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ICT for Enhancing Teaching and Learning

Study Material: Units-3,4,5.

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UNIT -3: COMPUTER FUNDAMENTALS AND APPLICATIONS

3.1.1. Characteristics or Features of Computer System

A computer is an electronic device which performs arithmetic and logical operations at a very high speed and provides the results with a predefined accuracy. It has a large amount of storage capacity.

In general, a computer performs the following functions.

- It accepts data from the user through various input devices.
- It performs basic arithmetic and logical operations on the desired data.
- It provides the desired results.

Important features

1. *Speed*

It is one of the important characteristics of the computer. It works at a very high speed and provides the output in fraction of a second. A powerful computer can handle trillions of instructions per second. The speed of the computer is measured in micro seconds and nanoseconds.

2. *Accuracy*

A computer can perform the calculations at almost 100% accuracy. A computer never commits errors. Errors may occur in a computer, but only because of wrong human input or improper program.

3. *Memory*

A computer has a built-in memory, where it can store a large amount of data. It has different types of memory, viz., primary memory, secondary memory and cache memory.

4. *Storage capacity*

A computer can store large amount of data. The storage capacity of the computer is commonly measured in Mega-Bytes (MB), Giga-Bytes (GB), Tera-Bytes (TB), and Penta-Bytes (PB).

Note: 1 KB = 1024 Bytes, 1 MB = 1024 KB, 1 GB = 1024 MB, 1 TB = 1024 GB, 1 PB = 1024 TB.

5. *Diligence*

Unlike human beings, the computer never gets tired or lacks its concentration. It can work for hours without any fatigue. It provides the results with same accuracy from the beginning to the end. There is no degeneration in the quality of the output produced by the computer.

6. *Versatile*

It is one of the wonderful features of the computer. It has the ability to perform completely different kinds of works with same accuracy and efficiency at the same time. It is not just a calculating device anymore. For example, it can be used to prepare documents, and the next moment it can be used for any multimedia task, etc.

7. *Reliability*

The results obtained by the computer are very reliable. But this is true when the data given to the computer is correct and reliable.

8. *Consistency*

If the computer is given the same set of data multiple times, it will give the same result each time.

3.2 Computer Hardware and Software

Hardware of Computer System

The physical parts of the computer system which we can see and which we can touch is called computer hardware.

Internal Hardware: Processor, Motherboard, RAM Memory, ROM Memory, Hard Disk Drive, Power supply unit are the basic hardware components of the computer system.

External Hardware (Peripherals):

Input devices: Keyboard, Mouse, Scanner, Barcode reader, OMR, OCR, MICR, Track ball, Joy stick, Touch screen, Voice recognition system, etc.

Output devices: Monitor, Printer, Plotter and Speakers.

Storage devices: Floppy disc, C.D (Compact Disc), D.V.D (Digital Versatile Disc), Pen Drive.

Some important computer hardware components

1. Mother board

The motherboard is the main component inside the system unit (case). It is an integrated circuitry that connects the other parts of the computer. Components directly attached to the motherboard include: central processing unit (CPU), chip set, RAM (Random Access Memory), BIOS (Basic Input Output System) and internal buses.

2. Power Supply Unit

Power supply unit converts high voltage AC power to low-voltage DC power for the internal components of the computer. Power supply units used in computers are always Switch Mode Power Supplies (SMPS). The SMPS provides regulated direct current power at several voltages required by the motherboard and accessories such as disk drives and cooling fans.

3. Input devices

The device which is used to input the information into the computer is input device. Data and instructions are entered into a computer through input devices. An input device converts input data and instructions into suitable binary form which can be accepted by the computer. There are a large variety of input devices.

Text Input device

Keyboard: The commonly used input device is key board. Programs and data are entered into a computer through a key board which is attached to a computer. A key board is similar to key board of a type writer. It contains alphabets, digits, special characters and some control keys. When a key is pressed, an electronic signal is produced which is detected by an electronic circuit known as key board encoder.

Pointing devices

Mouse: It is a pointing device. It is a hand-held device and moved across a flat surface. When user moves the mouse on a flat surface the cursor moves on the monitor screen in the direction of the mouse's movement. By moving the mouse, the user can point to menu on the screen. By clicking the button on the mouse, the user communicates his choice to the computer. The mouse is also used to draw sketches, diagrams etc. on the monitor screen. A mouse has one or more buttons on the surface for the control purpose. An optical mouse uses laser light for its working.

Trackball: It is a pointing device that contains a protruding ball housed in a socket that can rotate in any direction. The user spins the ball in different directions to move the cursor on the monitor screen. This type device is normally used in Laptop computers.

Gaming devices

Joystick: It is also a pointing device. It is used to move the cursor position on a monitor screen. Its function is similar to that of a mouse. A joy stick is a stick which has spherical ball at its upper end as well as its lower end. The lower spherical ball moves in a socket. The joy stick can be moved left, right forward or backward. It is mainly used for playing the games.

Game controller: A specific type of controller specialized for certain gaming purposes.

Optical Scanners

Image Scanner: In some situations, information, picture or text, is available on paper and is needed on the computer disc. The simplest way is to take a photograph of the image directly from the source and convert it into a form that can be saved on the disc and then printed. A scanner scans an image and transforms the image to the code used by the computer.

It provides faster and more accurate data entry. It is capable of entering information directly into the computer. The main advantage of direct entry of information is that users need not have to key (type) the information.

Optical Mark Reader (OMR): Special marks such as bubble or square are prepared on examination answer sheets or questionnaires. The users fill in these bubbles or squares with soft pencil or ink to indicate their choice. These marks are detected by an optical mark reader and the corresponding signals are sent to the processor. This method is used, where one out of few alternatives is to be selected and marked. For example, objective type answers sheets (multiple choice where choice is restricted to one out of a few choices.

Optical Character Reader (OCR): An optical character reader detects alphanumeric characters printed or type written on paper. It may be a hand-held scanner or a page scanner to detect light reflected from a line or from a page of text. An OCR can scan several thousands of printed or type written characters per second. They are used in large volume applications such as computer-oriented bills prepared by public utilities.

Optical Bar Code Reader: This method uses a number of bars (lines) of varying thickness and spacing between them to indicate the desired information. Bar codes are used in most grocery items. An optical bar code reader can read such bars and convert them into electric pulses to be processed by a computer. The most commonly used bar code is Universal Product Code (UPC). The UPC code uses a series of vertical bars of varying widths. These bars are detected as ten digits. The first five digits identify the supplier or manufacturer of the item. The second five digits identify individual product.

A point-of-sale terminal often contains an optical bar code reader. The bar code reader reads the bar-code of an item. The bar-code is decoded and data is sent to the computer. The computer prints the name of the item, its price and other necessary information on the receipt.

Magnetic Ink Character Reader (MICR): Human readable characters are printed on documents such as cheques using a special ink that contains magnetizable particles of iron oxide. Special font has been set for these characters by American Banking Association. A magnetic ink character reader reads these characters by examining their shapes, using 7x10 matrix. It is widely by banks to process large volumes of cheques and deposit forms written every day. A special type of cheque is used in banks that are processed using MICR. In a cheque, the branch code and the cheque number are preprinted at the bottom using magnetic ink.

Audio input device

Microphone: It is an acoustic sensor that provides input by converting sound into electrical signals.

Video input device

Web cam: A video camera is used to provide visual input that can be easily transferred over the internet.

Voice input systems

Data entry into a computer manually using keyboard is a time-consuming and laborious job. It will become very easy if we can talk to a computer.

In a voice input system, the speech is converted into electrical signals employing a microphone. The signals are sent to the processor for processing. The signal pattern is compared with the pattern already stored in the memory. A word is recognized only when a choice match is found, and the computer gives a corresponding output. At present a voice recognition system is very costly. In future it is expected to become cost effective and will be used for direct entry of data.

Touch screen

A touch screen is an electronic visual display that can detect the presence and location of a touch within the display area. The term generally refers to touching the display of the device with a finger or hand. Touch screens can also sense other passive objects, such as a stylus. Touch screens are common in devices such as all-in-one computers, tablet computers, and smart phones.

It enables one to interact directly with what is displayed. Such displays can be attached to computers, or to networks as terminals. They also play a prominent role in the design of digital appliances such as the personal digital assistant (PDA), satellite navigation devices, mobile phones, and video games.

4. Output devices

The output devices receive information from the computer and provide them to users. The computer sends information to the output devices in binary coded form. The output devices convert them into a form which can be used by users such as printed form or display on a screen.

*Monitor***:** It is the most common output device. A monitor is an electronic visual display for computers. It is also known as visual display unit (V.D.U). The first computer monitors used Cathode ray tubes (CRTs), which was the dominant technology until they were replaced by LCD monitors in the 21st Century.

Printer: Printers are commonly used output devices. They provide information in a permanent readable form. They produce printed output of results, programs and data. Printers which are used with computers are classified as follows.

i) Character printers: Dot matrix printer

ii) Line printers: Drum printer, Chain printer

iii) Page printers: Laser printer

A character printer prints one character of the text at a time. A line printer prints one line of the text at a time. A page printer' prints one page of text at time.

*Plotter***:** It is also an output device. It is used to produce precise and good quality graphics and drawings under computer's control. They use ink pen or ink-jet to draw graphics or drawings. Either single colour or multi colour pens can be used. The pens are driven by motor. Drawings can be prepared on paper or polyester film (mylar plastic).

*Speaker***:** it is an output device that produces sound through an oscillating transducer called a driver. The equivalent input device of speaker is microphone.

5. Storage devices

Primary storage

RAM

- The read and write memory of a computer is called RAM.
- The users can write information into RAM and read information from it.
- It is accessible to users. The user enters his program and data into RAM.
- RAM is a volatile memory. The information written into it is retained in it as long as the power supply is on. As soon as the power supply goes off its stored information is lost.

ROM

- ROM stands for "Read Only Memory".
- It is non-volatile memory, i.e. the information stored in it is not lost even if the power supply goes off. It is used for permanent storage of information.

Secondary storage

- The secondary memory is used for bulk storage of programs, data and other information.
- It has much larger capacity than the main memory.
- The secondary memory is non-volatile.
- The most common secondary storage device is hard disk.

Hard Disk

The hard disk is made up of a collection of disks Known as platters. These platters are coated with a material that allows data to be magnetically recorded. The disks rotate at a very high speed. A typical speed is 3600 revolutions per minute. It is installed inside the computer.

Removable storage devices

CD-ROM (Compact Disc Read Only Memory)

The CD-ROM stands for compact Disc-Read Only Memory. CD-ROMs are used to store a wide variety of information like multimedia encyclopaedias, books, games, video libraries, presentations and more. The advantage is that it is a portable media and can store a large amount of data.

CD-ROM's are available in two forms:

i. **CD-R:** It is also called as the Recordable CD It is written once and can be read again and again. Data once written cannot be erased.
ii. **CD-RW**: It is also called as erasable CD. It is a recording system that allows the user to erase previously recorded information and then to record new information onto the same physical location on the disk.

CD-ROM Drive - a device used for reading data from a CD.

CD Writer - a device used for both reading and writing data to and from a CD.

DVD (Digital Versatile Disc)

The next generation of CD-ROM is called "DVD-ROM". It stands for digital versatile disc. A DVD is the same size as a compact disc. It is the most common way of transferring digital video, and is popular for data storage.

Physically, A CD-ROM and a DVD-ROM are similar. DVD represents the first merging of three technologies, namely computer, audio, and television, into one common format.

DVD-ROM Drive - a device used for reading data from a DVD.

DVD Writer - a device used for both reading and writing data to and from a DVD.

*Floppy Disk***:** It is an outdated secondary storage device. Floppy disks are individually packed disks. The recording medium on floppies is a mylar or vinyl plastic material with magnetic coating on one or both sides. Floppies are available in the following sizes:

- "5 1/4" diameter. This floppy has a storage capacity of 1.2 MB.
- "3 1/2" diameter. This floppy has a storage capacity of 1.44 MB.

Note: A device called floppy drive will be required in the computer systems to use these floppies.

*Magnetic Tapes***:** Magnetic tapes are similar to audio or video tapes except with the difference that magnetic tapes are coated with magnetically material. A Large variety of magnetic tapes are available commercially. Currently smaller size tapes, called cartridges are available with the size of our audio and video cassettes.

6. Cards

Cards are components added to computers to increase their capability.

Sound cards allow computers to produce sound like music and voice.

Colour cards allow computers to produce colour (with a colour monitor of course)

Video cards allow computers to display video and animation.

Network cards allow computers to connect together to communicate with each other.

COMPUTER SOFTWARE

- An instruction is a command given to the computer to do a particular task.
- A sequence of instructions is called program.
- A set of programs written for a computer is called software.

- *Software can be defined as a set of programs, procedures, algorithms and its documentation.*
- Computer software is a collection of computer programs and related data that provide the instructions for telling a computer what to do and how to do it.
- The instructions in the program direct the computer to perform input operations, process the data and output the results.

The software can be classified in to the following categories

1. System Software
2. Application Software

1. System Software

- System software is a set of one or more programs that are basically designed to control the operation of a computer system.
- It is a software which is designed to operate the computer hardware and to provide a platform for running application software.
- It offers a protective shield to all software applications.
- It coordinates all external devices of computer system like keyboard, monitor, printer, etc.
- Operating System (O.S), Assembler, Compiler, Interpreter and Utilities are the examples of System Software.

Operating System

An operating system is a collection of programs that controls the overall operation of a computer. It is a master control program that runs the computer. It controls the flow of signals from CPU to various part of the computer. When the computer is switched on, operating system is the first program loaded into the computer's memory.

Examples: MS-DOS. Windows, Apple Mac, UNIX, Linux, and OS /2.

Assembler

Assembler is a program which translates an assembly language program into a machine language program

Compiler

Compiler is a program which translates a high-level language program into a machine language program. A compiler goes through the entire program and then translates the entire program into machine codes.

Interpreter

An interpreter is a program which translates one statement of a high-level language program into machine code and executes it. In this way it proceeds further till all the

statements of the program are translated and executed. An interpreter is smaller program as compared to the compiler. A compiler is faster than an interpreter.

Utilities

The programs which are helpful to the users in developing, writing, debugging and documenting programs are called utility programs or utilities. These are software tools to help users while preparing programs.

For example, a storage backup program, a disk and file recovery program, virus scanner and remover etc. are some of the utilities.

2. Application Software

- It is a program or group of programs designed for end users.
- It is designed to help the user to perform specific tasks.
- It is generally used for commercial purpose.
- It pertains to one specific application.

Different Types of Application Software:

Word Processing Software: It allows users to create, edit a document.

Example: MS Word, Word perfect, word star etc.

Spreadsheet Software: It allows users to create document and perform calculation.

Example: Excel, Lotus1-2-3 etc.

Database Software: It allows users to store and retrieve vast amount of data. Example: MS Access, Oracle etc.

Presentation Graphic Software: It allows users to create visual presentation. Example: MS Power Point

Multimedia Software: It allows users to create images, audio, video etc.

Example: Real Player, Media Player etc.

Additional Information

Command: Any instruction given to the computer to do a particular task.

Program: A set of instructions or commands given to a computer and written in a computer language

Low Level Language: A programming language in which statements are written using 0's and 1's only. It is also called machine language.

High Level Language: A programming language written using English words, mathematical symbols and numbers.

Compiler: A translator program which generates a low-level language program from a high-level language program.

Interpreter: A translator program which translates and executes a program written in a high-level language, line by line.

Source Program: The program written in high level language.

Object Program: The translated program in machine language.

3.3. OPERATING SYSTEM

Concept of Operating System

- Operating system is software. It comes under System software.
- System software is a collection of programs which control the overall functions of computer.
- An operating system is a set of programs that manages all other components of the computer system.
- An operating system is a program designed to run other programs on a computer.
- Without an operating system, a user cannot run an application program on his computer, unless the application program is self-booting.
- It is considered the backbone of a computer, managing both software and hardware resources.
- It can also be considered as brain of the computer. A computer without an operating system is like a man without brain.

Operating system is responsible for everything from the control and allocation of memory to recognizing input from external devices and transmitting output to computer display. It also manages files on computer hard disk and control peripheral devices like printers and scanners. An operating system also has a vital role to play in security. It prevents unauthorized users from accessing the computer system.

Example of operating systems: MS DOS, MS Windows, UNIX. Some of the popular modern operating systems are Linux, Android, Apple Mac.

Different Types of Operating Systems

1. Single User Operating System: A Single-user operating system allows only one user at a time to access the computer.

Ex: MS DOS, Windows 95.

2. Multi-User Operating System: A multi-user operating system allows two or more users to access a computer at the same time. This type of operating system may be used for just a few people or hundreds of them. In fact, there are some operating systems that are used to allow thousands of people to run programs at the same time. The actual number depends on hard ware and O.S design.
Ex: UNIX operating system.

3. Network Operating System: An operating system that enables a computer to participate in a network is known as the Network operating system.
Ex: Windows NT, Novell Netware, Variants of UNIX like IRIX, Linux, HP-UNIX and Solaris.
4. Multiprocessing Operating System: A multiprocessing operating system allows a program to run on more than one processor at a time. This can come in very handy in some work environments, at schools, and even for some home-computing situations.
5. Single Tasking Operating System: A single tasking operating system allows only one program to execute at a time, and the program must finish executing completely before the next program can begin.
6. Multitasking Operating System: A multitasking operating system allows a single CPU to execute more than one program at a time.
7. Multithreading Operating System: Multithreading operating systems are more different, allowing varied parts of one program to be used simultaneously.
8. Real-time Operating System: Real-time operating systems are designed to allow computers to process and respond to input instantly. Usually, general-purpose operating systems, such as disk operating system (DOS), are not considered real time, as they may require seconds or minutes to respond to input. Real-time operating systems are typically used when computers must react to the consistent input of information without delay. For example, real-time operating systems may be used in navigation.

Functions of Operating System

1. Providing a user interface – Users interact with application programs and computer hardware through a user interface. Operating system acts as an interface between user and hardware of computer system. Almost all operating systems today provide a windows-like Graphical User Interface (GUI).

Note:

User interface is a term used to describe the communication between people and computer systems.

CLI (**C**ommand **L**ine **I**nterface) is a form of interface where the user types commands for the computer to carry out.

GUI (**G**raphical **U**ser **I**nterface) is an interface where the user issues commands by using a pointing device (e.g. mouse) to point and click on icons, buttons, menus and lists on the screen.

2. Managing Resources: Operating system coordinates all the computer's resources. It acts as a resource manager.

Processor management: assignment of processor to different tasks being performed by the computer system.

Memory management: allocation of main memory and other storage areas to the system program as well as user programs and data.

Input/output management: co-ordination and assignment of the different output and input device while one or more programs are being executed.

File management: the storage of files in various storage devices. It also allows all files to be easily changed and modified through the use of text editors or some other devices.

3. Running applications: Operating system load and run applications such as word processors and spread sheets. Most operating systems support multitasking, or the ability to run more than one application at a time. When a user requests a program, the operating system locates the application and loads it into the primary memory or RAM of the computer. As more programs are loaded, the operating system must allocate the computer resources.

4. Support for built-in utility programs –The operating system uses utility programs for maintenance and repairs. *Utility programs* help identify problems, locate lost files, repair damaged files, and backup data.

5. Control to the computer hardware – The operating system sits between the programs and the Basic Input Output System (BIOS). The BIOS controls the hardware. All programs that need hardware resources must go through the operating system. The operating system can either access the hardware through the BIOS or through the device drivers.

6. Providing Security: Operating system takes the responsibility of data security also. Providing protection to programs and data and to ensure data security is one of the functions of operating system. Data security is important in organizations like banks, defence departments etc., The O.S maintains the pass words and other security settings of the computer.

Services provided by Operating system

Program Execution: Loading the program into memory, executing and terminating the program.

Error Detection: Identifying and repairing errors detected while processing user requests. For example: keyboard errors, shortage of memory etc.

Resource Allocation: Management of available resources and allocation of resources to different users.

Input and Output Operation: Execution of input and output requests involving devices and files.

File Management or Manipulation: Executing request for read, write, rename or delete the data file as well as file management services.

Accounting: Maintaining accounts of users of the resources.

3.5.1. Concept, Uses, Types and Applications of Computer Networks

Concept of Computer Network

A computer network is a collection of computers interconnected by communication channels that allow sharing of resources and information.

It is a collection of autonomous computers interconnected by a single technology. Two computers are said to be interconnected if they are able to exchange information. Copper wire, fiber optics, micro waves, infrared rays or communication satellites can be used for connecting the computers.

Uses of Computer Networks

1. **Sharing of computing resources**: In a networked environment, each computer on the network may access and use the resources provided by devices on the network. All equipment, programs and data is available to anyone on the network. For example, a group of office workers share a common printer or scanner.
2. **Sharing of files, data, and other types of information:** In a network environment, authorized users may access data and information stored on other computers on the network. The capability of providing access to data and information on shared storage devices is an important feature of many networks.
3. **Communication medium**: Using a network, people can communicate efficiently and easily via email, instant messaging, chat rooms, telephone, video telephone calls, and video conferencing. A computer network can provide a powerful communication medium among the employees. For example, employees generally use E-mail for daily communication. Another form of computer assisted communication is video conferencing. Using this technology, employees at distant locations can hold a meeting, seeing and hearing each other and even writing on a shared virtual black board. Video conferencing is a powerful tool for eliminating the cost and time previously devoted to travel. It is sometimes said that communication and transportation are having a race, and whichever wins will make the other obsolete. Video conferencing is very useful even in government administration.
4. **Transaction platform**: A computer network can be used to place orders for financial products over a network. This includes products such as shares, bonds, currencies, commodities and derivatives with a financial intermediary, such as a

brokers, market makers, Investment banks or stock exchanges. Such platforms allow electronic trading to be carried out by users from any location. Many people already pay their bills, manage their bank accounts and handle their investments electronically.

5. **E-commerce**: Electronic commerce, commonly known as e-commerce, refers to the buying and selling of products or services over electronic systems such as the Internet and other computer networks. However, the term may refer to more than just buying and selling products online. It also includes the entire online process of developing, marketing, selling, delivering, servicing and paying for products and services. Home shopping is already popular and enables users to inspect the on-line catalogs of thousands of companies.
6. **Access to remote information:** A computer network provides access to remote information in many ways. One can get information on any topic through web. Newspapers have gone on-line and can be personalized. One can read newspapers on-line and selected articles can be downloaded. The next step beyond newspapers is on-line digital library. Many international organizations like UNESCO have many journals and conference proceedings on-line. Instant messaging facility allows two persons to type messages at each other in real time. A multi person version of this idea is the chat room, in which a group of people can type messages for all to see. Newsgroups (discussion forums) are available for discussing issues related to any topic. On them you may post your questions, observations, ideas for new features, and reports of possible bugs.

Types of Computer Networks

Networks may be classified according to a wide variety of characteristics.

Types of networks based on physical scope: Networks are often classified as local area network (LAN), wide area network (WAN), metropolitan area network (MAN), personal area network (PAN), campus area network (CAN), and others, depending on their scale, scope and purpose,

Local Area Network (LAN)

It is a network that connects computers and devices in a limited geographical area such as home, school, computer laboratory, office building, or closely positioned group of buildings. Each computer or device on the network is a node. Current wired LANs are most likely to be based on Ethernet technology.

The defining characteristics of LANs, in contrast to WANs (Wide Area Networks), include their higher data transfer rates, smaller geographic range, and no need for leased telecommunication lines

Wide Area Network (WAN)

A wide area network (WAN) is a computer network that covers a large geographic area such as a city, country, or spans even intercontinental distances, using a communications channel that combines many types of media such as telephone lines, cables, and air waves. A WAN often uses transmission facilities provided by common carriers, such as telephone companies.

The best example of a WAN is the Internet, which is a network composed of many smaller networks. The Internet is considered the largest network in the world.

Metropolitan Area Network (MAN)

A Metropolitan area network is a large computer network that usually spans a city or a large campus.

Personal Area Network (PAN)

A personal area network (PAN) is a computer network used for communication among computer and different information technological devices close to one person. Some examples of devices that are used in a PAN are personal computers, printers, fax machines, telephones, PDAs, scanners, and even video game consoles. A PAN may include wired and wireless devices. The reach of a PAN typically extends to 10 meters.

Campus Network

A campus network is a computer network made up of an interconnection of local area networks (LAN's) within a limited geographical area. The networking equipment (switches, routers) and transmission media (optical fiber, copper plant, Cat5 cabling etc.) are almost entirely owned (by the campus tenant / owner: an enterprise, university, government etc.).

In the case of a university campus-based campus network, the network is likely to link a variety of campus buildings including; academic departments, the university library and student residence halls.

Global Area Network

A global area network (GAN) is a network used for supporting mobile communications across the satellite coverage areas. The key challenge in mobile communications is handing off the user communications from one local coverage area to the next.

Internet

The Internet is a global system of interconnected governmental, academic, corporate, public, and private computer networks. It is based on the networking technologies of the Internet Protocol Suite. It is the successor of the Advanced Research Projects Agency Network (ARPANET) developed by DARPA of the United States Department of Defense. The Internet is also the communications backbone underlying the World Wide Web (WWW).

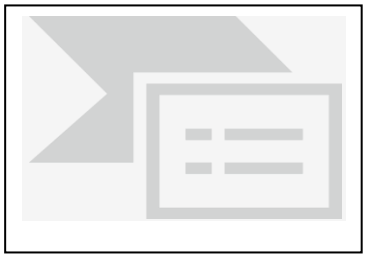
Types of Computer Networks based on Topology

In computer networking, *topology* refers to the layout of connected devices. Network topologies are categorized into the following basic types:

- bus
- ring
- star
- tree

More complex networks can be built as hybrids of two or more of the above basic topologies.

Bus Network Topology

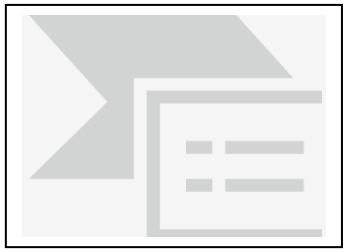


Bus networks use a common cable to connect all devices. A single cable functions as a shared communication medium. A device wanting to communicate with another device on the network sends a broadcast message onto the wire that all other devices see, but only the intended recipient actually accepts and processes the message. The following diagram illustrates the bus network topology.

Ring Network Topology

In a ring network, every device has exactly two neighbors for communication purposes. All messages travel through a ring in the same direction (either "clockwise" or "counterclockwise"). A failure in any cable or device breaks the loop and can take down the entire network. The following diagram illustrates the ring network topology

Star Network Topology



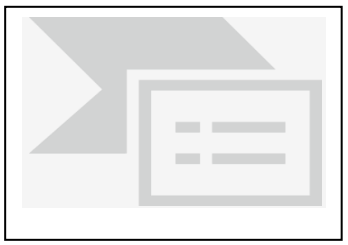
Many home networks use the star topology. A star network features a central connection point called a "hub" that may be a hub, switch or router. Devices typically connect to the hub with Unshielded Twisted Pair (UTP) Ethernet.

Compared to the bus topology, a star network generally requires more cable, but a failure in any star network cable will only take down one computer's network access and not the entire LAN. (If the hub fails, however, the entire network also fails.)

The following diagram illustrates the star network topology. A star topology typically uses a network hub or switch and is common in home networks.

Tree Network Topology

Tree topologies integrate multiple star topologies together onto a bus. In its simplest form, only hub devices connect directly to the tree bus, and each hub functions as the "root" of a tree of devices. This bus/star hybrid approach supports future expandability of the network much better than a bus (limited in the number of devices due to the broadcast traffic it generates) or a star (limited by the number of hub connection points) alone.



The following diagram illustrates the tree network topology. A tree topology integrates the star and bus topologies in a hybrid approach to improve network scalability.

Applications of Computer Networks

1. Radio and television broadcasting: It is the most common communication service. Various stations (programs) transmit signals simultaneously over radio or cable distribution networks. User can select station or program of his interest.

2. Telephone service: It is the most common real time service provided by a communication network. Two people can communicate by transmitting their voices across the network.

3. Cellular telephone service: It extends the normal telephone service to mobile users who are free to move within a regional area covered by the network.

4. Electronic mail: It is another popular network service. Electronic mail, commonly called e-mail, is a method of exchanging digital messages from a person to one or more recipients. Modern e-mail operates across the Internet or other computer networks. Some early email systems required that the author and the recipient both be online at the same time, in common with instant messaging. Today's email systems are based on a store-and-forward model. Email servers accept, forward, deliver and store messages. Neither the users nor their computers are required to be online simultaneously

5. Video on demand: It is a system which allows users to select and watch video or audio content on demand. IPTV technology is often used to bring ‘video on demand’ to televisions and personal computers This is an interactive service. It provides access to video library. The user initiates the service by accessing a menu from which a selection is made. The server that contains the selection begins to transmit the video information across the network to the user.

6. Audio conferencing: It involves the exchange of voice signals among a group of speakers.

7. Video conferencing: Videoconferencing uses telecommunications of audio and video to bring people at different sites together for a meeting. This can be as simple as a conversation between two people in private offices (point-to-point) or involve several sites (multi-point) with more than one person in large rooms at different sites. Besides the audio and visual transmission of meeting activities, videoconferencing can be used to share documents, computer-displayed information.

3.5.2. Internet and World Wide Web

Internet

Internet is not a single network. But it is a vast collection of different networks that use certain common protocols and provide certain common services. It is an unusual system in that it was not planned by anyone and is not controlled by any one. Internet is the interconnection of several computers belonging to various networks around the globe. It was developed to enable communication between computers that were attached to different networks.

The Internet is a global system of interconnected computer networks that use the standard Internet Protocol Suite (TCP/IP) to serve billions of users worldwide. It is a *network of networks* that consists of millions of private, public, academic, business, and government networks, of local to global scope, that are linked by a broad array of electronic, wireless and optical networking technologies. The Internet carries a vast range of information resources and services, such as the inter-linked hypertext documents of the World Wide Web (WWW) and the infrastructure to support electronic mail. It is the largest data network in the world.

The computer which is connected to the internet is called host computer or node. For a computer to communicate directly with other computers on the internet, it must have its own IP address (internet protocol address). This IP address must be unique in the entire Internet and it is used for host identification.

Today most end users who want internet connection use the services of internet service providers (ISPs). There are international service providers, national service providers, regional service providers, and local service providers. The internet today is run by private companies, not the government.

World Wide Web (W.W.W or simply Web)

World Wide Web is a hypertext system which allows access to interlinked hypertext documents. It is one of the popular applications of the internet. It is an easy-to-use feature of the internet.

The W.W.W is a worldwide, Internet-based, multimedia presentation system. It is a system of cooperating internet host computers that offer multimedia presentations; indexes, cross references, and text search capabilities so that users can find text documents across the globe. It is a collection of servers on the internet that provide web pages (hyper text documents) to the clients that request to receive them. Web pages are usually written in HTML (*Hyper Text Markup Language*). The World Wide Web supports many kinds of documents such as text, formatted text, pictures, video, and

sounds. The WWW uses internet to transmit hypertext documents between computer systems nationally or internationally.

The World Wide Web refers to the body of information – the abstract space of knowledge. It is a compilation of millions of hypertext documents, has brought together information from all over the world, 'just a click away'.

Presence of hyperlinks, the worldwide availability of content and universal readership is some of the striking features of the World Wide Web. The interlinked hypertext documents form a web of information. The information on the web is available 24/7 across the globe. It is updated in real time and made accessible to web users around the world. Except for certain websites requiring user login, all the other websites are open to everyone. This all-time availability of information has made the Internet, a platform for knowledge-sharing.

World Wide Web activity began in March 1989 and completed by 1991. Tim Berners Lee, a physicist of CERN (European Centre for Nuclear Research) proposed the networked hypertext concept to transmit documents and to communicate among members in the physics community. Tim Berners Lee is known as father of World Wide Web.

Working of World Wide Web

The working world wide web is based on client-server technology. The network of web servers serves as the backbone of the World Wide Web. The Hypertext Transfer Protocol (HTTP) is used to gain access to the web. A web browser makes a request for a particular web page to the web server, which in turn responds with the requested web page. It then displays the web page as requested by the user.

Each resource on the web is identified by a globally unique identifier (URL – Uniform Resource Locator). With the help of this URL, browser accesses the web sites.

Distinction between Internet and World Wide Web

The terms Internet and World Wide Web are often used in every-day speech without much distinction. However, the Internet and the World Wide Web are not one and the same. The Internet is a global system of interconnected computer networks. In contrast, the Web is one of the services that run on the Internet. It is a collection of textual documents and other resources, linked by hyperlinks and URLs, transmitted by web browsers and web servers. In short, the Web can be thought of as an application "running" on the Internet.

While the Internet is an infrastructure providing interconnectivity between network computers, the web is one of the services of the Internet. It is a collection of documents that can be shared across Internet-enabled computers.

The World Wide Web is a system of hypertext documents that are linked to each other. Internet is the means to access this set of interlinked documents. These hypertext documents can contain text, images or even audio and video data. The World Wide Web, serving as an enormous information base, has also facilitated the spread of this

information across the globe. It has led to the emergence of the Internet age. It will not be an exaggeration to say that the Internet owes its popularity to the World Wide Web.

3.5.3. Some important Internet Concepts

1. **Internet Service Provider (I.S.P)**

- It is an organization that provides internet connections and services.
- It provides access to the internet, usually for a fee.

Examples:

Reliance Jio, Airtel, Vodafone Idea, ACT Fibernet, BSNL (Bharat Sanchar Nigam Limited), MTNL (Maha Nagar Nigam Limited).

2. **IP Address**

- Each computer connected to the internet is called host computer.
- Each host computer has some unique address so that it can be identified by the network known as IP address.
- An IP address is a unique address that identifies a device on the internet or a local network.
- IP stands for "Internet Protocol," which is the set of rules governing the format of data sent via the internet or local network.

3. **Website**

- A website is a place in the internet where an organisation or individual can store its or his information.
- A website is a collection of web pages.
- Web pages usually contain hyperlinks to other pages and resources.
- A website site is identified by a common domain name.
- Each website has its own address known as URL (Uniform Resource Locator).
- A **URL** is nothing but address of a web resource.

Ex: http://www.anu.ac.in,http://www.indianrail.gov.in

- Websites are usually dedicated to a particular topic or purpose, such as news, education, commerce, entertainment, or social networking.
- Hyperlinking between web pages guides the navigation of the site, which often starts with a home page.
- The first page of the website is known Home Page.
- Users can access websites by using a web browser.

Examples for websites:

Some educational websites are given below.

https://ncert.nic.in, https://scert.gov.in, https://ugc.ac.in, https://ncte.gov.in, https://apsche.ap.gov.in, https://anu.ac.in

4. Web Server

- A web server is a computer that runs websites.
- It is used to store, process and deliver web pages to the users.
- It uses Hypertext Transfer Protocol (HTTP) for delivering web pages.
- A web server is an internet server that responds to http requests for delivering contents and services.

Examples:

Apache **Web Server**, IIS **Web Server**, and LiteSpeed **Web Server** are some popular web servers.

5. URL (Uniform Resource Locator)

- URL stands for ***Uniform Resource Locator***.
- A URL is nothing but the address of a web resource.
- In simple language, it is known as website address.
- A URL is an address that shows where a particular web page can be found on the World Wide Web.
- Most web browsers display the URL of a web page above the page in an address bar.
- A typical URL could have the form http://www.example.com/index.html, which indicates a protocol (http), a hostname (www.example.com), and a file name (index.html).
- All URLs on the Web start with either *http:* or *https:* which means the browser will retrieve them with the Hypertext Transfer Protocol (HTTP).
- In the case of *http:*, the communication between the browser and the web server is encrypted for the purposes of security and privacy.

6. Web Browser

- A web browser is application software for accessing World Wide Web.
- The purpose of a web browser is to get content from the Web and display it on a user's device.
- When a user requests a web page from a particular website, the web browser retrieves the necessary content from a web server and then displays the page on the user's device.

Examples: Some popular web browsers are given below.

- Google Chrome
- Mozilla Firefox
- Microsoft Internet Explorer (IE)
- Microsoft Edge
- Apple Safari

- Chromium
- UC
- Opera

7. <u>Web Search Engine</u>

- A search engine is a website through which users can search internet content.
- A search engine searches for information on the World Wide Web.
- It is a web-based tool that enables users to locate information on the World Wide.

Examples: Some popular web search engines are given below.

- Google
- Microsoft Bing
- Baidu
- Yahoo
- Yandex
- Ask
- DuckDuckGo
- AOL
- Altavista
- Yahoo
- MSN Search.

3.5.4. E-Mail

<u>Meaning</u>

- E-mail is the short of electronic mail.
- It is one of the popular applications of internet in the field of education.
- It is a method of exchanging messages between people using electronic devices.
- It is a best means of communication in the modern world.
- It allows individuals and groups to communicate with one another electronically.
- It operates across the Internet or other computer networks.
- Today's email systems are based on a store-and-forward model. Email servers accept, forward, deliver and store messages. Neither the users nor their computers are required to be online simultaneously.
- Email can be very formal (a business letter) or informal (a quick reminder memo). Email can be used for personal communication or professional communication.
- It can be long (contain an attachment) or very short (a note).

<u>Characteristics of E-mail</u>

- It is very fast.
- It is relatively cheap.
- It is highly reliable.
- It is highly secure.

- It is accessible from anywhere – as long as you have an internet connection.
- It is paperless, and therefore, beneficial for the planet.
- One can send the same message to any number of persons at a time.
- One can give the reply to received mail instantly.
- One can forward the received mail to others.

Uses of E-mail

Information Exchange

It can be used as a means of information exchange. E-mail messages can include a wide variety of information. One can send information directly to Individuals, small groups or large groups.

Brainstorming and Problem Solving

Although brainstorming and problem solving typically occur in face-to-face meetings in a class room, we can use email to help with these activities. By asking everyone to send their views about the problem and two or three possible solutions over email, one can organize a draft proposal to circulate to everyone. One might include the three or four most commonly cited solutions to the problem. By getting possible solutions in front of concerned people before you meet, you can make more progress when you convene a face-to-face meeting.

Record Keeping

Unlike telephone and face-to-face conversations, email "conversations" provides a built-in record of what you have asked for and what information you have received. By saving a copy of the messages you send, you can keep track of exactly what you asked for and when. By keeping a copy of messages you receive, you can remind yourself when it is time to follow up a request for information with a second email message or a telephone call.

Group Work

Groups use email to send messages to one another and produce documents together. For example, suppose your study group has a question about the material in a class. Instead of four or five people calling the teacher, one person can send an email message and distribute the answer to the study group. Or if you are writing a proposal with eight group members, you can email your section to everyone else. The other group members can then make changes and add to your text. E-mail's advantage is that other people can respond to your ideas quickly and easily.

Email also allows you to create distribution lists. For instance, a list including the eight group members on the proposal team means that you only have to send the message once, not eight times. Teachers often create distribution lists for their classes. 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—for example, 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.

Staying in Touch Socially

As more and more computer users connect to the Internet from home computers, email replaces telephone calls and letters that used to keep family and friends in touch.

Transmitting Documents

One can send longer documents electronically by attaching a file to an e-mail message. E-mail is used to transfer text, program files, spreadsheets, and even photographic images. Sending documents, data, and pictures electronically is much faster than sending them through a surface carrier. By attaching a file, one can

- Submit abstracts or papers to conferences or journals.
- Send a draft-in-progress to a friend, teacher, or some tutor.
- Send digital pictures to a friend.
- Send a table of data to a co-researcher.

The best free e-mail services to use in 2021

- Best overall email service: Gmail.
- Best email for Windows users: Outlook.
- Best email for Apple users: iCloud.
- Best email for small business: Zoho & Outlook.

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UNIT 4: ICT ENRICHED LEARNING EXPERIENCES

4.2 Application and Use of Multimedia Educational Software

Concept of Multimedia

Multi is a prefix that means more than one. Media on the other hand basically means anything that facilitates communication, for example Radio, T. V., newspapers etc. Multimedia therefore means anything that uses more than one medium to convey information. It can refer to text, sound, graphic, still images, art, animation and any combination that is delivered at once.

Multimedia is nothing but the processing and presentation of information in a more structured and understandable manner using more than one media such as text, graphics, animation, audio and video. A computer capable of handling text, graphics, audio, animation and video is called multimedia computer. If the sequence and timing of these media elements can be controlled by the user, then one can name it as *Interactive Multimedia*.

Importance Multimedia

Multimedia refers to the use of various media to communicate messages. It is often said, with voice you can communicate with about 70% efficiency, but with voice and video with 90% efficiency. Simultaneous delivery by multiple media for communicating messages and content increases the delivery efficiency, the message impact and the multi-sensory experience. Multimedia increases receiver's knowledge and understanding of the received messages. Computer Technology Research of 1993 says: "People retain only 20% of what they see and 30% of what they hear. But they remember 50% of what they see and hear, and 80% of what they see, hear and do simultaneously."

A Chinese proverb tells, "Tell me and I shall forget; show me and I shall remember; involve me and I shall understand." This is what the spirit behind multimedia is.

Use of Multimedia in Education

It plays a major role in education. They can be used to prepare teaching materials and also aid in computer based training. Edutainment, a form of entertainment that

combines education and entertainment can be used to teach people. The use of the internet is slowly changing the way information reaches us.

The elements of Multimedia in Education

A Multimedia learning environment involves a number of components or elements in order to enable learning to take place. Multimedia learning integrates five types of media to provide flexibility in expressing the creativity of a student and in exchanging ideas.

Text

Out of all of the elements, text has the most impact on the quality of the multimedia interaction. Generally, text provides the important information. Text acts as the keystone tying all of the other media elements together.

Graphics

Graphics provide the most creative possibilities for a learning session. They can be photographs, drawings, graphs from a spreadsheet, pictures from CD-ROM, or something pulled from the Internet. With a scanner, hand-drawn work can be included.

Video

The representation of information by using video can be immediate and powerful. Video can stimulate interest if it is relevant to the information on the page. Video can be used to give examples of issues referred to in the text. Video can elicit an emotional response from an individual.

Animation

Giving movement to an object is called animation. Animation is used to show changes in state over time. Animations, when combined with user input, enable students to view different versions of change over time depending on different variables. Animations are primarily used to demonstrate an idea or illustrate a concept.

Video is usually taken from life, whereas animations are based on drawings. There are two types of animation: Cel based and Object based.

Sound

Sound is used to provide emphasis or highlight a transition from one page to another. Sound used creatively, becomes a stimulus to the imagination. For instance, a script, some still images and a sound track, allow students to utilize their own power of imagination without being influenced by the inappropriate use of video footage. A great advantage is that the sound file can be stopped and started very easily.

Multimedia Software

Basic tools

There are different categories of basic tools

Music Sequencing and Notation

Cakewalk (previous name - Pro Audio): It stores sequences of notes in the MIDI possible to insert WAV files & Windows MCI command

Cubase: sequencing or editing program includes digital audio editing tools

Macromedia Sound edit: creating audio for multimedia project and web integrates well with other Macromedia products

Digital Audio

Cool Edit: Powerful, popular digital audio toolkit emulate professional audio studio include multi track productions sound file editing, along with digital signal process

Sound Forge: Sophisticated PC-based program for editing WAV permits adding complex special effects

Graphics and Image Editing

Adobe Illustrator: Powerful publishing tool for creating and editing vector graphics

Adobe Photoshop: Standard in tool for graphic, image processing & image manipulation

Macromedia Fireworks: Making graphics specifically for the web includes bitmap editor, vector graphic editor & JavaScript generator

Video Editing

Adobe Premiere: Simple, intuitive video editing tool for nonlinear

Adobe After Effects: Powerful video editing tool that enables users to add and change existing movies with effects

Final Cut Pro: Video editing tool offered by Apple for Mac Allows the capture of audio and video from numerous sources

Animation

Multimedia APIs: Java3D, DirectX, OpenGL

Rendering Tools: 3D Studio Max, Maya, Render Man.

Authoring tools

An authoring tool is a software package which developers use to create content deliverable to end users. They are commonly used to create e-learning modules. These modules are generally written according to international standard.

The content created with authoring tools can be distributed through web, interactive CD-ROM, and executable file.

Since the term is somewhat general, many programs can be considered authoring tools, including Flash, and PowerPoint. However, only a small group of programs specifically include support for e-learning content standards including Authorware, Director, e2train Composica, Macromedia (Adobe), Mohive, Lectora, Composer FX, and iSpring Presenter.

Educational benefits of Multimedia tools

- They allow students to function as designers
- They provide valuable learning opportunities to the students

- They empower students to create and design
- They encourages deep reflective thinking
- They create meaningful learning opportunities

Multimedia Applications in Education

Talking books

Digital texts can be read aloud using recorded human voice or synthetic text-to-speech programs. Read-aloud is an intrinsic feature of so-called talking books, but with text-to-speech software, virtually any digital content—including web-based texts—can be read aloud, with or without synchronous highlighting of the printed text.

Text-to-speech

It is also a beneficial writing tool. It may be easier for students to recognize errors when listening versus reading a composition. By using text-to-speech to read back the text they have written, students may be able to revise more successfully.

CD-ROM Storybooks

CD-ROM storybooks offer digital text in combination with features such as animations, illustrations, speech, and sound. For example, a CD-ROM storybook might offer the story text together with animations, vocabulary definitions, and sound effects. Some storybooks incorporate an audio version of the text. CD-ROM storybooks offer great potential for engaging students.

Video or videodiscs

Video/videodiscs offer a means to contextualize curriculum content and instruction across the curriculum. For example, video can be used to anchor mathematics instruction to an authentic context. That is, video can be used to present to students a real-world context within which mathematical problem-solving can then be situated.

Hypermedia

Hypermedia refers to hyperlinked multimedia—the linkage of text, audio, graphics, animation, and/or video through hyperlinks. For example, a hypermedia study guide might offer illustrated textbook content hyperlinked to web-based video and other content, glossary entries, and comprehension questions. Other hypermedia applications for the classroom include supported digital reading environments and lessons.

Computer simulations

Computer simulations are computer-generated versions of real-world objects (for example, a brain) or processes (for example, an election). They may be fully automated or interactive, eliciting user input. Computer simulations are a means to "open up the walls of the classroom," providing students with an opportunity to observe, manipulate, and investigate phenomena that are normally inaccessible.

Computer simulations can be used to increase content knowledge. For example, a simulated marine ecosystem can be used to teach ecology concepts. Simulations can also be used to develop skills. For example, simulated science experiments can be used to facilitate mastery of science process skills. Computer simulations are available on the web, as well as in software form.

4.4. Project Based Learning (PBL)

Meaning

- Project-based learning is a dynamic classroom approach in which students actively explore real-world problems and challenges.
- It is an activity based approach. Students learn the subject by working on a project.
- It is a style of active learning and inquiry-based learning.
- In this approach, students take responsibility for their learning.
- It encourages students to investigate and respond to a real problem or challenge.
- It integrates knowing and doing.
- It is based on the psychological principles ‘learning by doing’, ‘learning by living’ and ‘learning through cooperation’.
- It believes the assumption ‘knowledge grows by application’. In this approach, the students apply what they know to solve problems.
- It engages students in investigation.

Procedure

In this approach, students look for solutions to problems by asking and refining questions, debating ideas, making predictions, designing and planning experiments, collecting and analyzing data, drawing conclusions, communicating ideas to others, and creating artefacts.

Need of PBL

We live in a modern world advanced through the successful completion of projects. Knowledge is a consequence of experience. Solving real-world problems is important to us. If we are to prepare students for success in life, we need to prepare them for a project-based world.

Characteristics of Project-Based Learning

- Its focus is on finding solutions to real world challenges or problems.
- It is inquiry-based.
- It uses 21st century skills such as critical thinking, communication, collaboration, and creativity.
- It gives importance to students' voice and choice.
- It provides opportunities for feedback and revision of the plan and the project.
- It requires students to present their problems, research process, methods, and results.

Benefits of Project Based Learning

- It connects the students to the real world.
- It prepares the students to meet challenges in the real world.
- It provides an opportunity for students to engage deeply with the target content.
- It improves student attitudes towards education.
- It increases self-motivation.
- It encourages self-discipline.
- It focuses on 21st-century skills, viz., critical thinking, communication, collaboration, and creativity.
- It helps students develop teamwork culture.
- It enhances students' technical skills.
- It develops problem-solving skills.
- It develops communication skills.
- It improves academic achievement.

Limitations of Project Based Learning

- Knowledge is not acquired in a sequential manner.
- Less content knowledge may be learned.
- It requires more time and takes away study time from other subjects.
- It creates some anxiety because learning is not organized.
- Sometimes group dynamics issues compromise PBL effectiveness.

4.5. Collaborative Learning

Collaborative learning is a situation in which two or more people learn or attempt to learn something together. Collaborative learning is an educational approach to teaching and learning that involves groups of students working together to solve a problem, complete a task, or create a product. Unlike individual learning, people engaged in collaborative learning get benefited from one another.

Collaborative learning is based on the model that knowledge can be created within a population where members actively interact by sharing experiences and take on asymmetric roles. Collaborative learning refers to methodologies and environments in which learners engage in a common task where each individual depends on and is accountable to each other. These include both face-to-face conversations and computer discussions (online forums, chat rooms, etc.).

Thus, collaborative learning is commonly used when groups of students work together to search for understanding, meaning, or solutions or to create a product of their learning. Collaborative learning activities can include collaborative writing, group projects, joint problem solving, debates, study teams, and other activities. This approach is closely related to cooperative learning.

Collaborative learning is rooted in Vygotsky's concept of learning called zone of proximal development (Z.P.D). Typically there are tasks learners can accomplish and tasks learners cannot accomplish. Between these two areas is the zone of proximal development, which is a category of things that a learner can learn but with the help of guidance. In Vygotsky's definition of zone of proximal development, he highlighted the importance of *learning through communication and interactions with other rather than just through independent work***.** This has made way for the ideas of group learning, one of which being collaborative learning.

Technology has become an important factor in collaborative learning. Over the past ten years, the Internet has allowed for a shared space for groups to communicate. Virtual environments have been critical to allowing people to communicate long-distances but still feel like they are part of the group. Research has been conducted on how technology has helped increase the potential of collaborative learning.

Collaborative learning can lead to student success by deepening the understanding of a given topic. Essentially, Collaborative Learning at secondary level aims to actively engage students with material and each other to maximize knowledge retention.

Steps of Collaborative Learning Approach

1. Task or Concept or problem to be studied within a group situation is identified. It may be small or big, simple or complex, depending upon the learning environment. Students select the task of their choice.
2. Formation of groups is facilitated by the teacher.
3. There is exchange of ideas on the issue at hand through interactions.
4. Teachers facilitate their interactions towards the set goal within stipulated timeframe.

5. Learning evidences are assessed throughout the teaching-learning process and feedback is provided to all groups of the learners.

Different types of Collaborative Learning

1. **Collaborative Networked Learning (CNL)** – According to Findley (1987) "Collaborative Networked Learning (CNL) is that learning which occurs via electronic dialogue between self-directed co-learners and experts. Learners share a common purpose, depend upon each other and are accountable to each other for their success. CNL occurs in interactive groups in which participants actively communicate with one another within a contextual framework which may be facilitated by an online coach, mentor or group leader.
2. **Computer-Supported Collaborative Learning** (**CSCL**) is a relatively new educational paradigm within collaborative learning which uses technology in a learning environment to help mediate and support group interactions in a collaborative learning context. CSCL systems use technology to control and monitor interactions, to regulate tasks, rules, and roles, and to mediate the acquisition of new knowledge.
3. **Learning Management System (LMS)** In this context, collaborative learning refers to a collection of tools which learners can use to assist, or be assisted by others. Such tools include Virtual Classrooms (i.e. geographically distributed classrooms linked by audio-visual network connections), chat, discussion threads, application sharing (e.g. a colleague projects spread sheet on another colleague's screen across a network link for the purpose of collaboration), among many others.

4. **Collaborative learning development** Enables developers of learning systems to work as a network. Specifically relevant to e-learning where developers can share and build knowledge into courses in a collaborative environment. Knowledge of a single subject can be pulled together from remote locations using software system.
5. **Collaborative learning in virtual worlds** Virtual worlds by their nature provide an excellent opportunity for collaborative learning. At first learning in virtual worlds was restricted to classroom meetings and lectures, similar to their counterparts in real life. Now collaborative learning is evolving as companies starting to take advantage of unique features offered by virtual world spaces - such as ability to record and map the flow of ideas, use 3D models and virtual worlds mind mapping tools.
6. **Collaborative learning in thesis circles** in higher education is another example of people learning together. In a thesis circle, a number of students work together with at least one professor or lecturer, to collaboratively coach and supervise individual work on final (e.g. undergraduate or MSc) projects. Students switch frequently between their role as co-supervisor of other students and their own thesis work (incl. receiving feedback from other students).
7. **Collaborative scripts** structure collaborative learning by creating roles and mediating interactions while allowing for flexibility in dialogue and activities. Collaborative scripts are used in nearly all cases of collaborative learning some of which are more suited for face-to-face collaborative learning— usually, more flexible—and others for computer-supported collaborative learning—typically, more constraining. Additionally, there

are two broad types of scripts: macro-scripts and micro-scripts. Macro-scripts aim at creating situations within which desired interactions will occur. Micro-scripts emphasize activities of individual learners.

Advantages of Collaborative Learning

1. It increases openness of students.
2. It improves socialization and communication skills.
3. It improves relationships among the students.
4. It encourages cooperation among the students.
5. It increases self-esteem of students.
6. It improves student retention.
7. It increases subject matter comprehension, efficiency and productivity of students.
8. It increases achievement of students.

Limitations of Collaborative Learning

1. Very meticulous planning is required for its successful implementation. It may be difficult for an inexperienced teacher.
2. It may lead to erroneous conclusions If interaction among the group is not properly monitored.
3. The success of this approach mainly depends on active participation of all students. Some students may not participate actively in the group.
4. It may be difficult to monitor the work of all the groups working at same time for an inexperienced teacher.

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UNIT-5: APPLICATIONS OF COMPUTERS IN EDUCATION

5.1.1. Computer as a Learning tool

- Storage of information.
- Better presentation of information.
- Audio-visual aid in teaching.
- Quick data processing.
- Access to the Internet.
- Quick communication between students, teachers and parents.
- Drill and Practice
- Individual Teaching and Learning
- Simulation and Gaming
- Useful for Discovery Learning.
- Helpful for Problem solving.
- Responding to enquiry
- Organization of Learning aspects

5.1.2. Concept of E-Learning

Meaning

- E-learning refers to the learning that takes place by electronic means.
- It involves the use of a computer or some electronic device to provide training or learning material.
- It can also be termed as a network enabled transfer of skills and knowledge.
- e-learning, is education based on modern methods of communication including the computer and its networks, various audio-visual materials, search engines, electronic libraries, and websites, whether accomplished in the classroom or at a distance.

Types of E-Learning

Synchronous e-Learning is when the learners and the instructor interact with each other in real time, from different locations.

Asynchronous eLearning is when learners complete self-paced online training. In this case, the learner and the instructor are not online at the same time.

Characteristics or Features of E-Learning

- It is comprehensive.
- It is effective and quick.
- It makes learning exciting, engaging and compelling.
- It takes place in a virtual environment.
- It can occur in or out of the classroom.
- E-Learning is self-paced and gives students a chance to speed up or slow down as necessary.

- It is self-directed, allowing students to choose content and tools appropriate to their differing interests, needs, and skill levels.
- Accommodates multiple learning styles using a variety of delivery methods.
- Designed around the learner.
- Geographical barriers are eliminated, opening up broader education options.
- 24/7 accessibility
- It provides on-demand access.

Benefits of E-Learning for students

1. Accommodates everyone's needs.
2. Lectures can be taken any number of times.
3. Offers access to updated content.
4. Quick delivery of lessons.
5. Fosters greater student interaction and collaboration.
6. Consistency.
7. Effectiveness.
8. Travel time and associated costs (parking, fuel, vehicle maintenance) are reduced.
9. Overall student costs are frequently less (tuition, residence, food, child care).
10. Enhances computer and Internet skills.
11. It reduces the usage of paper, so it is eco-friendly.
12. Less impact on environment.

Challenges of E-learning

1. Unmotivated students may fall behind.
2. Students may miss social interaction.
3. Instructor may not always be available.
4. Slow or unreliable internet connection can be frustrating.

5.2. Web 2.0 Technologies

Meaning of Web 2.0

- It is the second generation of the World Wide Web.
- It describes a variety of web sites and applications that allow anyone to create and share online information.
- It allows people to create, share, collaborate and communicate.

Characteristics of Web 2.0

- User created content.
- Rich user experience.
- User participation.
- Dynamic content.
- Metadata.
- Openness.
- Freedom and collective intelligence by way of user participation.

Importance of Web 2.0 Tools

Web 2.0 tools can be used for creating and sharing student-generated projects and products.

These tools allow the user to go beyond just receiving information through the web. The user is expected to interact and to create content with others. They are interactive, multi-purpose, easy-to-use digital platforms that encourage students to collaborate with each other.

Major benefits of using Web 2.0 technologies in teaching include (1) interaction, communication and collaboration, (2) knowledge creation, (3) ease of use and flexibility, and (4) writing and technology skills.

Examples of Web 2.0 Tools

1. **Wikipedia**
    - Wikipedia is a free online encyclopaedia.
    - It is hosted by the Wikimedia Foundation.
    - It is created and edited by volunteers around the world.
    - It is a free, open content online encyclopaedia created through the collaborative effort of a community of users known as *Wikipedians*.
    - Anyone registered on the site can create an article for publication; registration is not required to edit articles.
    - The site's name comes from wiki, a server program that enables anyone to edit Web site content through their Web browser.
2. **YouTube,**

    - It is a popular Video-sharing website.
    - It allows the users to view and upload videos.
    - It allows users to share the videos.
    - Users can comment on videos created by others.
    - It offers a wide variety of user-generated and corporate media videos.
    - Most of the content on YouTube is uploaded by individuals, but media corporations like BBCoffer some of their material via YouTube as part of the YouTube partnership program.
    - Unregistered users can only watch videos on the site, while registered users are permitted to upload an unlimited number of videos and add comments to videos.
    - The vast majority of its videos are free to view and there are subscription-based premium channels also.
3. **Teacher Tube**
    - It is a video sharing website similar to YouTube.
    - It is designed to allow those in the educational field, particularly teachers, to share educational resources such as video, audio, documents, photos, groups and blogs.
    - It contains a mixture of classroom teaching resources and others designed to aid teacher training.

4. **Slideshare**
    - It is the most popular presentation sharing website in the world.
    - It allows you to post PowerPoint slides and videos as a presentation.
    - Presentations can then be searched, viewed and shared by anyone.

5. **Podcasting**
    - The term comes from a combination of the words iPod (a personal digital audio player made by Apple) and broadcasting.
    - It is an episodic series of digital audio or video files which a user can download and listen to.
6. **Blog**
    - A blog is a discussion or informational website published on the World Wide Web.
    - It is a regularly updated website run by an individual or small group.
    - It consists of informal diary-style text entries (posts).
    - Posts are typically displayed in reverse chronological order, so that the most recent post appears first.
    - Until 2009, blogs were usually the work of a single individual, and often covered a single subject or topic. Now "multi-author blogs" (MABs) are popular with posts written by large number of authors.
7. **Flickr (pronounced "flicker")**
    - It is a photo-sharing Web site
    - It is a popular website for users to share personal photographs.
    - It is widely used by photo researchers and by bloggers to host images in blogs and social media.
    - Photos and videos can be accessed from Flickr without any registration, but registration is required to upload photos and images.
    - **Face book**
    - It is a popular free Social Networking Website.
    - It allows registered users to create profiles, upload photos and video, send messages and keep in touch with friends, family and colleagues.
    - The most popular feature of Face book is, *the Wall*, which is essentially a virtual bulletin board. Messages left on a member's Wall can be text, photos or video.
    - Another popular feature is the virtual Photo Album. Photos can be uploaded from the desktop or directly from a Smartphone camera.
    - The site, which is available in 37 different languages, includes public features such as: *Marketplace* - allows members to post, read and respond to classified ads and *Groups* - allows members who have common interests to find each other and interact.
8. **LinkedIn**
    - It is a business- and employment-oriented social networking service
    - It operates via websites and mobile apps.
9. **WhatsApp Messenger**
    - It is a free messaging app available for Android and other smartphones.

- It can be used to send and receive messages, calls, photos, videos, documents, and Voice Messages.
- It uses phone's Internet connection to send the messages and to make calls.

10. Google Plus

- It is an Internet-based social network that is operated by Google.
- It was launched in June 2011.
- It is used to post photos and status updates to the interest based communities.
- It is useful for multi-person instant messaging, text and video chat called Hangouts, events, location tagging,
- It can be used to edit and upload photos to private cloud-based albums.

11. Instagram

- It is a photo and video-sharing social networking service owned by Face book.

12. Twitter

- It is an online news and social networking service.
- It allows the users to post and interact with messages known as "tweets".
- Tweets were originally restricted to 140 characters, but this limit was doubled for some languages.
- Registered users can post tweets, but those who are unregistered can only read them.
- Users access Twitter through its website interface, through Short Message Service (SMS) or mobile-device application software ("app").

13. *Google Docs*

- Google Docs is a Web 2.0 technology tool that enables collaboration.
- It is an Internet-based social network that is owned by Google.
- It is a very powerful real-time collaboration and document authoring tool.
- Multiple users can edit a document at the same time, while seeing each other's changes instantaneously.
- *It* is a free Web-based application in which *documents* and spread sheets can be created, edited and stored online.
- Users can produce text documents, slide presentations, spreadsheets, drawings, and surveys.
- Files can be accessed from any computer with an Internet connection and a Web browser.

14. **Google Maps**

- It is a web mapping platform offered by Google.
- It offers satellite imagery, aerial photography, street maps, real-time traffic conditions.
- It offers route planning for travelling by foot, car, bike, air and public transportation.
- As of 2020, Google Maps was being used by over 1 billion people every month around the world.

5.3.1. Virtual Classroom

Meaning

- A virtual classroom is an online learning environment. The environment can be web-based and accessed through a portal or software-based and require a downloadable executable file.

- A virtual classroom is an online classroom that allows participants to communicate with one another, view presentations or videos, interact with other participants, and engage with resources in work groups.

- Just like in a real-world classroom, a student in a virtual classroom participates in synchronous instruction, which means that the teacher and students are logged into the virtual learning environment at the same time.

- Many schools have rolled out virtual classrooms to provide synchronous distance education. Virtual classroom software applications often employ multiple synchronous technologies, such as web conferencing, video conferencing, live streaming, and web-based VoIP to provide remote students with the ability to collaborate in real time. To enhance the educational process, applications may also provide students with asynchronous communication tools, such as message boards and chat capabilities.

Characteristics

- ***Non-Restricting***
- A virtual classroom allows both learners and instructors around the world to participate in live classes to collaborate and interact. MOOC programs like Coursera are a great example of this concept in action.

- ***Affordable***
- The low costs of virtual classrooms are considered to be a major advantage. Learners can save money by not having to worry about travel expenses. Participants also save time since all that is needed is an internet connection.

- ***Flexible Learning***
- Online classes also allow for the ability to record class as it happens, including any presentation audio and visuals. This means that the content is accessible even after being delivered, an added benefit for those who want a quick refresher, or perhaps did not fully understand the first time.

- ***Practical and Proven***
- Synchronous learning is a learning environment where everyone takes part in the learning at the same time. A traditional lecture is an example of this type of learning, and has been used for hundreds of years. Online learning

enables this same type of experience, but with far more conveniences and tools.

- ***Accessible***
- Virtual classrooms can be used to deliver lectures or even tutorials online. They are also great options for organizing meetings and group projects where members need to check-in on progress and bounce ideas of one-another. With the virtual environment, ideas and collaborators are never far away.

5.3.2. Smart Board

- The Smart Board is an interactive whiteboard that uses touch detection for user input.
- It was produced by Calgary of Smart Technologies.
- The Smart Board operates as part of a system that includes the interactive whiteboard, a computer, a projector and white boarding software.
- The components are connected wirelessly or via USB cables. A projector connected to the computer displays the desktop image on the interactive whiteboard. The whiteboard accepts touch input from a finger, pen or other solid object.
- The Smart Board interactive whiteboard uses DViT (Digital Vision Touch) technology to detect and respond to touch interactions on the interactive whiteboard surface. This camera-based touch technology for interactive whiteboards and interactive displays uses digital cameras and proprietary software and firmware to detect finger or pen contact with the screen. That contact is then interpreted as finger or pen activity.
- Smart's digital ink operates by using an active digitizer that controls the PC input for writing capabilities such as drawing or handwriting. The Smart Board interactive whiteboard uses passive pen tools, which means that no technology is housed in the pen tool to use digital ink or determine colour. All digital ink options can be selected from the Smart Board Pen Tray. Most models of Smart Board include a pen tray on the front of the interactive whiteboard that holds two to four plastic pen tools and an eraser. The pen tools have neither electronic components nor ink - the technology is in the pen tray. When a pen tool is removed from its slot in the tray, an optical sensor recognizes its absence. Smart Board software processes the next contact with the interactive whiteboard surface as a pen action from the pen tool that resides in the corresponding slot. Smart Board has slots for black, blue, red and green pen tools. Once a pen tool is removed from its slot, users can write in the selected colour with that pen tool, a finger, or any other object. Similarly, when the eraser is removed from its position in the pen tray, the software processes the next contact with the screen as an erasing action, whether the contact is from the eraser, the user’s finger or another object.

5.4. Concept and Significance of Open Educational Resources (OERs)

Concept of OER

- Open educational resources (OER) are freely accessible, openly licensed text, media, and other digital assets that are useful for teaching, learning, and assessing as well as for research purposes.
- The term OER describes publicly accessible materials and resources for any user to use, re-mix, improve and redistribute under some licenses.
- Open Educational Resources (OER) are high-quality, openly licensed, online educational materials that offer an extraordinary opportunity for people everywhere to share, use, and reuse knowledge.
- OER are teaching, learning, testing and research resources that reside in the public domain that permits their free use. Open educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge.
- Since 2002, the Hewlett Foundation has worked with OER to improve education globally by making high-quality academic materials openly available on the Internet.
- In its simplest form, the concept of Open Educational Resources (OER) describes any educational resources (including course materials, textbooks, streaming videos, multimedia applications, and any other materials that have been designed for use in teaching and learning) that are openly available for use by educators and students, without an accompanying need to pay royalties or license fees.
- The most important reason for using OER is that openly licensed educational materials have tremendous potential to contribute to improving the quality and effectiveness of education.
- The development and promotion of open educational resources is often motivated by a desire to provide an alternate or enhanced educational paradigm.
- OER is *not* synonymous with online learning or e-learning, although many people make the mistake of using the terms interchangeably.
- Openly licensed content can be produced in any medium: paper-based text, video, audio or computer-based multimedia. A lot of e-learning courses may use OER, but this does not mean that OER are necessarily e-learning.

Significance of OER's

- Provides access to high quality educational material.
- Saves costs for students and teachers.
- Raises the quality standards for educational resources.
- Helps prior learning and after learning.
- Allows faculty to create material that is customized for their classes.
- Shares best practice internationally.
- Creates additional opportunities for peer review.
- Maximizes the use and increases availability of educational material.

5.5. Critical issues in the Usage of Internet

1. Reliability of Internet data

Unlike similar information found in newspapers or television broadcasts, information available on the Internet is not regulated for quality or accuracy; therefore, it is particularly important for the individual Internet user to evaluate the resource or information.

2. Internet Addiction

Internet addiction is defined as an unhealthy behaviour that causes stress in one's personal, school or work life. Like other addictions, compulsive Internet usage completely dictates a person's life.

Internet addiction is when a person has a compulsive need to spend a great deal of time on the Internet. It will affect the other areas of the life (such as relationships, work or health) of a person.

3. Internet Plagiarism

Plagiarism is the representation of another author's language, thoughts, ideas, or expressions as one's own original work.

Plagiarism is presenting someone else's work or ideas as your own, with or without their consent, by incorporating it into your work without full acknowledgement.

All published and unpublished material, whether in manuscript, printed or electronic form, is covered under this definition.

4. VIRUS

- A computer virus is a piece of software. It is a self-replicating program. It is a malicious program designed to spread from device to device. The computer gets infected through the replication of malicious code.
- The viruses disrupt the normal functioning of a computer, damaging its software or stealing its data.
- A virus can damage programs, delete files and erase the hard drive, which results in reduced performance or even crashing of the system.
- Computer viruses come in different forms to infect the system in different ways.
- Hackers can also use viruses to access your personal information to steal or destroy your data.

How to protect the computer system from VIRUS

- Use trusted antivirus software and keep it updated time to time.

  Ex: McAfee, Norton, Kaspersky are the popular antivirus software. AVG and Panda are examples of two free antivirus softwares.

- Avoid clicking on any pop-up advertisements.

- Always scan your email attachments before opening them.

- Always scan the files that you download using file sharing programs.

5. Hacking

- It is the unauthorized access to control the computer system for some illicit purpose.
- It is the activity of identifying weaknesses in a computer system or a network to gain access to personal data or business data.
- A Hacker is a person who finds the weakness in computer system to gain access. Hackers are usually skilled computer programmers with knowledge of computer security.

6. Copy Right Act

- Copyright (or author's right) is a legal term used to describe the rights of the authors or creators over their content or products.
- Copyright, as its name suggests, includes the right to prevent others from copying one's work.
- Copyright, a form of intellectual property law protects original works of authorship including literary, dramatic, musical, and artistic works, such as poetry, novels, movies, songs, computer software, and architecture.
- It encourages creativity and innovation and enables producers to benefit financially.
- Many different types of content like books, poems, plays, music, songs, films, and artwork can be protected by copyright.
- Copyright protection has been extended to websites and other online content. Therefore, any original content published on the Web is protected by copyright law.

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All the Best