normal sequence.

10) It is very useful to concept learning or where the material is given I larger steps.

11) The role of active response is not central in intrinsic theory. Intrinsic programme offer less guidance to learner as to what material in the frame is important.

Limitations of Branching programme

1) The learner may guess the correct response without understanding the subject matter of the frame.

2) Infinite branching cannot be provided. It cannot cater to the needs of the individuals. It is very difficult to find out the total number of branches for each individual.

3) Cost of preparation is high, audio-visual equipment is costly.

4) The programme needs revision after every two years which is a very costly affair.

5) Programmes are the product of programmer's imagination and it is he who decides diagnostic questions and level of content.

6) Branching model can be used after sixth grade the grade because small children do not follow its mechanism.

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

Mathetics

  Mathetics type of programming was formulated by Thomas F. Gilbert and the term is derived from the Greek word "Mathein"- meaning "to learn". A Mathetics programme begins with an instructional plan and an analysis of what is to be taught. Gilbert emphasizes that analysis must concentrate on learner activity and not subject coverage. Although mathetical programming may be applied to any subject the emphasis on task simulation makes it particularly suitable vehicle for teaching skills where 'transfer of training forms an essential part of instruction'.

  One of the main concepts of Mathetics is to start with the most motivating task and generally it is the last or the final step in any task. Hence the learner starts from the last task and goes

backward to finally finish and reach the introductory part. The tasks or frames have to be carefully chained. Otherwise they will lose relevance, sequence and logic.

Principles of Mathetics

a) Principle of Chaining:

Elements of the content are presented in stimulus and response form. The stimulus and responses are arranged in chain such that each response works as stimulus for the next i.e.

$$S_1 \longrightarrow R_1 \longrightarrow S_2 \longrightarrow R_2 \longrightarrow S_3 \longrightarrow R_3 \ldots$$
$$S_n \longrightarrow R_{1n}$$
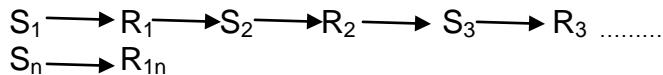
b) Principle of Discrimination:

The main idea here is that discrimination of situation of learning is generated by providing different stimuli having different responses. Every stimulus and response is independent of each other. i.e.

$$S_1 \longrightarrow R_1$$

$$S_2 \longrightarrow R_2$$

$$S_3 \longrightarrow R_3$$

$$S_n \longrightarrow R_n$$

c) Principle of Generalization:

The main idea here is to emphasis the fact that generalization is a crucial situation of learning. In this type of situation, a group of stimuli emits a single response.i.e

$$
\begin{array}{c}
S_1 \searrow \\
S_2 \longrightarrow R \\
S_3 \nearrow
\end{array}
$$
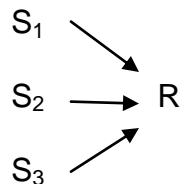
Mathetics is helpful in teaching complex chains to human learners. Each time learner completes the total chain he is reinforced by success. This type of programming provides opportunity for developing divergent thinking and skills in technical training.

Check Your Progress

1. Discuss the features of liner programming
2. Discuss the features of branching programming
3. Discuss the principles of mathetics

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6.6 PREPARATION OF SLM

Designing and producing an effective learning material is very important to create a great quality learning environment. Competency based self learning material provides an opportunity to learn the subject effectively. A flexible and good quality competency based self learning material provides better understanding of the subject.The following Principles may be followed for the Preparation of Self-learning Materials.

Principles for the Preparation of Self-learning Materials
The following are the principles for the Preparation of Self-learning Materials:
- Ground Work
- Range
- Structure and design
- Flexible delivery
- Ingress and Equity
- Content
- Evaluation & Feed Back.

Ground Work
Self Learning materials must be relevant to learner's needs so that they are capable of preparing the learner for the current and future trends in the education system. It should be challenging but still appropriate for the level of the target group. It is better to adapt rather than duplicate the existing materials. SLMs should be nationally / internationally comparable.

Range

The range refers to the breadth and depth of the learning material. In order to ensure that the scope is fit for purpose-developers need to:

- Indentify the relevant outcomes of learning and support their acquisition

- Relate to the appropriate target group.SLM should be flexible enough to accommodate the varying abilities and

backgrounds. SLM should provide clear examples, explanation and illustration.

- SLM should provide an accurate education context to suit current and future learning environment.

Structure and Design

Self Learning materials must not only promote effective learning and assessment strategies but also have a clear structure and be sequenced such that the target group can easily explore them.

They must

- Be easy for the learner to navigate through ;
- Present a visually attractive design;
- Provide activities and learning strategies designed to motivate learners; and
- Use words / language appropriate for the level of the target group.

Flexible Delivery

Self Learning materials must consider the learners varying needs, preferences and entry levels therefore must

- Provide a variety of learning methods;
- Provide for use in a variety of training/learning context
- Provide guidance on entry requirements ;
- Be adaptable for use under different but similar conditions ;
- Be challenging to cater for target population.

Ingress and Equity

In order for self learning materials to be inclusive; they must

- Accommodate cultural diversity;
- Challenge stereotypes of gender, ethnicity, creed and ability status, which can be corrected/ reversed by use of non discriminatory words, pictures, illustrations and examples ;
- Be affordable in terms of purchase price ;
- Be moderately colorful but attractive
- Be produced in a way that is cost effective ;
- Take information technology needs on board ;
- Provide guidance on learning

Content

Content refers to what goes into the self learning material. A well-balanced content must

- Be interactive by keeping the target group engaged;
- Be presented in a language appropriate for the level of the user;
- Be simple ;
- Simulate reality in terms of work requirements and problem solving;
- Assist the trainer's effort in delivering / implementing the curriculum;
- Nationally / internationally and locally comparable and up to date.

Feedback and Evaluation

Self learning materials must promote self assessment for the learner and provide feedback to both the learner and the developer.

Self Learning Material Development Process

The following model can be adopted for the purpose of self learning material development.

- Before preparing the package the developer can prioritize and strategize on special issues.
- Input is those aspects that the developer needs to bring together when developing learning materials.
- The overall objective of resource mobilization is to make material reach people it is intended for.
- Piloting is done to determine the strengths and weaknesses of the developed material in order to take necessary remedial actions prior to its full implementation.
- Once the material has been piloted, the developer needs to amend, as necessary, in accordance with feedback from those involved in the trial run to meet the needs of learners.
- Implementation stage is considered that the material can be used to deliver the programme. Revision and review of the material should be done regularly
- In order to determine the value factor of the material, evaluation instruments must be developed and implemented to determine the correlation between the identified needs and the impact of the material on learner's performance.

Check your Progress

1. Write the Principles for preparing an effective SLM

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6.7 EVALUATION OF SLM

Good SLM should normally contain the elements listed below:

Explicit aims and objectives:

Statements of intent (what the learner should be able to do as a resultof studying the particular unit). Learner competency/objectives related statements enable SLM Developers to:

- Clarify educational intentions
- Identify and sequence content
- Decide on most appropriate media (in case of multi-media materials)
- Select the most appropriate activities
- Decide on suitable ways of assessing learning
- Evaluate the effects & effectiveness of materials

    Explicit aims and objectives also provide advantages for the Learners:

- Show them what is to be covered in the unit (concepts to be learned, skills to be mastered)
- Present them with challenges ahead and standards to be achieved
- Enable them to evaluate themselves (assess own progress against objectives)
- Build their self confidence
- Prepare them for learning and examinations

Standardized content:

SLMs should include sections and sub-sections which will enable the following:

- Arouse attention and motivate
- Link up with previous knowledge
- In-built guidance for learning
- Activate – suggest activities for learning in between
- Provide feedback (through intext questions)
- Facilitate retention (tables, graphics, flow charts, etc. in between and summarizing at the end)

SLM developers should Write Clearly keeping in mind the following:

- Use Familiar words in preference to less familiar.
- Use short sentences in preference to long, but not at the expense of cohesion
- Do not use unnecessary words and phrases
- Highlight the key points
- Write in a logical order
- Give specific and concrete instances
- The content should have In-text questions
- Provide feedback for self assessment
- Put in variety of questions: mainly objective and short answer
- Questions should be based on the preceding section/sub-sections
- Answers or hints be provided

Summing Up

SLMs should have the summing up which should involve the following:
- Recapitulation of the whole unit
- Highlight important points
- Help in retention
- Help in quick revision

The Unit end exercises should:
- Enable self assessment of learning after the whole unit
- Variety of questions
- Essay type long questions may be included
- Questions should be stated in clear unambiguous language
- Answers/hints may be provided

Hence a SLM must depict explicit objectives, Expert content, Updatable content, structured learning, Active learning and frequent feedback.

Check your Progress

1. Enumerate the criterion for evaluating a SLM.

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LET US SUM UP

Self Learning Material has the following characteristics:

➢ **Self –explanatory**
➢ **Self contained**
➢ **Self directed**
➢ **Self Motivating**
➢ **Self evaluating**
➢ **Self Learning**

Principles of programmed instruction

- Principle of small steps
- Principle of active responding
- Principle of immediate feedback
- Principle of self pacing
- Principle of student testing

Types of Programmed instruction

- Linear programme
- Branching programme
- Mathetics

Some of the special features of SLM are as follows:

- Clearly stated objectives
- User friendly you and I style of writing
- Shortish, manageable chunks of learning
- Plenty of helpful examples
- Reference to the learner's experience
- Use of illustrations where they are better than words
- Headings to help learners to find their way around
- Links to other appropriate media
- Obvious awareness of different learner needs
- Exercise that get the learners to use the material
- Space for learners to write down their own ideas
- Feedback to help learners to check their own progress
- Suggestions about getting help from other people

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7

RESEARCH IN INFORMATION AND COMMUNICATION TECHNOLOGY

Unit Structure:

7.0 Objectives

7.1 Introduction

7.2 Overview of Research Conducted in ICT

7.3 Emerging Research Trends in ICT

7.0 OBJECTIVES

- Learners are aware of the areas of research in 'Information and Communication Technology'
- Learners are familiar with the major findings of research in the area of ICT in education
- Learners are familiar with emerging research trends in ICT

7.1 INTRODUCTION

Information and Communication Technologies (ICT) form the core of any knowledge based society and they are critical to meeting the demands of society and economy as they play an important role in improving the competitiveness of industry. A society will progress to the extent that it spends its resources on research in ICT, and uses the findings of research to move ahead and cater to the demands and perceived needs of society.

Research in ICT could be pure research in developing newer and more efficient technologies as well as on finding newer areas where existing technologies can have an impact.

ICT has an impact on three key areas:-

Advances in science and technology - by supporting cooperation and access to information through availability of others' research findings.

Modernisation of public services, such as health, education, transport, town services etc.

Productivity and innovation, by facilitating creativity and better management.

Researches in ICT may focus on any of the above areas and their ramifications.

In the area of education and learning ICT is a means for an efficient and more flexible access to information and knowledge. Research on ICT in education focuses mainly on how we learn through ICT and on enhancing meaning and learning experiences from digital resources. It assumes active and responsible learners and provides for the need for better skilled and creative people in workplaces.

Researches in ICT focus on learning in different situations in various environments such as schools, museums, libraries, the workplace and cultural institutions. In fact, since IT has entered the personal lives of individuals through social networks and mobile computing (access to the internet on mobile phones), making learning resources easily available and increasing the individual's level of interaction and engagement with technology, the scope of research on ICT in education has increased considerably

7.2 OVERVIEW OF RESEARCH CONDUCTED IN ICT

Research in the area of **Information and Communication Technology (ICT) in education** can be classified into four broad areas:

- Impact of ICT
- Planning for Implementation of ICT
- Current Implementation of ICT in Education
- Costs

Each of these broad areas include several specific directions that researchers have taken resulting in vast amount of available literature relating to research in ICT. Examples of research interests include :

- Impact of ICT on learning and achievement
- Monitoring and evaluation with ICT
- Equity, special needs and marginalized groups
- Policy issues related to ICT in Education
- Training of teachers for ICT
- Planning and organizational issues within institutions
- Current projects and best practices
- Specific ICT tools used in education
- Teachers, Teaching and ICTs
- Content & Curriculum issues in implementation of ICT

- Costing for ICT

Important findings of the researches are described below:

Research on use and impact of ICT in developing countries conducted by the World Bank and Infodev reveals that inspite of large investments towards the introduction of ICT in education in the OECD countries over several years, there still remain several gaps in the current knowledge base and a lack of useful resources for policy makers. They investigated several critical areas of ICT implementation and their findings reveal that the relationship between use of ICT and learning outcomes is debatable. This arises, in part, from the lack of proper indicators to study the impact of ICTs. There appears to be a disconnect between the goals of ICT implementation (moving the educated populace to futuristic thinking and skills) and actual practice (using ICT as a means of computer literacy or for dissemination of learning materials).

There is considerable interest in introduction of ICT in education even in the most challenging of environments in developing countries.

Research has identified several 'best-practice' examples. However, except in a few cases, these are not disseminated widely enough. There is a need to package these into a format in which others too can make good use of them. While the objective of introducing ICT in education has been to bring about a change in the teaching-learning paradigm, in practice, teachers are seen to use it merely as a new (and expensive) tool to support existing teaching learning practices.

Its impact on student achievement is not clear. However, institutions using ICT certainly believe that ICT is a useful tool to motivate learning. It brings about greater efficiency in the education system and can help speed up educational reform.

Researchers in the European Union (mainly in Cypress and Greece) are working on the development of tele-education applications using terrestrial networks and satellite broadband technologies[1]. The aim was to reach out to remote audiences and deliver educational services to them and highlight the importance of space technology in distance learning. Because of the quality of its content, and the ease in use the project plays a crucial role in spreading computer literacy in remote areas and sea-borne communities.

Research in ICT in education is being conducted at and sponsored by a number of national level bodies around the world. One example is the Australian Council for Educational Research (ACER). There also exist such national level organizations in most countries.

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[1] *'Long Distance Learning for Remote Areas'*: Research*EU (2011) No 31 Results Supplement, Pg

28. (*http://cordis.europa.eu*)

The objective of such organizations is to sponsor research and use research findings to inform policy makers so that spending at the national level can be directed to the more beneficial areas. An example of the way in which such organizations work is provided in ACER's report on emerging technologies[2] wherein they provide their findings related to the information and communication technologies which are already being used by students and the need for the education department and the institutions to tap into this existing technology literacy to promote its use for the transmission of content. They foresee a need for training teachers at becoming more adept at using these technologies with greater fluency and developing content that will be more easily transmitted through these technologies.

A major initiative of Centre of Educational Research and Innovation (CERI) is ICT and the quality of learning. The report dwells upon the implications of ICT on education and learning in about 30 countries. It focuses on quality use of ICT, market & partnership issues and on research and evaluation. Research shows a definite shift from technology to content and people in several countries.

Research has indicated some disadvantages in the blind acceptance of learning through available technologies[3]. Tomkin states that though it is possible for the 'google generation' learners to retrieve information through the internet. This is not 'equal to' education. It does not bypass their need for intermediate steps to education. There is no shortcut to understanding. This is supported by a study conducted by the elearning guild that invited their members to provide their best learning tips[4] relating to strategies for effectively managing and using elearning. Respondents stated that objectives of e-learning are best achieved when it is synchronous with other learning modalities. In other words, though ICT can be an excellent source for information and content transmission, using ICT to bring about higher level 'understanding' is still a challenge for educationists.

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[2] ACT Department of Education and Training: *'Emerging Technologies: A Framework of Thinking'* (2005)Report
(http://www.det.act.gov.au/__data/assets/pdf_file/0010/74485/ACT_EmTech_Report_v1_2.pdf)

[3] Tomkin A: (2008*) 'If it quacks like a duck': developments in Search Technologies'* Emerging Technologies for
Learning : Vol 3 Chapter 5.

[4] E-learning Guild:(2008) **144 Synchronous E-learning Tips. Strategies and Research,**

(http://www.elearningguild.com)

Check Your Progress:

List at least four focus areas of research in ICT. What are the research findings in these areas?

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7.3 EMERGING RESEARCH TRENDS IN ICT

World over, research in ICT, including 'ICT in education' is being promoted through sponsorship and funding. Some of the newer areas of research are:

Educational Technologies for Specific Subject Content: Researchers are looking at ways in which advances in technology can be put to use to take learners through the complexities of a subject, interacting with them as a tutor would, in order to improve their conceptual understanding of the subject. In the case of subject areas which require experimentation such as science and technology, remote laboratories and virtual experimentations for learning are being promoted. It is assumed that such services will enable online interactive experimentation by access and control of real instruments or simulated situations.

Researchers are looking at developing appropriate interfacing techniques for components of 'plug and play' type setups of remote and virtual labs. Such user interfaces should be able to overcome the complexities of creation and usability of experiments by learners at different levels.

Enabling faster and economical re-skilling of employees at workplaces: Researchers are trying to find more flexible and faster means of improving employee skills at workplaces that would create a networked learning environment that any person wanting to use could, as and when he needs it.

Such efforts are generally aimed at needs of small and medium sized enterprises in order to help them adapt to innovations and improve their competitiveness

Using ICT to foster creativity: Researchers are looking at ways in which ICT can develop tools which can foster learner's creative potential. This needs the ICT used, to question and develop the thinking potential of the learners, by incorporating components that are challenging, that facilitate questioning and that is able to make the connections between people's responses and their ideas. This will most likely tap the creative potential of the people using the ICT

Exploratory Activities: Some current research studies are aimed at new ways in which ICT can be used for learning. Evaluation of the new methods and their impact on learning forms part of the research. The impact of ICT is expected in areas of adaptation to the new technologies, its penetration in schools and higher level institutions, effectiveness of the tutoring provided by ICT, and the extent of involvement with their work that comes as a result of use of ICT and the emergence of new models of learning.

Technology-enhanced Learning systems which have the capabilities of human tutors. Researchers are now looking at developing systems that can understand and react appropriately to the learner's abilities and difficulties through user's responses. For example they would look at understanding the response as a result of deep/shallow thinking and reasoning. They would use this information to influence learner's further learning and improve his cognitive skills and develop personalised instructional designs.

This needs preparing teachers for the new challenges and researchers are preparing teachers' toolkits that will attempt to accomplish this[5]. The project hopes to change classroom practice by increasing teachers' capacity to incorporate technologies into teaching and learning. It will help teachers access online professional learning, analyse, plan and implement changes in their teaching approaches and access quality online resources. The project is expected to reach the classroom in 2012.

As the technologies develop so too will the expectations from it. Considering the costs involved in implementing an equitable ICT environment for all, and the tight budgets in education, they will be adopted by educationists to the extent that they are able to deliver what they promise to deliver.

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[5] Education Services Australia (2011) *ICT in Everyday Learning - Teacher Online Toolkit,*

(http://www.esa.edu.au/)

Check Your Progress:

What areas of research in ICT are of interest to educationists in the current scenario? In your opinion, which is of utmost important in the Indian context? Justify your response.

REFERENCES

Centre for Educational Research and Innovation (2008) *Inspired by Technology, Driven by Pedagogy: A Systemic Approach to Technology Based School Innovations* , OECD- Directorate for Labour and Employment.

Australian Government – Department of Education, Employment and Workplace Relations(2010) *ICT Professional Learning: National Mapping of ICT-based Learning,* Education Services Australia , Final Report, Melbourne.

Jager,A K & A H Lokman (1999*): Impacts of ICT in Education. The Role of the Teacher and Teacher Training,* European Conference on Educational Research, Lahti, Finland.

Princeton Survey Research Associates (2002)*Education, Innovation and The Internet: Nobel Laureates Look to the Future,* Global Summit.

Trucano, M (2005): Knowledge Maps: ICT in Education; Infodev / WorldBank Publications; Washington DC.
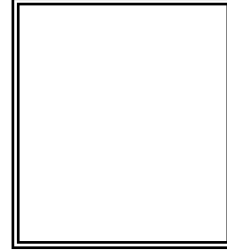
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M.A EDUCATION
(PART II)

GROUP B- PAPER – VII

INFORMATION
AND COMMUNICATION
TECHNOLOGY

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M.A EDUCATION (PART II) - GROUP B- PAPER – VII INFORMATION AND COMMUNICATION TECHNOLOGY

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SYLLABUS

M.A. PART II - EDUCATION

GROUP B PAPER 7
INFORMATION AND COMMUNICATION TECHNOLOGY
Course Objectives
To develop an understanding of

- Overview of Educational Technology as a discipline «
  Psychological Principles of ICT
- Instructional Design (ID)
- Computer, Internet and its application

MODULE I: OVERVIEW OF EDUCATIONAL TECHNOLOGY AS A DISCIPLINE

1. **Concept of Information, Communication and Educational Technology**
   a. Concept of Information Technology, Communication Technology and Instructional Technology
   b. Concept of Educational technology
   c. Need and Significance of ICT in Education
   d. Historical Perspective of Educational Technology (with reference to the above mentioned concepts) ,
   e. Emerging trends in Educational technology (with reference to the above mentioned concepts)

MODULE II: PSYCHOLOGICAL PRINCIPLES OF ICT

2. **Learning and ICT**
   a. Learner Characteristics (Learner Analysis)
   b. Learning Environment
   c. Processes Associated with ICT Learning,
   d. Factors Affecting and Facilitating ICT Learning
   c. Application of Theories of Learning to ICT
   i. Behavoiurism
   ii. Congnitivism
   iii. Constructivism
   f. Adult Learning and Learning Styles

MODULE III: INSTRUCTIONAL DESIGN (ID)

3. **Concept of Instructional Design (ID)**
   a. Concept of ID
   b. UivelsofID
   c. Overview of Theories and Models of ID
   d. ADDIH Mode!
   e. Dick and Carey Model

f. Stages of Development of II)

MODULE IV : COMPUTER, INTERNET AND ITS APPLICATION

4. Compters in Education
a. Computer Hardware
b. Computer Software
c. Application of Computers in Education
- i   CAI,CAL, CBT, CML [Characteristics and uses]
- ii   Preparation of CAI Package
- iii Evaluation of CAI Package

5. Internet in Education
a. Internet Tools, Search Engines and Browers
b. Application of Internet Resorces to Educations
c. Synchronous and Asynchronous Mode of Internet Communication
d. Educational Portals
e. Online Learning and Online Evaluation

MODULE V: DEVELOPMENT OF SELF LEARNING MATERIAL AND RESEARCH IN ICT

6. Concept and Preparation of Self Learning Material {SLM}
a. Concept of SLM
b. Concept of programmed Learning Material (PLM)
c. Historical overview of SLM and PLM
d. Types of PLM (Linear, Branching, Mathetics)
e. Preparation of SLM
f. Evalution of SLM

7. Research in ICT
a.   Overview of researches conducted in ICT
b.   Imerging research trends in ICT

ASSIGNMENTS FOR INTERNAL ASSESSMENT

1. Identify websites using search engines for any educational topic.
2. Preparation of Self Learning Material in any one subject.

REFERENCES

1. Clarlson,P.D.A. and Toomey, R.(1999)Whole School Reform and the Use of ICT: An Evaluation of the Navigator Schools Projects Melbourne : Department of Education, Employment and Training.

2.   Dowling C., Kwok-Wing Lai (2003) Information and Communication Technology '   Md the Teacher of the Future, International Federation for Information Processing Published by Springer

3. Eric E. B., Eric Braun (1994) The Internet Directory: A Guide to Internet, Usenet, and Bitnet, Fawcett Columbine, Original from the University of Michigan

4. Ghosh, P.P. ((2005) Modern Educational Technologies, Aavishkar Publishers, Distributers. Jaipur, Rajasthan.

5. Johnson, D. (1996). Evaluating the Impact of Technology: The Less Simple Answer, the Educational Technology Journal, Vol. 5, No. 5, January

6. Laurence, J C. (2006) Impact.of Digital Technology on Education, Rajat Publication, New Delhi.

7. Marilyn Leask, (2.001) Issues in Teaching Using ICT, Published by Routledge

8. Sagar K. (2005) Digital Technology in Education, Author press publication, New Delhi.

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