Vijaya

PEDAGOGY OF COMPUTER SCIENCE

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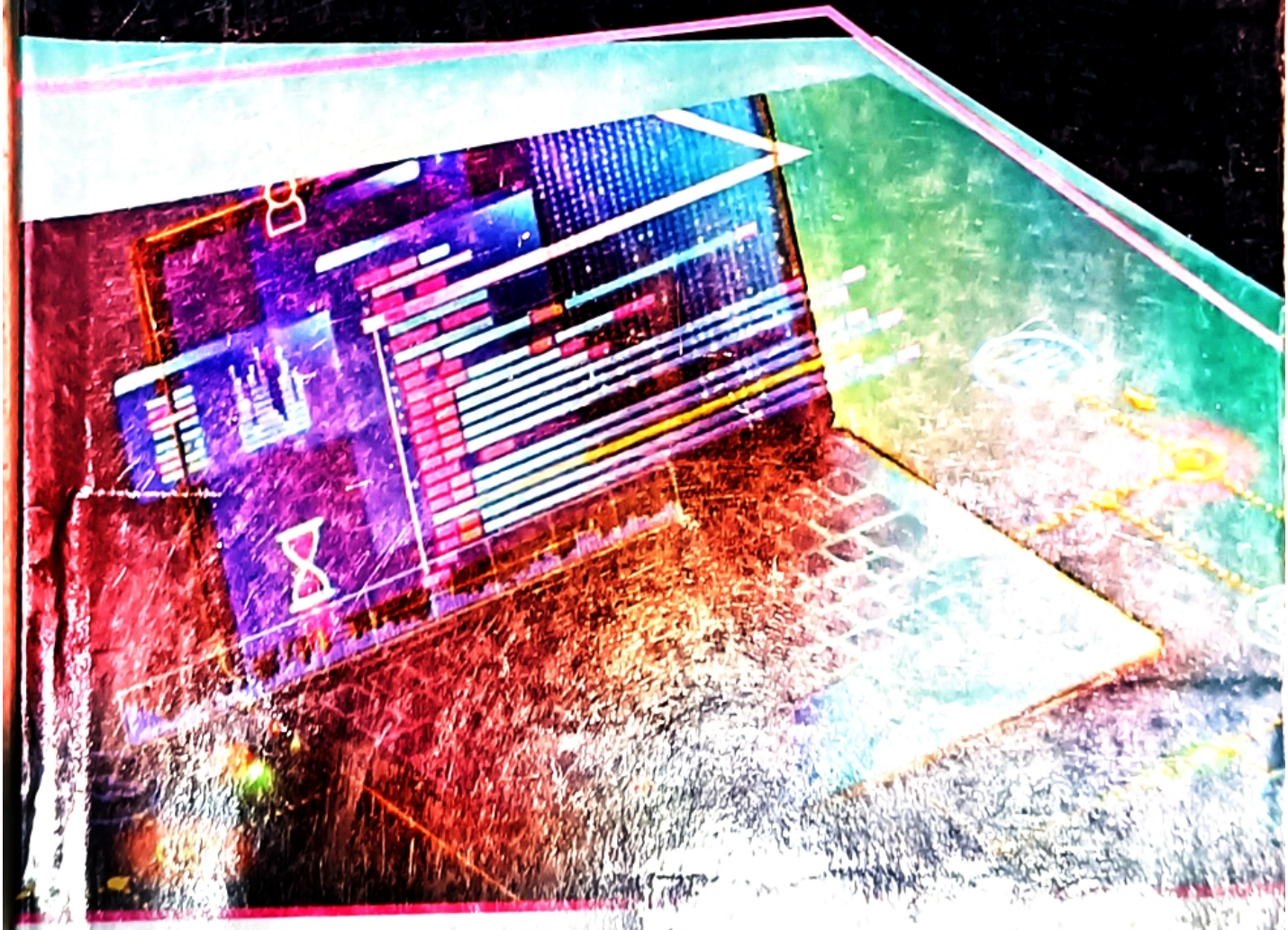

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1

Concept , Need and Scope of Computer Science

As the demand for new technology grows and changes, Computer Science is always at the forefront of developments in the field.

The present age is very aptly called "the age of science and technology". It has made our daily life pleasant, easy and comfortable. The dream of a push-button existence has come true for us. We have conquered distance with the help of science. Thus the world is becoming a single whole or a "Global Village". We feel the persistent impact of machines in our every day life.

The invention of computer is another milestone in scientific achievements. It is one of the most important events in human history of the twentieth century. It has added to develop and improve the effectiveness and accuracy of all the scientific machines of the present world. It has helped in bringing the distance closer with respect to information and development taking place all around the globe.

Computer is an electronic device for storing and processing data, making calculations or controlling machines. It can process at a very high speed with remarkable accuracy. It can also perform all arithmetic and logical function to solve any problem and produce processed information.

From research to space world and from entertainment to laboratories, offices and homes, it is a machine that never gets tired and is ready to serve us at our commands. It has gained such a high degree of importance in every day life today that no sphere of activity around us can afford to ignore it. It is only computer that can help us live and compete with the rapidly changing world. This is possible only through exchange of information and knowledge abreast with the latest development. As such data communication of information remains a major focus of computer industry. And in deed information technology remains pivotal to computer users.

Computer education enables the artists in creating realistic images. Musicians having computer education, can create multiple voice composition and play back music with hundreds of variations.

Computer has changed the life of modern man. A man sitting in the room can have the latest information about politics, sports, scientific inventions and can do business with people at the other corner of the world. Through internet we can learn about the affairs of the world and can get every information about the happenings all around the world. It helps to enhance the talents and knowledge of the new generation. It opens their eyes and mind to the wonders and vastness of the universe around us. It has proved a phenomenon of revalidation of the present age exhibiting in its modern form.

Computers cannot do things on their own. The users must understand the ways in which problems can be solved with computers. The science which is deeply concerned with how computers and computer systems work, and how they are designed and programmed is known as computer science.

Concept of Computer Science

Computer Science at its core is largely about the formalization of process Computer science is the study of *information processes*. A process is a sequence of steps. Each step changes the state of the world in some small way, and the result of all the steps produces some goal state. For example, baking a cake, mailing a letter, and planting a tree are all processes. Because they involve physical things like sugar and dirt, however, they are not pure information processes. Computer science focuses on processes that involve abstract information rather than physical things.

The boundaries between the physical world and pure information processes, however, are often fuzzy. Real computers operate in the physical world: they obtain input through physical means (e.g., a user pressing a key on a keyboard that produces an electrical impulse), and produce physical outputs (e.g., an image displayed on a screen). By focusing on abstract information, instead of the physical ways of representing and manipulating information, we simplify computation to its essence to better enable understanding and reasoning.

Computer Science is the study of how computers and computer systems work, and how they are constructed and programmed, and the foundations of information and computation, in both artificial and natural information processing systems. Computer science includes (among many other things)

- **Algorithms**: These are re-usable procedures (often a sequence of steps) for getting something done. For example, plan the shortest delivery route for a lorry, given the required stops on the route.

- **Data structures**: The ways to organise data so that a program can operate quickly on it. For example, there are many different ways to represent numbers (twos-complement, floating point, arbitrary precision, etc) with different trade-offs. Another example: a lookup table might be organised as a sorted array or as a hash table, depending on the size of the table and key distribution.
- **Programs:** It tells the computer exactly what to do. Every program is written in some programming language, each with different strengths. Good languages embody many "abstraction mechanisms", that allow a piece of code to be written once, and reused repeatedly without reference to its internal structure. These mechanisms are the key to controlling the enormous complexity of real programs (e.g. a web browser), which consists of dozens of layers of such abstractions.
- **Architecture:** It is the term used to describe the large scale structure of computer systems. At the bottom is real physical hardware. On top of that are layered virtual machines. Compilers translate from a high level programming language to the low-level binary that the hardware or virtual machine executes. Operating systems manage the resources of the machine. Hardware and software interfaces, including device drivers, are required for interactions with other things, e.g. if the system is controlling a chemical plant or interacting with humans.
- **Communication**. Almost all computer systems consist of a collection of sub-computers, each running one or more programs, and communicating with the others by sending messages or modifying shared memory. The internet itself is a large-scale example, and uses protocols (standardised procedures) that keep data flowing smoothly despite all the control being decentralised. Increasingly computers need to be given natural language competences for communicating with humans, along with abilities to understand pictures, drawings and gestures.

Alongside these concepts are a set of Computing 'methods' or ways of thinking, including:

- **Modelling**: It represents chosen aspects of a real-world situation in a computer. This includes both modelling new engineering designs in order to test them and modelling natural information processing systems in the course of understanding and predicting their behaviours.
- **Decomposing:** It decompose the problems into sub-problems, and decomposing data into its components.

- **Generalising:** It represents particular cases of algorithm or data into a more general-purpose, re-useable version. This is often followed by discovering new applications for such generalisations.
- **Designing, writing, testing, explaining, and debugging:** It involves the design, construction, and testing of purposeful programs/ artefacts.

Origin of Computer science

Computer science has its roots primarily in the fields of electrical engineering (i.e., electronics), mathematics and linguistics. It is still a relatively young field, mainly because it was only about a half century ago that electronics technology became sufficiently advanced to allow the construction of even primitive electronic computing devices.

Mechanical devices have long been employed to increase the efficiency of calculation. For example, the abacus was likely in use in Mesopotamia (the southern part of modern Iraq) by as early as 3000 B.C. And the ancient Greeks apparently possessed some surprisingly sophisticated mechanical computers, such as the geared device found by a Greek sponge diver off the isle of Antikythera in 1901[1].

However, the beginning of computer science is generally placed in the 1940s. At that time, World War II stimulated the development of the first digital electronic computers, particularly for use in calculating trajectories for projectiles and in breaking codes. Thus, it has only been a few decades since computer science became recognized as a distinct discipline and developed its own terminology and methods.

The word *computer* itself has been around for much longer than the type of device to which the term refers today. It originally referred to a person whose profession was to spend all day performing calculations, such as for creating tables of trajectories. (This would be considered a very tedious profession today.) After World War II, dictionaries began defining the word computer in terms of a machine as well as a person.

Computer science in universities was initially treated as a branch of mathematics and not as a separate discipline. Computer science today is about learning to understand the media we use every day. This idea for computer science has been around since at least the early 1960's but is most accessible through the well known and highly regarded McLuhan statement "The medium is the message." The first computer science department in the U.S. was established in 1962 at Purdue University, and today most universities today have separate (and thriving) departments devoted to this field.

Computer Science Definition

Computer Science contains the word *science*, is usually considered to be a branch of engineering. This is in sharp contrast to most of the physical sciences, which separate the understanding and advancement of the science from its practical applications. Science is a technique for learning about the natural world by applying the principles of the *scientific method* (which includes making empirical observations, proposing hypotheses to explain those observations, and then testing those hypotheses); engineering is the application of science.

Computer Science is the study of principles and practices that underpin an understanding and modelling of computation, and of their application in the development of computer systems. At its heart lies the notion of computational thinking: a mode of thought that goes well beyond software and hardware, and that provides a framework within which to reason about systems and problems. This mode of thinking is supported and complemented by a substantial body of theoretical and practical knowledge, and by a set of powerful techniques for analysing, modelling and solving problems.

Computer science is the study of the storage, transformation and transfer of information. The field encompasses both the theoretical study of algorithms (including their design, efficiency and application) and the practical problems involved in implementing them in terms of computer software and hardware.

Computer science or computing science (sometimes abbreviated CS) is the study of the theoretical foundations of information and computation, and of practical techniques for their implementation and application in computer systems. It is frequently described as the systematic study of algorithmic processes that create, describe, and transform information.

Computer Science is the systematic study of the feasibility, structure, expression, and mechanization of the methodical processes (or algorithms) that underlie the acquisition, representation, processing, storage, communication of, and access to information, whether such information is encoded in bits and bytes in a computer memory or transcribed in genes and protein structures in a human cell. It is the study of information and computation, and of practical techniques for using machines to process information and perform computation. Computer Science study includes the following broad topics:

- How computers manage and process information - algorithms, data structures and data management.
- How computers and computer systems work - architecture, systems software, programming languages, data communications, networks, security.

- Applications of computers in science and society - artificial intelligence, human-computer interaction, the Internet, computer graphics, computer vision, robotics.
- The limitations of computers - computational complexity and computability.

Computer Science provides insights into a broad range of systems — not only ones that include computers — and computational thinking influences fields such as biology, chemistry, linguistics, psychology, economics and statistics. Computing allows pupils to solve problems, design systems, and understand the power and limits of human and machine intelligence. Pupils who can think computationally are better able to conceptualise and understand computer-based technology, and so are better equipped to function in modern society.

Need of Computer Science

Computer science is a young discipline that is evolving rapidly from its beginnings in the 1940's. As such it includes theoretical studies, experimental methods, and engineering design all in one discipline. This differs radically from most physical sciences that separate the understanding and advancement of the science from the applications of the science in fields of engineering design and implementation. In computer science there is an inherent intermingling of the theoretical concepts of computability and algorithmic efficiency with the modern practical advancements in electronics that continue to stimulate advances in the discipline. It is this close interaction of the theoretical and design aspects of the field that binds them together into a single discipline.

Computer Science as a subject is closely related to, but essentially different from, fields such as Software Engineering, Information Technology, Information Systems, Computer Engineering. It also has strong links with Mathematics. Because of the importance of computation in modern life, Computer Science has an ever-growing relationship with many other disciplines in the sciences, engineering and humanities.

Computer Science is a discipline

Education enhances pupils' lives as well as their life skills. It prepares young people for a world that doesn't yet exist, involving technologies that have not yet been invented, and that present technical and ethical challenges of which we are not yet aware.

To do this, education aspires primarily to teach disciplines with long-term value, rather than skills with short-term usefulness, although the latter are certainly useful. A "discipline" is characterised by:

- **A body of knowledge** It includes widely-applicable ideas and concepts, and a theoretical framework into which these ideas and concepts fit.
- **A set of techniques and methods** Techniques and methods that may be applied in the solution of problems, and in the advancement of knowledge.
- **A way of thinking and working** It is that which provides a perspective on the world that is distinct from other disciplines.
- **Longevity**: It is a discipline does not "date" quickly, although the subject advances.
- **Independence from specific technologies**, especially those that have a short shelf-life.

Computer Science is a discipline with all of these characteristics. It encompasses foundational principles (such as the theory of computation) and widely applicable ideas and concepts (such as the use of relational models to capture structure in data). It incorporates techniques and methods for solving problems and advancing knowledge (such as abstraction and logical reasoning), and a distinct way of thinking and working that sets it apart from other disciplines (computational thinking). It has longevity (most of the ideas and concepts that were current 20 or more years ago are still applicable today), and every core principle can be taught or illustrated without relying on the use of a specific technology.

Computer Science is a STEM discipline

Computer Science is a quintessential STEM discipline, sharing attributes with Engineering, Mathematics, Science, and Technology:

- It has its own theoretical foundations and mathematical underpinnings, and involves the application of logic and reasoning.
- It embraces a scientific approach to measurement and experiment.
- It involves the design, construction, and testing of purposeful artifacts.
- It requires understanding, appreciation, and application of a wide range of technologies.

Moreover, Computer Science provides pupils with insights into other STEM disciplines, and with skills and knowledge that can be applied to the solution of problems in those disciplines.

Although they are invisible and intangible, software systems are among the largest and most complex artefacts ever created by human beings. The marriage between software and hardware that is necessary to realize computer-based systems increases the level of complexity, and the complex web of inter-

relationships between different systems increases it yet further. Understanding this complexity and bringing it under control is the central challenge of our discipline. In a world where computer-based systems have become all pervasive, those individuals and societies that are best equipped to meet this challenge will have a competitive edge.

Computer Science is Transforming of Computational thinking in all aspects of our society

Many subjects teach problem-solving skills to some degree, but Computer Science develops a particularly systematic and deep approach to thinking about complex problems, often called "computational thinking". Computational thinking is the process of *recognising* aspects of computation in the world that surrounds us, and *applying* tools and techniques from Computer Science to understand and reason about both natural and artificial systems and processes. Pupils learn to think about the same problem at many levels of abstraction, and to recognise that a single solution may apply to many other apparently different problems.

More profoundly, thinking about other disciplines through a computational lens has radically changed the way those subjects are studied, whether physics or biology, psychology or economics. For example, viewing biological processes as computational systems that process information has led to fundamental new insights in understanding disease that would not have been obtained through traditional thinking. Computational thinking has, indeed, led to whole new disciplines such as bioinformatics, and all scientists now need a core understanding of this kind of thinking.

Computational thinking is made concrete in programming. Programming takes computational thinking skills and empowers pupils to take charge of computers and create new software of their own, rather than simply to consume things made by others. This ability unleashes enormous creativity, drives innovation, and opens up completely new horizons and possibilities. For example To take an analogy from mathematics, every child should understand algebra, be capable of abstracting appropriate problems into algebraic expressions, and be able to solve simple algebraic equations. In the same way, in the computational sphere every child should be able to construct elementary algorithms in programmatic form that encapsulate simple ideas and concepts. Programming is a way of expressing creativity, of communicating and sharing ideas, just as mathematics does in a different area of discourse.

Scope of Computer Science

The most important aspect of computer science is problem solving, an essential skill for life. Students study the design, development and analysis of software and hardware used to solve problems in a variety of business,

scientific and social contexts. Because computers solve problems to serve people.

- Develops Key transferable skills: Skills like Logical thinking, problem solving, abstraction and systematic analysis are not second mature for most people, yet are highly transferable to other disciplines and greatly in demand. Computer Science is a great way to develop these skills.
- Great job prospects: Computing jobs are among the highest paid and have the highest job satisfaction. This is because the computer industries run on innovation - the emphasis on new ideas leads to higher productivity, and keeps the mind fresh.
- Future proofing: A deeper and broader understanding of computers allows us to cope better with increasingly rapid changes in technology.
- Excitement and challenge: Computer Science is a fast-moving and varied field. It has deep philosophical and mathematical questions, startling new applications that make a real difference to our quality of life, and fun gadgets.

Computer science is a discipline that involves the understanding and design of computers and computational processes. In its most general form it is concerned with the understanding of information transfer and transformation. Particular interest is placed on making processes efficient and endowing them with some form of intelligence. The discipline ranges from theoretical studies of algorithms to practical problems of implementation in terms of computational hardware and software.

Is Computer Science and Information Technology are same or different?

Computer Science and Information Technology are complementary subjects. Computer Science teaches a pupil how to be an effective *author* of computational tools (i.e. software), while IT teaches how to be a thoughtful *user* of those tools. This neat juxtaposition is only part of the truth, because it focuses too narrowly on computers as a technology, and computing is much broader than that. As Dijkstra famously remarked, "Computer Science is no more about computers than astronomy is about telescopes". More specifically:

- **Computer Science** is a discipline that seeks to understand and explore the world around us, both natural and artificial, in computational terms. Computer Science is particularly, but by no means exclusively, concerned with the study, design, and implementation of computer systems, and understanding the principles underlying these designs.

- **Information Technology** deals with the purposeful application of computer systems to solve real-world problems, including issues such as the identification of business needs, the specification and installation of hardware and software, and the evaluation of usability. It is the productive, creative and explorative use of technology.

Question

Q. Define Need and scope of Computer science.

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2

Aims And Objectives Of Teaching Computer Science

Introduction

Most of us agree that the goal of education is learning and education is likely to be more effective if educators are clear about what it is that they want the learners to learn. If teachers have a clear idea about what learners are expected to learn, they can more easily and more accurately determine how well students have learned.The importance of aims and objectives of education is recognised by all the educational, professional, political, nonpolitical and religious associations, organisations and groups at various levels in their memoranda, letters and brouchures. It is said that education without clear cut aims is like a rudderless ship.

Aims & Objectives

Aims : Aims are general statements concerning the overall goals, ends or intentions of teaching. Aim is setting a determined course in order to achieve a set target. Aims are usually long term. Example: The person aims to acquire the required doctorate to become a doctor

Objectives: Objectives are the individual stages that learners must achieve on the way in order to reach these goals. An objective is a more specific target set in order to achieve the goal. It must usually be completed in a particular time limit. Example: The person should begin his doctorate studies by next year.

Usually an educational objective relates to gaining an ability, a skill, some knowledge, a new attitude etc. rather than having merely completed a given task. Since the achievement of objectives usually takes place during the course and the aims look forward into the student's career and life beyond the course

one can expect the aims of a course to be relatively more long term than the objectives of that same course.

For example a teacher might have an aim that a learner should be able to save work on a computer. To achieve this aim a series of objectives must be met. eg to create a folder, navigate between menus, save a document.

Difference between Aims & Objectives: There is a lot of confusion over the difference between these words. Many consider aims and objectives to be synonyms, however, that is not the case.

- Aims are concerned with purpose whereas objectives are concerned with achievement.
- Aims are what you want to achieve, while, objectives are what you will do to achieve them.
- An objective is more specific in character, while an aim is more abstract. Also, an objective is time-bound whereas an aim need not be.

So we can say that an aim can be slightly vague. It can be a general statement. However, an objective must be as specific as it can be. Thus it can be said that an objective is SMART in character. "SMART" stands for specification, measurement, accuracy, reason and time. However, an aim need not fit all these categories.

Aims And Objectives Of Teaching Computer Science

Just as we give every student the opportunity to learn the workings of physics, chemistry, and biology, because they live in a physical, chemical, biological world, so we should offer every student the opportunity to learn the workings of the digital systems that pervade their world. This knowledge is empowering, enriching, and inspiring; the skills involved readily transferable. Writing a computer program, while seemingly esoteric, is the closest a child can come to thinking about thinking. Likewise, debugging a program is the closest one can come to learning learning. Amongst other things, Computer Science embodies logic, rigour and problem solving.

Computer Science is a discipline, like Maths, Physics, or History. It has a body of knowledge, established techniques, and thinking skills, that will last students a lifetime. The core skill-set of Computer Science is independent of new technologies and programming techniques. Pupils studying computing gain insight into computational systems of all kinds, whether or not they include computers. Computational thinking influences fields such as biology, chemistry, linguistics, psychology, economics and statistics. It allows us to solve problems, design systems and understand the power and limits of human and machine intelligence. It is a skill that empowers, and that all pupils should be aware of and have some competence in. Furthermore, pupils who can think

computationally are better able to conceptualise and understand computer-based technology, and so are better equipped to function in modern society. It helps in developing the following :

- Computer Science develops a unique way of thinking about issues, problems and situations, that uses the powers of logic, algorithm, precision and abstraction.
- Computer science is intensely creative; in a real sense we build computer systems from pure "thought-stuff". It empowers students to bring new things into being, and to move from being consumers of technology to producers and shapers of technology.
- Computer Science lets us understand the natural world in a new way, and is rapidly invading other disciplines, not merely as a way to do calculations, but as a whole new way of thinking. For example, Systems Biologists regard cells as machines controlled by DNA, and are busy programming them, while computational models are illuminating studies of biodiversity and animal populations.
- Computer Science equips students to understand and contribute to understand and argue rationally about societal issues involving computation, such as software patents, identity theft, genetic engineering, electronic voting systems for elections, complex modern financial trading systems, and so on.

Indeed, in a world in which digital technology and computational concepts play an increasingly crucial role. Computer Science is really the "fourth science" and The Government is now encouraging every school to offer Computer Science as part of their curriculum, from primary school onwards by keeping the following aims and objectives:

Elementary stage

The chief aims and objectives of teaching basic computer science at the primary level are:

- To advance, evolve and enhance Computer Science fundamentals.
- Arousing and maintaining interest
- Developing the habits of observations, exploration, classification and a systematic way of thinking.
- Developing the child's power of manipulation and so on.

Secondary stage

The following aims and objectives should be included at the middle school stage:

- Understanding the impact of computer science on out way of life.

- Developing the ability to reach generalizations and to apply them for solving everybody problems
- Developing interest in hobbies related to computers their generations and so on.
- To build the interest in students for greater research

Senior secondary stage

Aims and objectives of teaching computer science at Senior secondary stage are:

- To familiarize the pupil with the world in which he is living and to make him understand the impact of computer science on society so as to enable him to adjust himself to the environments.
- To develop scientific attitude. This includes (a) a desire for accurate knowledge, (b) belief in cause and effect (c) critical thinking (d) intellectual honesty open-mindedness and so on.
- To give the students a historical perspective, so that they may understand the evolution of computers, development in computers etc.
- To guide students in the development of newer languages.
- To create the ability in students for better hardware production.

Importance Of Computer Science In School Curriculum

On the 14th November, the **Associaion** for School and College Leaders and Microsoft co-hosted the first **Importance of Computer Science in the Curriculum Conference** in the Microsoft London offices. The aim of the day was to convey the necessity of students learning computer science at school. And provide hands-on advice for schools needing to implement computer science in the curriculum and empower students to skill themselves for the future.

a) **Students Interaction with the Computers:** Students are introduced to the major components of the computer including: input, output, memory, storage, processing software, and the operating system. Students consider how internet elements (e.g. email, chatting, web, search engines, etc.) are engaged and organized in effective searching and how the email is sent. Fundamental features of the functioning of the computers and the internet world are introduced.

b) **Problem Solving**: As far as computer science is concerned, problem solving covers the basic steps in algorithmic problem-solving including the problem statement, examination of sample instances, design, program coding, testing, and verification, etc.

c) **Designing of web:** By this students learn to create user friendly manuals, websites and program, interfaces. Students apply fundamental features of coding and simultaneously the hardware and software applications are also explored.

d) **Programming:** Programming of problem-solving includes control structures, functions, parameters, objects and classes, structured program-mming and event-driven programming techniques.

e) **Computing and Data Analysis:** The students in the discipline of computer science at the school level are made to learn, how computing has facilitated new methods of managing and interpreting data. Students are taught to use computers for various processes and visualize data in order to find patterns. Students become enabled to work with a variety of large data sets that illustrate how widespread access to data and information facilitates identification of problems.

If we want our children to understand and play an active role in the digital world that surrounds them, not to be passive consumers of an opaque and mysterious technology. A sound understanding of computing concepts will help them see how to get the best from the systems they use, and how to solve problems when things go wrong. Moreover, citizens able to think in computational terms would be able to understand and rationally argue about issues involving computation, such as software patents, identity theft, genetic engineering, electronic voting systems for elections, and so on. In a world suffused by computation, every school-leaver should have an understanding of computing.

Question

Q. Define the aims and objectives of teaching computer science at different stages of school.



3

Introduction to Computer

Introduction

A computer is an electronic machine, capable of performing basic operations like addition, subtraction, multiplication, division, etc. It is also capable of storing information, which can be used later. It can process millions of instructions in a few seconds and at the same time with high accuracy. Hence a computer can be defined as an automatic electronic machine for performing calculations or controlling operations that are expressible in numerical or logical terms. Computers are very accurate and save time by performing the assigned task very fast.

Definition of Computer: Computer is an electronic device for storing and processing data, making calculations or controlling machines. It can process at a very high speed with remarkable accuracy. It can also perform all arithmetic and logical function to solve any problem and produce processed information.

Computer is a tool for solving problems. Computers accept instructions and data, perform arithmetic and logical operations and produce information. Hence the instructions and data fed into the computer are converted into information through processing.

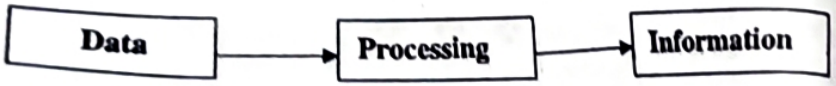


Fig. Data, Processing and Information

Basically data is a collection of facts from which information may be derived. Data is defined as an un-processed collection of raw facts in a manner suitable for communication, interpretation or processing.

Components of a computer system

A computer system has two major components, hardware and software. In practice, the term hardware refers to all the physical items associated with a

computer system. Software is a set of instructions, which enables the hardware to perform a specific task.

Computer Hardware

A computer is a machine that can be programmed to accept data (*input*), and process it into useful information (*output*). It also stores data for later reuse (*storage*). The *processing* is performed by the hardware. The computer hardware responsible for computing are mainly classified as follows:

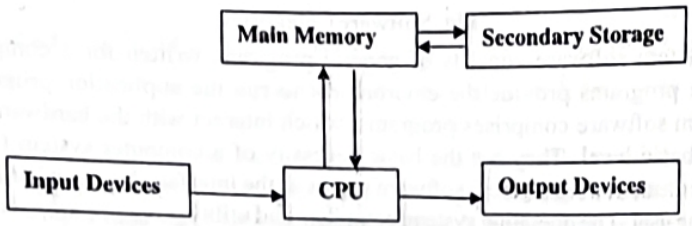


Fig. Computer Hardware

- **Input devices :** These devices allows the user to enter the program and data and send it to the processing unit. The common input devices are keyboard, mouse and scanners.
- **The Processor:** It is more formally known as the *central processing unit* (CPU), has the electronic circuitry that manipulates input data into the information as required. The central processing unit actually executes computer instructions.
- **Memory:** It is that from which the CPU fetches the instructions and data is called main memory. It is also called as primary memory and is volatile in nature.
- **Output devices :** It show the processed data – information – the result of processing. The devices are normally a monitor and printers.
- **Storage devices:** It usually means secondary *storage*, which stores data and programs. Here the data and programs are permanently stored for future use.

The hardware devices attached to the computer are called peripheral equipment. Peripheral equipment includes all input, output and secondary storage devices.

Computer Software

Software refers to a program that makes the computer to do something meaningful. It is the planned, step-by-step instructions required to turn data into information. Software can be classified into two categories: System Software and Application Software.

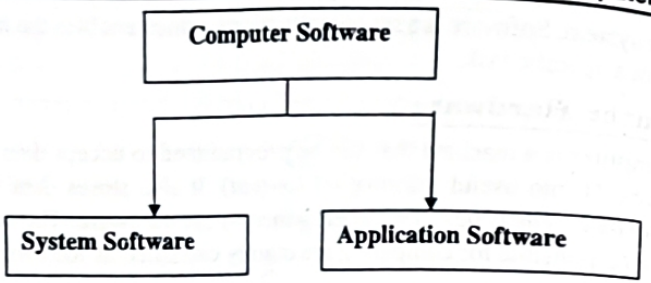


Fig. Software Categories

System software consists of general programs written for a computer. These programs provide the environment to run the application programs. System software comprises programs, which interact with the hardware at a very basic level. They are the basic necessity of a computer system for its proper functioning. System software serves as the interface between hardware and the user. The operating system, compilers and utility programs are examples of system software.

System Software

System Software is a set of programs that control and manage the operations of computer hardware. It also helps application programs to execute correctly. System Software are designed to control the operation and extend the processing functionalities of a computer system. System software makes the operation of a computer more fast, effective, and secure. Example: Operating system, programming language, Communication software, etc.

Features of System Software

An important features of System Software are:

- System Software is closer to the system
- Generally written in a low-level language
- The system software is difficult to design and understand
- Fast in speed
- Less interactive
- Smaller in size
- Hard to manipulate

Types of System Software

Here are the important types of System Software:

- **Operating systems:-** Operating system software helps you for the effective utilization of all hardware and software components of a computer system.

- **Programming language translators:-** Transforms the instructions prepared by developers in a programming language into a form that can be interpreted or compiled and executed by a computer system.
- **Communication Software : -** Communication software allows us to transfer data and programs from one computer system to another.
- **Utility programs: -** Utility programs are a set of programs that help users in system maintenance tasks, and in performing tasks of routine nature.

Application Software

Application Software is a program that does real work for the user. It is mostly created to perform a specific task for a user.

Application Software acts as a mediator between the end-user and System Software. It is also known as an application package. This type of software is written using a high-level language like C, Java, VB. Net, etc. It is a user-specific and is designed to meet the requirements of the user.

You can also install multiple Application Software on a single System Software. You can store this kind of software on CDs, DVDs, flash derive, or keychain storage devices. Example: Word-processing, Spreadsheet, Database, etc.

Features of Application Software

An important feature of Application Software:

- Perform more specialized tasks like word processing, spreadsheets, email, photo editing, etc.
- It needs more storage space as it is bigger in size
- Easy to design and more interactive for the user
- Generally written in a high-level language

Types of Application Software

Here, are some important types of Application Software

- **Word-processing software:-** It makes use of a computer for creating, modifying, viewing, storing, retrieving, and printing documents.
- **Spreadsheet software:-** Spreadsheet software is a numeric data-analysis tool that allows you to create a computerized ledger.
- **Database software:-** A database software is a collection of related data that is stored and retrieved according to user demand.
- **Graphics software:-** It allows computer systems for creating, editing, drawings, graphs, etc.

- **Education software:-** Education software allows a computer to be used as a learning and teaching tool.
- **Entertainment software:-** This type of app allows a computer to be used as an entertainment tool.

Differences between System and Application software

Here are major differences between System and Application software:

System Software	Application Software
They are designed to manage the resources of the system, like memory and process management, security, etc.	They are designed to fulfill the requirements of the user for performing specific tasks.
It is written in a low-level language like a machine or assembly language.	A high-level language is used to write Application Software.
The System Software starts running when the system is powered on and runs until the system is powered off.	The Application Software starts when the user begins, and it ends when the user stops it.
The System Software is a general-purpose software	Application Software is specific purpose software.
It is classified as a package program or customized program	It is classified as time-sharing, resource sharing, client-server.
Installed on the computer system at the time when the operating system is installed.	Installed as per user's requirements.
Capable of running independently.	Can't run independently.
Users never interact with system software as it functions in the background.	Users interact with application software while using specific applications.
System software are independent of the application software	Application software needs system software to run.
System software is crucial for the effective functioning of a system.	Application software is not extremely important for the functioning of the system.

TYPES OF COMPUTERS

Introduction

Classification of the electronic computers may be based on either their principles of operation or their configuration. By configuration, we mean the size, speed of doing computation and storage capacity of a computer.

Classification based on Principles of Operation

Based on the principles of operation, computers are classified into three types:

1. analog computers
2. digital computers and
3. hybrid computers.

1. Analog Computers

Analog Computer is a computing device that works on continuous range of values. The analog computers give approximate results since they deal with quantities that vary continuously. It generally deals with physical variables such as voltage, pressure, temperature, speed, etc.

2. Digital Computers

On the other hand a digital computer operates on digital data such as numbers. It uses binary number system in which there are only two digits 0 and 1. Each one is called a bit. The digital computer is designed using digital circuits in which there are two levels for an input or output signal. These two levels are known as logic 0 and logic 1. Digital Computers can give the results with more accuracy and at a faster rate.

3. Hybrid Computers

A hybrid computing system is a combination of desirable features of analog and digital computers. It is mostly used for automatic operations of complicated physical processes and machines. Now-a-days analog-to-digital and digital-to-analog converters are used for transforming the data into suitable form for either type of computation.

For example, in hospital's automated intensive care unit, analog devices might measure the patients temperature, blood pressure and other vital signs. These measurements which are in analog might then be converted into numbers and supplied to digital components in the system. These components are used to monitor the patient's vital sign and send signals if any abnormal readings are detected. Hybrid computers are mainly used for specialized tasks.

Classification of Computers based on Configuration

Based on performance, size, cost and capacity, the digital computers are classified into four different types :

1. Super computers
2. Mainframe computers
3. Mini computers and
4. Micro computers.

1. Super computers

Supercomputer is a broad term for one of the fastest computers currently available. Supercomputers are very expensive and are employed for specialized

applications that require immense amounts of mathematical calculations (number crunching). For example, weather forecasting requires a supercomputer. Other uses of supercomputers scientific simulations, (animated) graphics, fluid dynamic calculations, nuclear energy research, electronic design, and analysis of geological data (e.g. in petrochemical prospecting). Perhaps the best known supercomputer manufacturer is Cray Research.

2. Mainframe computers

Mainframe was a term originally referring to the cabinet containing the central processor unit or "main frame" of a room-filling Stone Age batch machine. After the emergence of smaller "minicomputer" designs in the early 1970s, the traditional big iron machines were described as "mainframe computers" and eventually just as mainframes. Nowadays a Mainframe is a very large and expensive computer capable of supporting hundreds, or even thousands, of users simultaneously. The chief difference between a supercomputer and a mainframe is that a supercomputer channels all its power into executing a few programs as fast as possible, whereas a mainframe uses its power to execute many programs concurrently. In some ways, mainframes are more powerful than supercomputers because they support more simultaneous programs. But supercomputers can execute a single program faster than a mainframe. The distinction between small mainframes and minicomputers is vague, depending really on how the manufacturer wants to market its machines.

3. Mini computers

It is a midsize computer. In the past decade, the distinction between large minicomputers and small mainframes has blurred, however, as has the distinction between small minicomputers and workstations. But in general, a minicomputer is a multiprocessing system capable of supporting from up to 200 users simultaneously.

4. Micro Computers

The invention of microprocessor (single chip CPU) gave birth to the micro computers. They are several times cheaper than mini computers. The micro computers are further classified into

1. workstation
2. personal computers

1. Workstation

It is a type of computer used for engineering applications (CAD/CAM), desktop publishing, software development, and other types of applications that require a moderate amount of computing power and relatively high quality graphics capabilities. Workstations generally come with a large, high-resolution

graphics screen, at large amount of RAM, built-in network support, and a graphical user interface. Most workstations also have a mass storage device such as a disk drive, but a special type of workstation, called a diskless workstation, comes without a disk drive. The most common operating systems for workstations are UNIX and Windows NT. Like personal computers, most workstations are single-user computers. However, workstations are typically linked together to form a local-area network, although they can also be used as stand-alone systems.

2. Personal computer

It can be defined as a small, relatively inexpensive computer designed for an individual user. Today the personal computers are the most popular computer systems simply called PCs. These desktop computers are also known as home computers. They are usually easier to use and more affordable than workstations. They are self-contained desktop computers intended for an individual user. Most often used for word processing and small database applications.

Personal Computer Types

Actual personal computers can be generally classified by size and chassis / case. The chassis or case is the metal frame that serves as the structural support for electronic components. Every computer system requires at least one chassis to house the circuit boards and wiring. The chassis also contains slots for expansion boards. If you want to insert more boards than there are slots, you will need an expansion chassis, which provides additional slots. There are two basic flavors of chassis designs–desktop models and tower models–but there are many variations on these two basic types. Then come the portable computers that are computers small enough to carry. Portable computers include notebook and subnotebook computers, hand-held computers, palmtops, and PDAs.

Tower model

The term refers to a computer in which the power supply, motherboard, and mass storage devices are stacked on top of each other in a cabinet. This is in contrast to desktop models, in which these components are housed in a more compact box. The main advantage of tower models is that there are fewer space constraints, which makes installation of additional storage devices easier.

Desktop model

A computer designed to fit comfortably on top of a desk, typically with the monitor sitting on top of the computer. Desktop model computers are broad and low, whereas tower model computers are narrow and tall. Because of their

shape, desktop model computers are generally limited to three internal mass storage devices. Desktop models designed to be very small are sometimes referred to as **slimline models**.

Notebook computer

An extremely lightweight personal computer. Notebook computers typically weigh less than 6 pounds and are small enough to fit easily in a briefcase. Aside from size, the principal difference between a notebook computer and a personal computer is the display screen. Notebook computers use a variety of techniques, known as flat-panel technologies, to produce a lightweight and non-bulky display screen. The quality of notebook display screens varies considerably. In terms of computing power, modern notebook computers are nearly equivalent to personal computers. They have the same CPUs, memory capacity, and disk drives. However, all this power in a small package is expensive. Notebook computers cost about twice as much as equivalent regular-sized computers. Notebook computers come with battery packs that enable you to run them without plugging them in. However, the batteries need to be recharged every few hours.

Laptop computer

A small, portable computer — small enough that it can sit on your lap. Nowadays, laptop computers are more frequently called notebook computers.

Subnotebook computer

A portable computer that is slightly lighter and smaller than a full-sized notebook computer. Typically, subnotebook computers have a smaller keyboard and screen, but are otherwise equivalent to notebook computers.

Hand-held computer

A portable computer that is small enough to be held in one s hand. Although extremely convenient to carry, handheld computers have not replaced notebook computers because of their small keyboards and screens. The most popular hand-held computers are those that are specifically designed to provide PIM (personal information manager) functions, such as a calendar and address book. Some manufacturers are trying to solve the small keyboard problem by replacing the keyboard with an electronic pen. However, these pen-based devices rely on handwriting recognition technologies, which are still in their infancy. Hand-held computers are also called PDAs, palmtops and pocket computers.

Palmtop

A small computer that literally fits in your palm. Compared to full-size computers, palmtops are severely limited, but they are practical for certain

functions such as phone books and calendars. Palmtops that use a pen rather than a keyboard for input are often called hand-held computers or PDAs. Because of their small size, most palmtop computers do not include disk drives. However, many contain PCMCIA slots in which you can insert disk drives, modems, memory, and other devices. Palmtops are also called PDAs, hand-held computers and pocket computers.

Personal Digital Assistants (PDA)

Short for personal digital assistant, a handheld device that combines computing, telephone/fax, and networking features. A typical PDA can function as a cellular phone, fax sender, and personal organizer. Unlike portable computers, most PDAs are pen-based, using a stylus rather than a keyboard for input. This means that they also incorporate handwriting recognition features. Some PDAs can also react to voice input by using voice recognition technologies. The field of PDA was pioneered by Apple Computer, which introduced the Newton MessagePad in 1993. Shortly thereafter, several other manufacturers offered similar products. To date, PDAs have had only modest success in the marketplace, due to their high price tags and limited applications. However, many experts believe that PDAs will eventually become common gadgets. PDAs are also called palmtops, hand-held computers and pocket computers.

Question

Q. Define system software.

Q. Define the difference between system software and o application software.



4

Input, Output and Storage Devices

Model of Digital Computer with Functioning of Digital Computer

The model of a digital computer contains the following parts–

1. Input Unit. Information is entered into a computer through input devices. An Input Device reads the data and program into-the computer. The program contains instructions about what has to be done with the data. It provides a way of man to machine communication. An input device converts input information into suitable binary form acceptable to the computer. Some popular input devices are listed below:

1. Keyboard
2. Mouse
3. Joystick
4. Floppy and Hard Disk
5. CDs/DVDs
6. Optical Mark Reader.

In short, the INPUT UNIT performs the following functions:

(i) It accepts or reads the data and program (set of instructions).

(ii) It converts these instructions and data in computer acceptable form.

(iii) It supplies the converted instructions and data to the computer system for further processing.

2. Output Unit. The output devices receive results and other information from the computer and provide them to the users. The computer sends information to an output device in the binary form. An output device convers it into a suitable form convenient to users such as printed form, display on a screen, voice output etc. Some of the popular output units are–

(i) Computer screen called VDU (Visual Display Unit)

(ii) Printer

(iii) Plotter

In short, the following functions are performed by,an output unit–

(i) It accepts the results produced by the computer which are in coded form.

(ii) It converts these coded results to human acceptable form.

(iii) It supplies the converted resits to the outside world.

3. Storage Unit. The function of Storage unit is to store information. The data and instructions that are entered into the computer system through input units have to be stored inside the computer before the actual processing starts. Similarly, the results produced by computer after processing must be kept somewhere before they are passed onto the output unit for display. Moreover, the intermediate results produced by the computer muse also be preserved. The storage unir or the primary/main memory of the computer provides support for these storage functions. The main memory is a fast memory. It stores programs along with data. The main memory is directly accessed by the CPU.

The secondary memory, also called the auxiliary memory, is used to store the information, data and program instructions permanently. These may be used later on or deleted whenever not required.

To sum up, the stoage unit performs following functions–

(i) It stores the data and the program (set of instructions).

(ii) It holds the intermediate results of processing.

(iii) It stores the final results of processing before they are passed onto the output unite

4. Central Processing Unit. The CPU is the brain of a computer. Its primary function is to execute programs. Besides executing programs, the CPU also controls the operation of all other componments such as memory, input and output devices. The major sections of a CPU are–

(i) Arithmetic and Logic Unit (ALU)

(ii) Control Unit (CU).

(i) ALU. The functions of an ALU is to perform arithmetic and logic operations such an addition, subtraction, multiplication and division: AND, OR, NOT, EXCLUSIVE OR Operation. It also performs increment, decrement, left, shift and clear operations.

(ii) Control Unit. The control unit is the most important part of the C.P.U. as it controls and co-ordinates the activities of all other units such as ALU, memory unit, input and output unit Although, it does not perform any actual processing on the data, the CU acts as a central nervous system.

To sum up, it performs the following functions–

(i) It can get instructions out of the memory unit.

(ii) It can decode the instructions.

(iii) It sets up the routing, through the internal wiring of data to the correct place at the correct time.

(iv) It can determine the storage location from where it is to get the next instruction after the previous instruction has been executed.

Input Devices

1. Keyboards. Keyboard is the most important input medium. A keyboard is just like *a* typewriter with modified and enhanced functions. A keyboard has 101 keys in all. These days 104 keys keyboards are widely used. As soon as we press a key on the keyboard, corresponding character is displayed on the screen or corresponding function is done.



Fig. Keyboard with 104 keys

2. Mouse. Mouse is another widely used input device. It is a pointing device which is used in the process of feeding and editing data. It is moved across a flat surface or a plane table. It is supported by a long wire which is connected to the motherboard of the computer. It shows the arrow like image on the screen. This arrow is called **mouse pointer.** Mouse is associated with two or three push buttons which can be gently pressed by the fingers. When the mouse is activated, we see a flashing arrow on the monitor screen. When the mouse is moved on the surface of the table or mouse pad, this arrow comes in the movement. Within no time this arrow can be reached from one part to the other part of the screen. This movement can be diagonal, from left to right or right to left, up and down as per requirements.



Fig. Mouse

3. Joystick. It is also a pointing input device which is used frequently in programs like video games and on personal computers. It is an electric device which is used like a mouse for controlling cursor movement. It consists of four micro-switches arranged in tour directions. When the joystick is moved in a particular direction, the switch is activated in that direction and gives a signal to the cursor. The cursor moves in the direction in which the stick has been moved.



Fig. Joystick

4. Scanner. A scanner is a device which is used to scan a diagram, photograph etc. and the image can be brought on to the monitor. A scanner may be in different shapes. It may be hand-held or flat bed scanner. A hand-held scanner is moved on the text, photograph, diagram etc. to capture the image. It is moved uniformly through the movement of hand.



Fig. Scanner



Fig. Hand-held Scanner

The flat ted scanner is kept at one position and page of text, photograph, diagram etc. is placed in the scanner which captures image and sends it to the computer screen.

You can save the text in image form or even in document (rich text format) form. Photos can be saved in the form of bit map images or jpg files.

These captured Images can be edited by document/photo editing software. Very high resolution scanners are used for scanning for high- resolution printing, but lower resolution scanner are adequate for capturing images for computer display.

5. Microphone. A microphone is a device for converting sound waves into electric energy that has wave characteristics similar to those of the sound. All microphones have a diaphragm or other similar element which vibrates when the wave fronts reach to it. A sensor in the microphone measures the movement of the vibrating element.



Fig. Microphone

It then converts the mechanical vibrations into electrical signals. These electrical signals can then be amplified, transmitted (as in a radio station or telephone), stored (as in a compact disk or MP3) or processed, in addition to their use in telephone transmitters, microphones are most widely applied in hearing aids, sound-recording systems and public address systems.

6. Optical Character Reader (OCR). OCR are scanning devices which are used to detect alphabetic and numeric characters printed on paper. These characters may be typed or handwritten. When a user scans any document it is stored in the form of an image. This image can relocated into word processing software such as MS-Word where he can easily edit it as per his need.

It has made scanning, printing and transferring of documents in editable format quite easily.

7. Magnetic Ink Character Recognition (MICR). MICR is a special technique of interpretation of a line of characters by a computer. These special characters are written on a paper which can be read by the computer. MICR system is used in banking applications worldwide. This technique is in operation since last some years, in this method, the cheques are pre-coded and what is written on it, is read by the machines. The requisite information is printed on the cheques with a special type of ink. This ink is made up of magnetic material and when the cheque is inserted in -the machine, the infoimation printed on the cheque is magnetized and is read by the machine. The information is printed on the tower horizontal part of the cheque. This area is called MICR band. The band is 5/8" in width.



Fig. Light Pen

8. Light Pen. Light pen as the name suggests, is a pen-shaped light- sensitive device and can be connected to a computer to draw graphics and to highlight the text directly on the computer screen. It contains the light receptor and is activated by pressing the pen against the face of monitor. When the pen is brought close to the screen, the fight emitted by it modifies the data. The pen consists of a light-sending mechanism at the end of a pen. It allows the user to point to displayed objects or draw on the screen, in a similar way to a touch screen but with greater positional accuracy. A fight pen can work with any CRT-based display. A light pen is fairly simple to implement. It works by sensing the sudden small change in brightness of a point on the screen when the electron gun of the light pen refreshes that spot.

9. Optical Bar Code Reader (OBR). OBR scans a set of vertical bars having different width for specific data. These devices are available as hand-hold devices and are used to read merchandise in stores, library, books, medicines *etc.*

OMR is a technology of electronically extracting data from the marked fields such as checkboxes, ovals and other shapes on printed forms. OMR technology scans a printed form and reads predefined positions and records where marks are made on the form. This technology is useful for applications in-which large numbers or hand-filled forms needs to be processed quickly and with great accuracy such as checking of multiple choice 'Questions, surveys, reply cards and questionnaires etc.

In a multiple choice question paper, the student indicates the answer on the test by filling in the corresponding bubble (oval shape) and the form is fed through an optical mark reader.

An OMR is a device that scans the document and reads the data from the marked fields,

10. Digital Camera. A digital camera is a camera that captures photographs or digitally by recording images via an electronic image sensor. It records and stores photographic images in digital form. Many current models are also able to capture sound or video, in addition to still images. Capture is usually accomplished by use of a photo sensor. The stored images can be uploaded to a computer immediately or stored in the camera for to be uploaded into *a* computer or printer later.



Fig. Digital Camera

Digital cameras can do those things that film cameras cannot : displaying images on a screen immediately after they are recorded, thousands of images on a single small memory device, recording video with sound and deleting images to free storage space.

Most digital cameras have an LCD for viewing both images in the viewfinder and those in the camera's memory. Kodak, Canon, Sony, Nikon, Olympus and several other companies make digital cameras of different ranges.

Output Devices

1. Speakers. Computer speakers are external speakers, commonly equipped with a low-power internal amplifier. The speakers are attached to sound card in lime green jack plug. A plug and socket for a two-wire coaxial cable that is widely used to connect analog audio and video components, USB speakers which are powered from the 5 volts at 200 milliamps provided by the USB port.

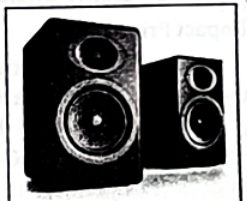


Fig. Speaker

Computer speakers range widely in quality and in price. The computer speakers typically packaged with computer systems are small plastic boxes with mediocre sound quality. Some of the slightly better computer speakers have equalization features such as bass and treble controls, improving their sound quality somewhat.

The choice of buying computer speakers depends greatly on the purpose for which you want to buy them Simply if you have to do - works like sound of video editing or are a gaming expert and want to make the game come alive, then definitely you will have to option for multi-channel high end speakers. If you need to have the speakers for general purpose then you can choose from the products which are cheaper and are entry level models.

2. Printers. Printers are the output devices. The data/information from the main memory of computer is transferred to the printer and the same is printed. The data can be printed in the form of graphs, letters, reports *etc.*

As given in the figure below, printers are mainly divided into two types (1) Impact Printers (2) Non-Impact Printers

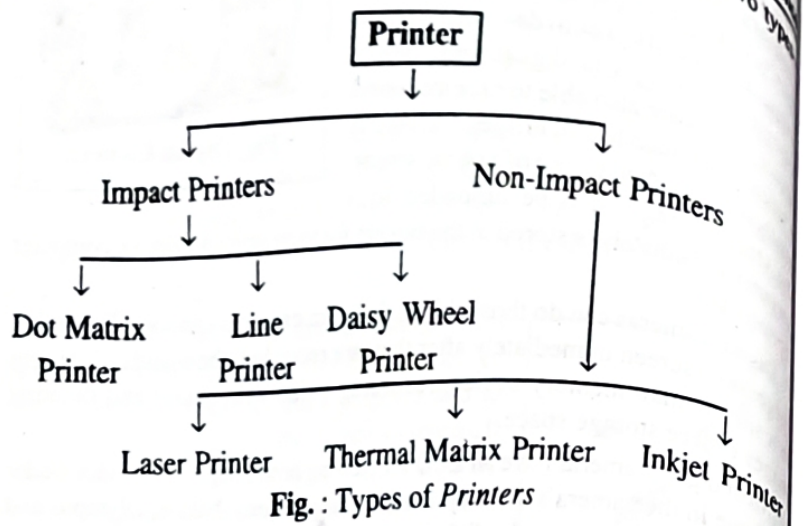


Fig. : Types of *Printers*

3. Impact Printer. Impact Printer uses ribbon/carbon papers to leave the impression on the paper. There is a mechanical contest between print head and paper. Dot Matrix Printer and Daisy Wheel Printer come in the category of Impact Prints

4. Dot Matrix Printer. Do! Matrix Printer leaves the impression of cha·acter in the form of dots. This printer consists of a hammer which prints the characters one by one. Output is obtained in the form of dots. This printer is widely used with personal computers. The hammer or head contains 9 pins or 24 pins. The typical speed of dot matrix printer is 40 characters per second to 1000 characters per second. 7x5 Dot Matrix Printer means that maximum vertical height of the letter is 7 dots and horizontal height is 5 dots.



Fig. Dot Matrix Printer

Many of these printers are bidirectional *i.e.,* they can print from either directions left or right. Some printers are rated as Light Duty Printers he-cause these cannot be used for a continued period of time.

These printers are available in 80 column, 132 column and 136 column styles. Some of these printers can- also print different types of fonts such an Draft, Roman. Sans Serif, Courier, Script in the size of 10, 12 and 15 cpi (characters per inch). Printing speed can vary upto 100 cps at 12 cpi. These printers are widely used in government offices.

5. Chain Printer. In *a* chain printer, a chain of characters rotates and in this process hammer of the printer strikes on chain and the character of the chain

leaves an impression of the character on the paper. This printer can work for a longer time but the quality of output is not so good.

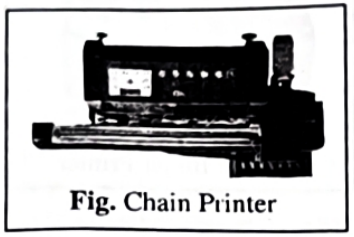


Fig. Chain Printer



Fig. Daisy Wheel

6. Daisy Wheel Printer. This printer contains a disk of metal or plastic and it has 96 characters on its petals. This disk is capable of rotating. The hammer of this printer pushes the character and it leaves an impression of the alphabet on the paper. Typical speed of daisy wheel printer is 20 characters per second to 100 characters per second. Daisy wheel printers cannot be used for longer duration and also they are slow in functioning. The main feature of this printer is that the printing is of superior quality.

7. Non-Impact Printers. The printers in which there is no mechanical contact between the print head and paper are called Non- Impact Printers. These printers can be classified as follows :–

(i) Laser Printer. These printers generate both graphics as well as text as image outputs. The quality of output is very good. These printers use the technique of laser and photocopy. The speed of this printer is marvelous. It can print more than 300 pages in one minute. It can print a normal book only in one minute. With the development of technique, Laser Printers, now can also print multi-coloured graphics output. As the quality of the output is very good, laser printers are used in Desk Top Publishing (DTP).

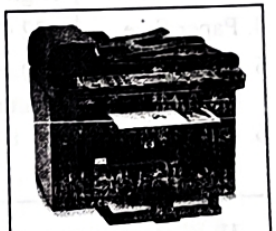


Fig. Laser Printer

(ii) Thermal Matrix Printers. This is another type of non-impact printers. These printers work on heating arrangement. Special type of paper is needed for printing. It contains print wires and when electricity is passed through these wires and with passage of current, the wires get heated and leave impression with the help of special type of ribbon. These printers are slow and costly.

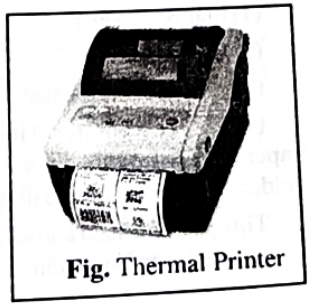


Fig. Thermal Printer

(iii) Inkjet Printer. Inkjet printer is a non-impact printers. The drops of ink appear in the form of character. Small pumps release tiny drops of ink through nozzles onto the paper in the form of character. The printing of this printer is good and a good quality of graphics can be obtained. The speed of Inkjet printer ranges between 300-360 dpi per second and the noise level while printing is very less.



Fig. An Inkjet Printer

Comparison of Printers

Points of Difference	Dot Matrix Printer	Inkjet Printer	Laster Printer
1. Speed	300 cps	300-360 dpi	300-600 dpi
2. Print Quality	Printing in Dot forms Not so good	Average Printing	Superior Quality
3. Noise Level	High	Less	No Noise
4. Paper Size	132 Column	A4 Size	A4 Size
5. Life span	100 million characters	15-00 pages	60,000 pages
6. Cost	Rs. 8,000-16,000	Rs. 2,500-15,000	Rs. 5,000-25,000

11. Plotters. Plotters are output devices and are used for various purposes like graphics, diagrams *etc.* There are different types of plotters and are used for various purposes. Plotters mainly are of three types :-

(1) Flat Bed Plotter

(2) Drum Plotter

(3) Electrostatic Plotter

(1) Flat Bed Plotter. This plotter uses a light pen and draws graphs on the papers. Multi-coloured pens are used for graphics. Pen is controlled by pen holder. To draw a colored diagram or graph, pens of 8-10 colours are used.

This plotter is also known as Light Pen Plotter. It can make graphs of small to large size depending upon the size of Bed.

(2) Drum Plotter. It is a type of pen plotter than wraps the paper around a drum with a pin feed attachment. The drum turns to produce one direction of the plot and the pens move to provide the other. The hotter was the first output device to print graphics and large engineering drawings. Using different coloured pens, it can draw in coloured graphics.

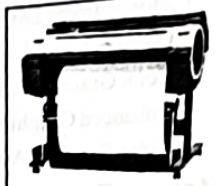


Fig. A Drum Plotter

High quality drawings including two-dimensional and three- dimsnsional, can be produced at relatively much cheaper cost.

(3) Electrostatic Plotter. It is a type of plotter that uses an electrostatic method of (Printing, Plotters using liquid toner use a positively charged toner that is attracted towards paper which is negatively charged by passing by a line of electrodes. They can print in black and white or color and some handle paper up to six feet wide. Newer electrostatic plotters are really large format laser printers and focus light onto a charge drum.



Fig. Electrostatic Plotter

Advantages of Plotters

(i) Drawings are of the same quality as if an expert drew them.

(ii) Larger sizes of paper can be used than most printers can manage.

12. Visual Display Unit. A visual display unit is a box similar to a small TV set. It displays the input being fed into the computer. Errors which are visible on the screen can be corrected with the movement of cursor. Exactly behind the screen of the VDU, the back part is a cathode ray tube (CRT) which is also called Electron Gun. It sends a regular beam of electrons. This beam helps in creating images on to the screen. The image is produced by varying the intensity of the electron beam. The process of image creation is performed by the horizontal scan and vertical retrace.



Fig. LCD Monitor

A color monitor contains 3 electron guns. These guns scan dots of red, green and blue phosphor that coat the screen's surface.

Monitors are available in various sizes e.g. 9", 12", 14", 15", 17" etc.

Types of Monitors. Monitors are available in different types which are explained below :-

1. Monochrome Display Adapter (MDA)
2. Hercules Graphic Card (HGC)
3. Color Graphics Adapter (CGA)
4. Enhanced Graphics Adapter (EGA)
5. Video Graphics Array (VGA)

Storage Device

1. Floppy Disk. Floppy can be used both as input and output medium. Floppy disk was developed in 70s. This is a very small storage device. This is made up of elastic plastic material and is finely coated with magnetic oxide. This disk is placed in plastic cover to avoid damage. The floppy has passed through three standard sizes of 8", 5.25" and 3.5". The storage capacity of each floppy disk is different. The floppy of 8" and 5.25" size are outdated now.



Fig. Floppy Disk

Floppy Size	Storage Capacity
8 inches	250 KB to 1.5 MB (outdated now)
5.25 inches	125 KB to 1 'MB (outdated now)
3.5 inches	1.44 MB

Features of Floppy Disk

(1) It is a handy storage device and can be easily taken from one place to another.
(2) It is a cheap storage medium.
(3) It is very useful for personal computer,
(4) It can be used both as input and output medium.
(5) It can be used both for reading and writing.
(6) It is very useful for small commercial organizations.

The floppy is inserted into floppy drive. This rotates inside the floppy drive like a musical record and the data is stored on fine circular paths called tracks. The data already stored in it can be removed and new data can be fed in place of it.

The storage capacity of floppy disk depends upon the following factors :
– Design – Density
– Surface
– Number of tracks (Cylinders)

Formula for calculating storage capacity of the floppy.

Capacity = $N \times n \times s \times d$

Where N = Number of tracks
n = Number of sectors
s = Number of sides
d = Data capacity

$$\text{Storage Utilisation Factor} = \frac{\text{Number of sectors used}}{\text{Total number of sectors}} \times 100$$

2. Magnetic Disk (Hard Disk). Magnetic Disk resembles a record player. This is very useful and one .of the most popular storage devices. The data stored onto it can be searched out very quickly and we have not to pass through the data sequentially. In this way the magnetic disk has an edge over magnetic tape. Magnetic disk pack consists of 6 or more than six disks which are elastic in nature. These disks rotate on one another in a spindle. The distance between each magnetic disk is 0.5 inch and these rotate at the rate of 60 or more rotations per second. Disks can be used from both surfaces. The surface of a magnetic disk is finely coated with magnetic oxide which gets magnetized very easily. The disk surface contains circular paths called tracks and each track is divided into a sector. The data can be stored equally in each track. The size of the inner tracks is smaller as compared to outer tracks. The packing density of the tracks is different. The tracks near to the centre of the disk have more packing density and the tracks away from the centre (large in size) have lesser packing density.

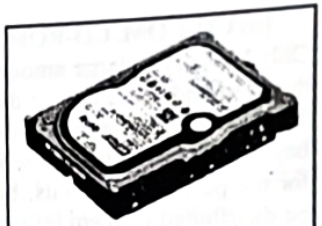


Fig. Hard Disk

The storage capacity of the disk depends upon the following factors:–
– Packing Density
– Number of surfaces
– Number of tracks in each surface
– Number of sectors in each track.

A standard magnetic disk contains 400 to 1600 tracks and the standard size is 14 inches. The hacks per surface on the magnetic disk are also referred to as cylinders.

(Number of tracks per surface = Number of cylinders)

Presently, hard disks with more than 200 GB capacity are used in computers.

3. Optical Disk. Optical disk is a recent development in the storage devices. This disk is also called Compact Disc (CD-ROM). The storage capacity of an

optical disc is 'wonderful. The diameter of this disk is 12 cms. and stores capacity is 700 MB. This is very fast and cheap storage device. An amazing fact about optical disc is that a single disc is equivalent to 500 floppy disks. The data/ information on the optical disc cannot be removed/altered. The data is stored permanently on the optical disc. Two types of optical discs are available.

(i) WORM

(ii) CD-ROM

(i) WORM. WORM means Write Once Read Many times. The data optically recorded on this device cannot be erased. The data can be read rapidly and repeatedly.

(ii) CD-ROM. CD-ROM means Compact Disc Read Only Memory. A large amount of data can be stored on this disc and ttjese can be distributed to several users. These devices cannot be simply written by the users because a special type of writing instrument is required for the purpose. Manuals, books, dictionaries, etc. can be distributed on them for reference purpose.



Fig. CD-ROM

DVD. The full form of DVD is Digital Versatile Disc. We know that a single CD can store a large amount of data on it. But even sometimes, a CD is not sufficient to store complete program/information on it. For example, a complete movie requires 2 or 3 CDs for storage. Some big programs/ softwares need more than one CD for recording. To eliminate this limitation, DVD-ROMs are used.



Fig. DVD

Physically a CD and a DVD look similar but the storage capacity of a DVD is much more than a CD. A DVD can store upto 4.7 GB of data. The quality of a DVD is better than CD.

DVD-ROM is read by the DVD drive. A DVD drive can read both CD and DVD.

4. Blu-Ray. Bu-ray is a high density optical disc storage medium designed by Sony to supersede the DVD format. The format was developed to enable recording, rewriting and playback oi high-definition video (HD), as well as storing large amounts of data The format offers more than five times the storage capacity of traditional DVDs and can hold up to 25 GB on a single-layer disc and 50GB on a dual-layer disc.



Fig. Blu-Ray

The name Blu-ray Disc is derived from the blue laster (violet- coloured) used to read and write to this type of disc. A single layer disc can store 25 GB whereas Blu-ray Disc can store 50 gigabytes, almost six times the capacity of a dual-layer DVD or ten and a half times that of a single-layer DVD.

Blu-ray Disc is developed by the Blu-ray Disc Association, a group representing makers of consumer electronics, computer hardware and motion pictures.

5. Pen/Flash Drive. Fen drives are also known by the name *thumb* drives. A pen drive can transfer large volumes of data from :

laptop to laptop

desktop computer to laptop

laptop to a desktop computer

desktop to desktop.



Fig. Pen Drive

Since storage capacity of pen drives is very much large as compared to portable medium like floppy, a large volume of data (8 Gigabytes or so) can be carried on a single pen drive. Pen drives make accessing and transferring audio-video files very easy with the of USB plug-and-play interface.

USB pen drives provide dependable data, music and video transfers and storage with plug and play ease. No driver software is needed for connecting pen drive if the operating system is Window XP or Windows Vista. Therefore, 3 pen drive can be put to use immediately as and when needed by the computer user. With no batteries, no software and no cables, a pen drive is totally portable.

Advantages of Pen Drive

1. It is portable.
2. It is light weight.
3. It is very compact.
4. It has a storage capacity ranging from 16 MB to 64 GB.
5. It can transfer data at a very high speed.

Pen drive has proved its usefulness to the programmers. They can carry their programs and even complete operating systems or high level languages and other utilities on a single pen drive.

6. Memory Stick. Memory stick is a removable flash memory card format, launched by Sony in October 1998 and is also used in general to describe the whole family of Memory Sticks. It allows greater maximum storage capacity and faster file transfer speeds. In December 2006, Sony added the Memory Stick PRO- HG, a high speed variant of the PRO to be used in high definition stills and video cameras. Capacity of memory stick is in the range of 4 MB to 32 GB.

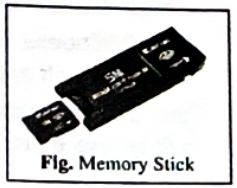


Fig. Memory Stick

❖ ❖ ❖

5

Ms Word

Microsoft Word is a software that helps you create neat and attractive documents easily and quickly. Features like spell and grammar check, easy insertion of new sentences and paragraphs in the already entered text page numbering etc. make the functioning of a word processor easier, faster and more accurate.

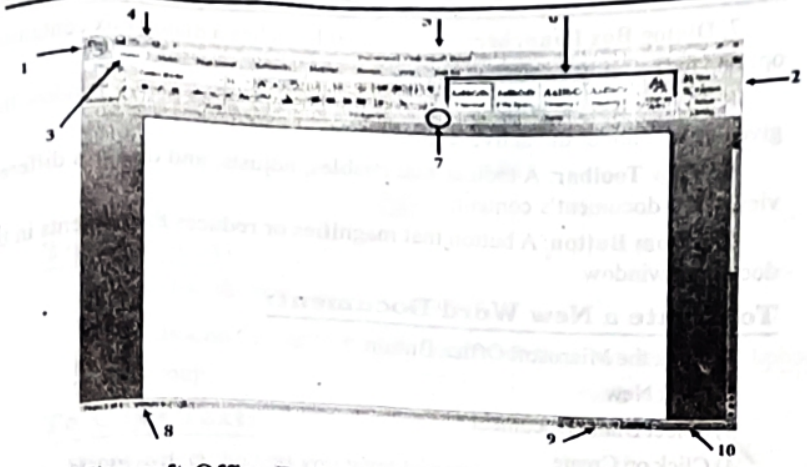
Features:

- It allows you to change the appearance of texts.
- It allows you to organise the information in your document in a systematic manner.
- You can add page number, page border, header and footer at the bottom of a page to display useful information.
- You can also present your information in tabular form.
- It allows you to use features like spell and grammar check, insertion of new paragraphs and sentences in the already texted page.

Starting Microsoft Word

To load Microsoft Word:

1. Click on the Start menu in the bottom left corner of the screen
2. Choose All Programs then Microsoft Office (from the sub-menu which appears)
3. Finally click on Microsoft Office Word 2007



1. **Microsoft Office Button**: A button that provides access to menu commands in Word. The Microsoft Office Button replaces the File button in previous versions. Here is where you will find commonly known features such as New, Open, Save, Print and Recent Documents. This is also where you will find the Word Options commands that were previously located in the Tools menu in previous versions.

2. **Ribbon**: An area across the top of the screen that makes almost all the capabilities of Word available in a single area. The Ribbon replaces the menus and toolbars in previous versions. The Ribbon exposes most of the features that used to be hidden in File menus. The Ribbon makes it easier to see and find commands to format your document. The Ribbon can be reduced to a single line of tabs by pressing CTRL + F1.

3. **Tab**: An area on the Ribbon that contains buttons that are organized in groups. The default tabs are Home, Insert, Page Layout, Reference, Mailings, Review and View.

4. **Quick Access Toolbar**: A customizable toolbar at the top of an active document. By default the Quick Access Toolbar displays the Save, Undo, and Repeat buttons and is used for easy access to frequently used commands. To customize this toolbar click on the dropdown arrow and select the commands you want to add.

5. **Title Bar:** A horizontal bar at the top of an active document. This bar displays the name of the document and application. At the right end of the Title Bar is the Minimize, Restore and Close buttons.

6. **Groups Categories**: A Group of buttons on a tab that are exposed and easily accessible. These buttons were formally embedded in menus on the Menu Bar.

7. **Dialog Box Launcher**: A button that launches a dialog box contai options for refining a command.

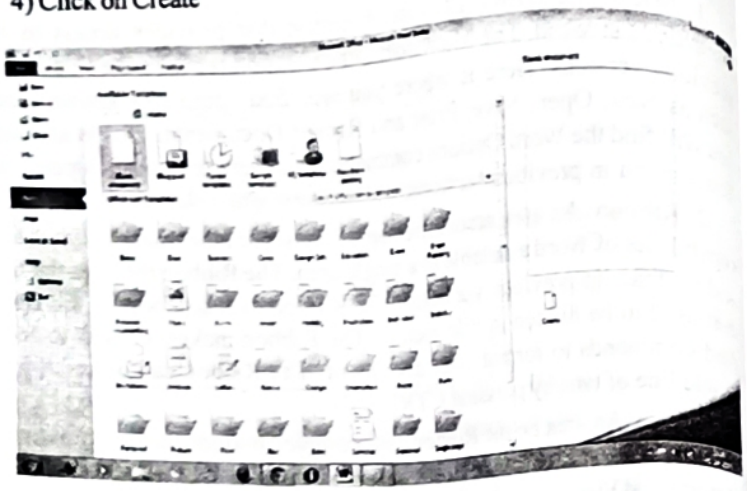
8. **Status Bar**: A horizontal bar at the bottom of an active window gives details about the active document.

9. **View Toolbar**: A toolbar that enables, adjusts, and displays diffe views of a document's content.

10. **Zoom Button**: A button that magnifies or reduces the contents in document window.

To Create a New Word Document:

1) Click the Microsoft Office Button
2) Click New
3) Select Blank Document
4) Click on Create



HOME TAB



Cut, Copy and Paste

Often times you will need to move text from one location in a document another, or to a different application.

In this case you will perform a Cut and Paste. To reproduce a specific pa of a document and place it elsewhere, you will perform a Copy and Paste.



To Cut Text:

1) Select the text you want to move
2) Click on the Cut icon located on the Home tab in the Clipboard group

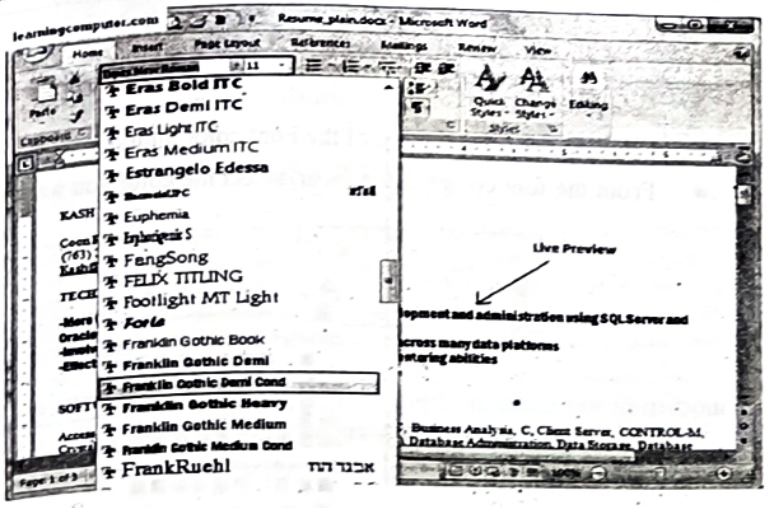
To Copy Text:

1) Select the text you want to copy
2) Click on the Copy icon located on the Home tab in the Clipboard group

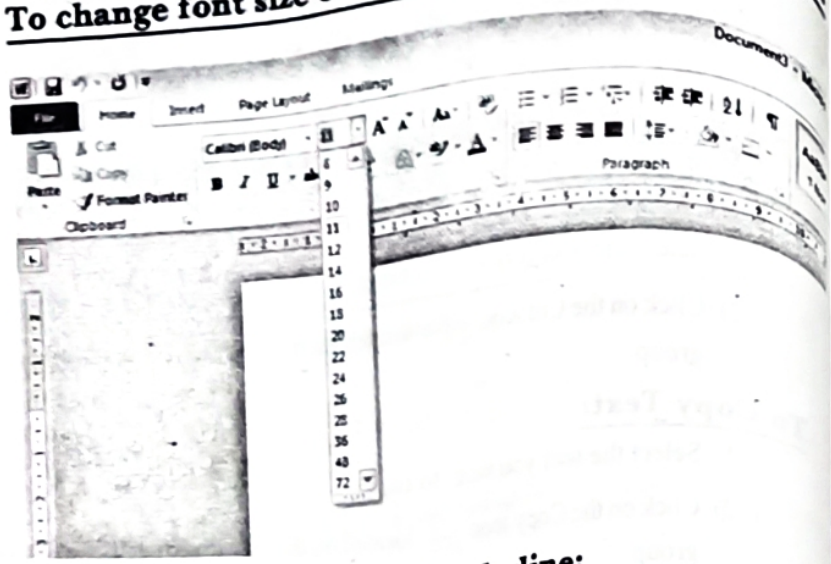
To Paste Text:

1) Click in the area of the document where you want to paste your text
2) Click on the Paste icon located on the Home tab in the Clipboard group

To change font style of the written texts:

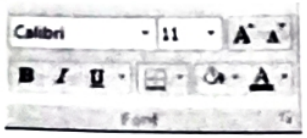


To change font size of the written text:



Adding Bold,Italic or/and underline:

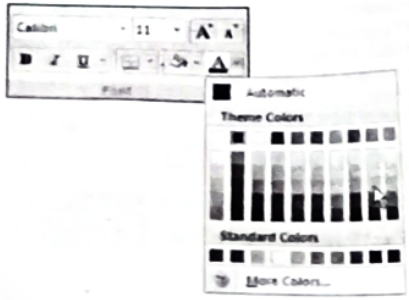
- Select the text you wish to format
- Click one of the following button to apply formatting:



To format your text...	Click on...
Bold	B
Italic	I
Underline	U

Changing color of the text:

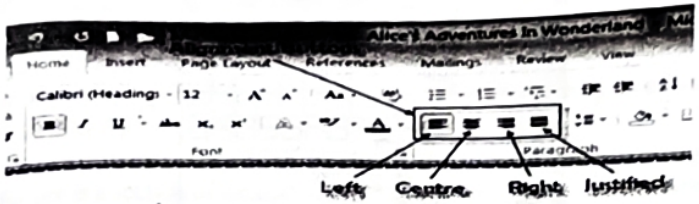
- Select the text you wish to format.
- Click on the down facing of the Font color button
- From the font colors that appear, select the color you want..



To change Alignment of the written texts:

Microsoft Word defaults to left justified (aligned) paragraphs. This means that new lines automatically line up with the left margin.

If you need to left align text, highlight the text with the mouse and click the Align Left button on the Home tab.



To center text, click the Center button. Your text is now lined up in the center of the page (along the vertical axis).



To move the text so it is aligned with the right margin, highlight the text you want to move, and click the Align Right button. Your text is now aligned to the right margin.



To make the text stretch out so it takes up whole lines, highlight the text you want to move, and click on Justify. Your text is now fully justified (spread out) across the page so that both the left and right sides of the paragraph are straight instead of being jagged.



INSERT MENU

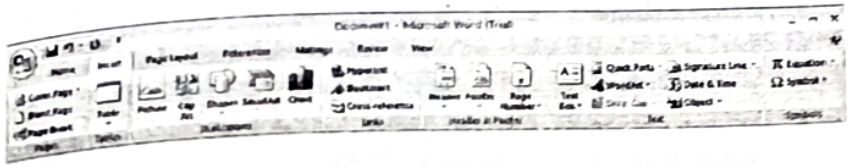


Table menu

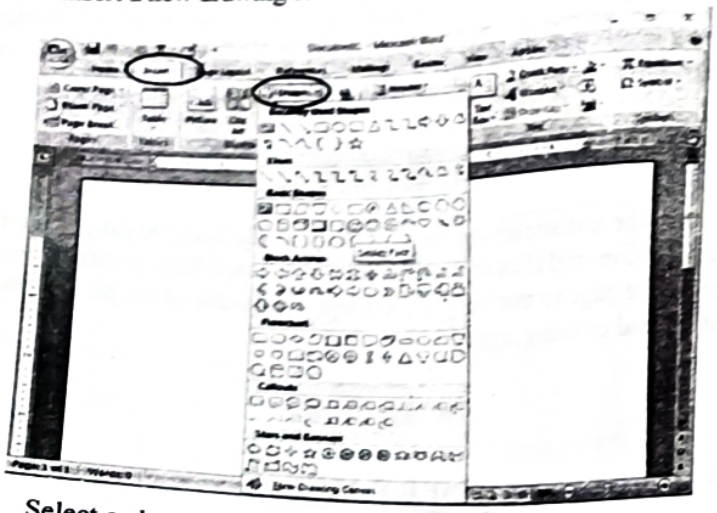
1. Click where you want to insert a table.

2. On the Insert tab, in the Tables group, click Table, and then, under Insert Table, drag to select the number of rows and columns that you want.

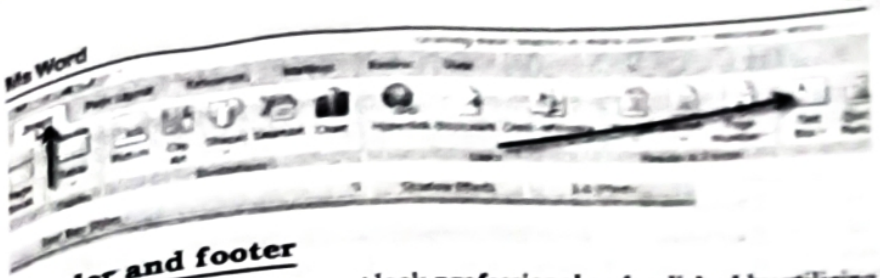


To insert shape:

The pull-down menu shows what shapes you've used most recently, as well as a list and pictures of other ready-made shapes that are available – you can also insert a new drawing canvas from this menu:



- Select a shape
- Put your cursor where you want to insert the shape, hold down the mouse button, and pull to draw
- As soon as you do this, the Shape Format menu appears, and you can change the way your shape looks
- You can draw several shapes, change their order front to back, and group them together so they move on the page at the same time, and you can add text (Insert⇨Text Box) or Right Click on Shape



Header and footer

You can make your document look **professional and polished** by utilizing the header and footer sections.

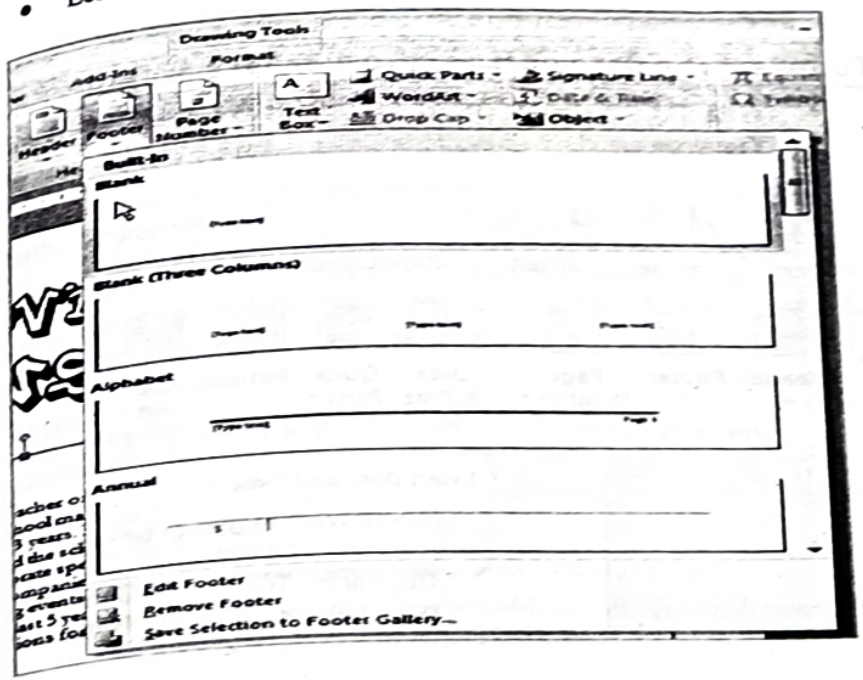
The **header** is a section of the document that appears in the **top margin**, while the **footer** is a section of the document that appears in the **bottom margin**. Headers and footers generally contain information such as page number, date, and document name.

To insert a header or footer:

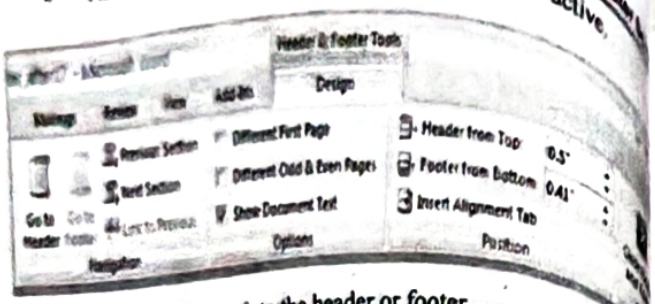
- Select the **Insert** tab.
- Click either the **Header** or **Footer** command. A menu appears with a list of **built-in options** you can use.
- Left-click one of the built-in options, and it will appear in the document.

OR

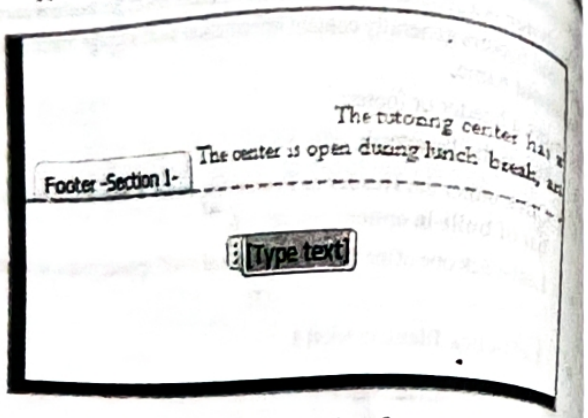
- Left-click **Blank** to select it.



- The Design tab with Header and Footer tools is active.

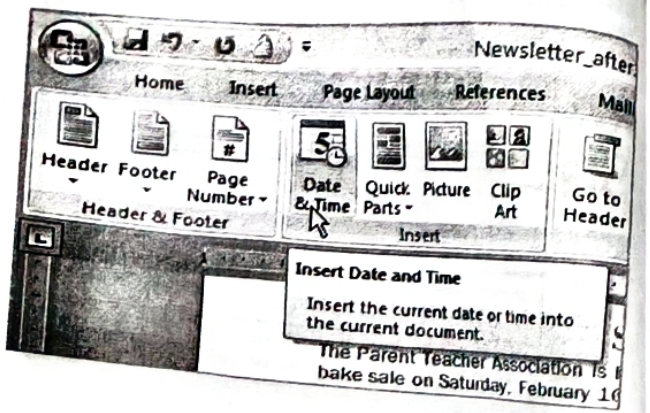


- Type information into the header or footer.

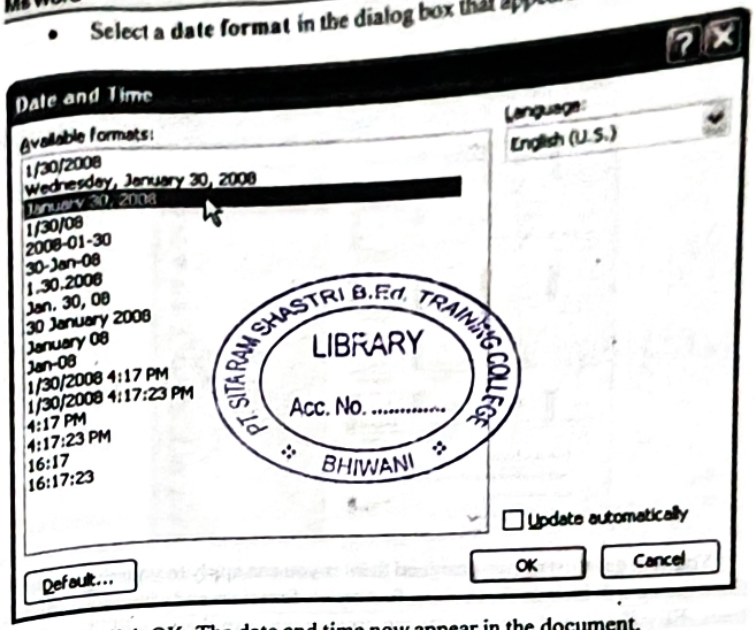


To insert the date or time into a header or footer:

- With the header or footer section active, click the **Date & Time** command.

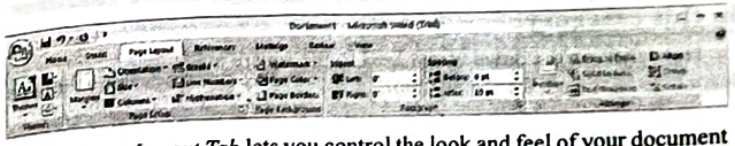


- Select a **date format** in the dialog box that appears.



- Click OK. The date and time now appear in the document.

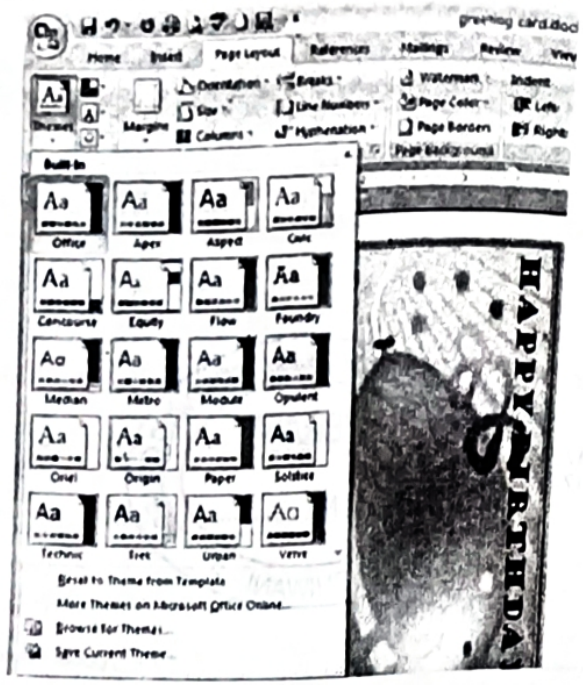
PAGE LAYOUT MENU



The *Page Layout Tab* lets you control the look and feel of your document in Microsoft Word 2007. You can apply a global design to your document by using one of the available themes and color schemes. You can also change the document orientation, page size, margins, indentation, line spacing and paragraph settings.

Themes

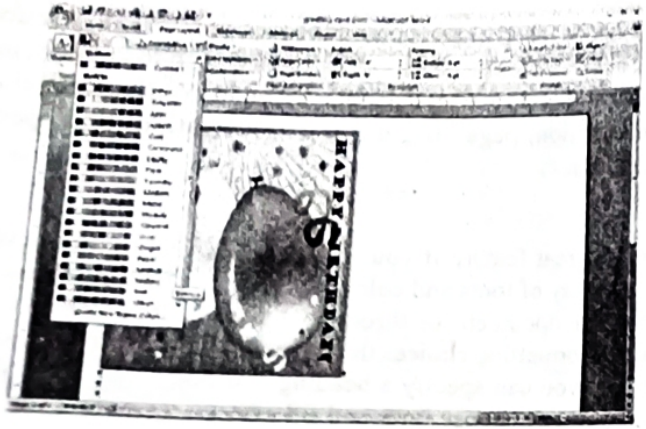
Themes is a great feature if you are typing an elaborate document and want to use a variety of fonts and colors and then duplicating those fonts and colors on another document or throughout a long document. A document theme is a set of formatting choices that include a set of theme colors, a set of theme fonts that you can specify a heading and body text font, and a set of theme effects you can choose lines and fill effects.



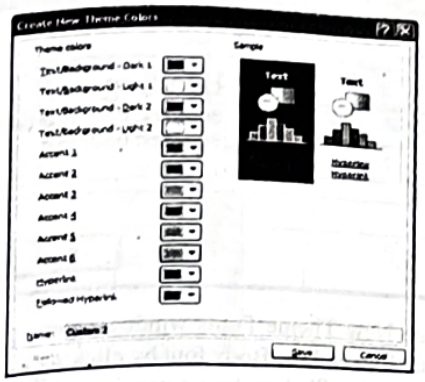
You will get a list of pre-designed themes you can apply to your document. Each theme will include font colors, font styles, font sizes and effects including lines, fill effects, and colors. you can create your own theme with the other options in the Theme section.

To create your custom theme with the other features in this category.

Now click on the down arrow next to the square made up of 4 colors to learn how to change the theme color.



When you click on the custom color theme drop down arrow you will get a list of Built-In Color themes for your document. These are colors are for a variety of things including heading, body, and accent colors. Now click on Create New Theme Colors.



The Create New Theme Colors window will appear. Here you get a better idea of what each line of colors is going to do.

Not only do you now understand what each color is for but you can modify the colors to your liking.

Once you are finished modifying the colors by clicking the dropdown arrow next to the color you want to change and selecting a new color then type a theme color name in the Name section the click Save.

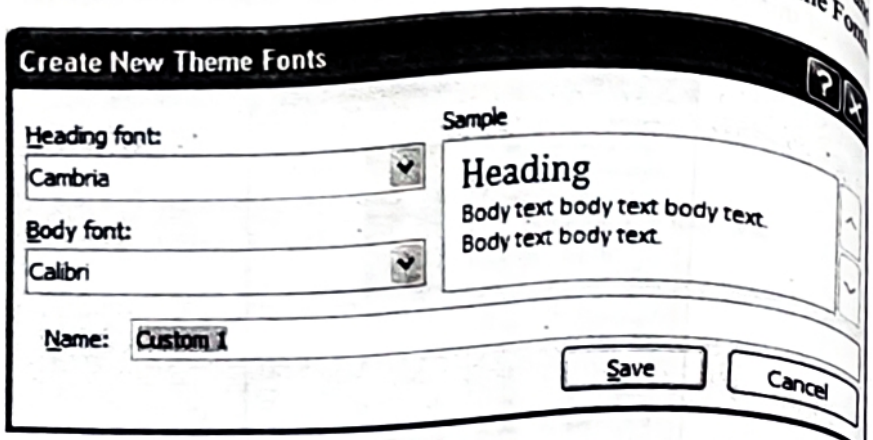
Your new modified color will appear in the list of Built-In Color Themes.

Font theme selector

Click the dropdown arrow next to the box with an A.



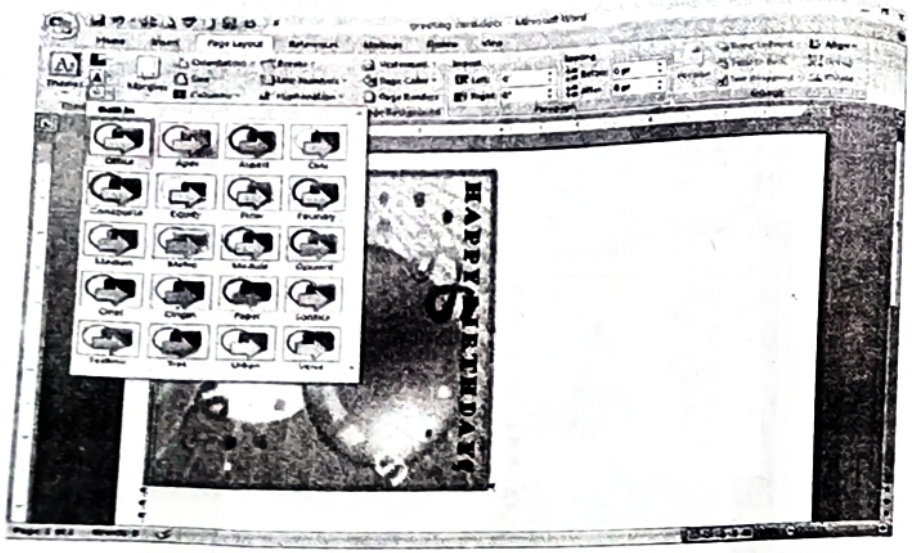
This menu works just like the colors but you are changing the fonts. It has the same Built-In selections Microsoft Word 2007 has provided for you and also the Create New Theme Fonts option. Click the Create New Theme Fonts



When the Create New Theme Fonts window opens go ahead and play around with Heading font and the Body font by clicking the dropdown arrow next to the font names. It will show you a preview of your selections in the Sample section. If you want to save your selections type a name in the Name section and click save.

Effects button

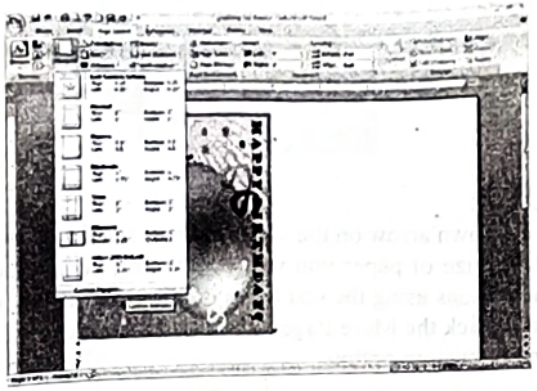
Theme effects are sets of lines and fill effects used on shapes and graphics you use in your document. Click the drop down arrow to see your list of choices.



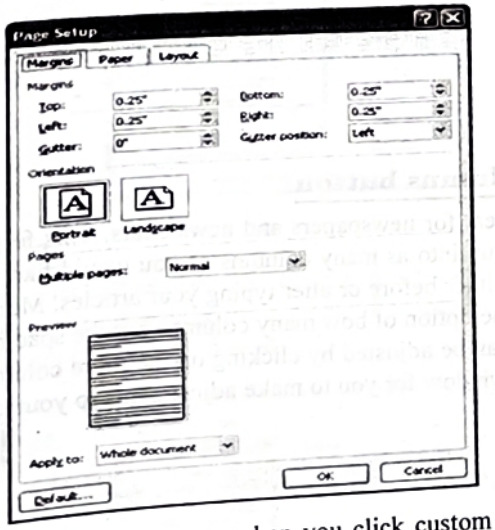
The effects don't let you customize your own but it gives you a wide variety of choices of boarders and fill effects to choose from.

Margins

Click the dropdown arrow under margins. Then click Custom Margin.



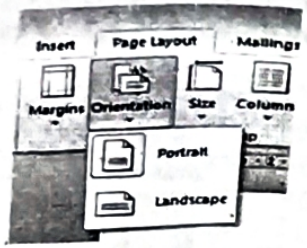
When you are creating a greeting card you don't want large margins. When you fold the greeting card you want a small margin so you don't have a lot of white space around your graphics and text.



The Page Setup window opens when you click custom margins. This window give you several options to customize your page but we only want to reduce our margin. Change the top, bottom, right, and left margins to .25 Once you have done that click OK.

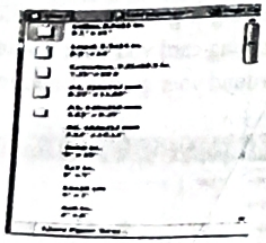
Orientation

The Orientation button lets you choose which direction your docu will print either Portrait or Landscape.



Size button

Click the down arrow on the size button to see the menu. This menu le you select the size of paper you will be printing your document on. Scro through the options using the scroll bar on the right. If you would like to se more options click the More Pages Sizes and a window will open for you t choose a more custom option.



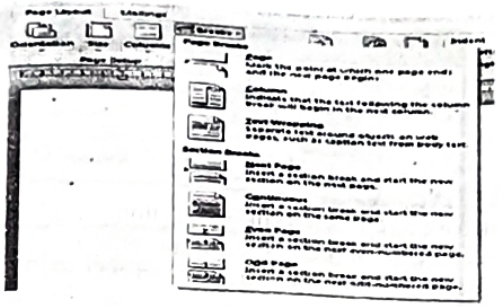
The Columns button

It is great for newspapers and newsletters. This feature will break your document up into as many columns as you would like. You can make your selection either before or after typing your articles. More Columns give you not only the option of how many columns but the spacing and width of your columns can be adjusted by clicking on the more columns option. This will open the window for you to make adjustments to your columns.



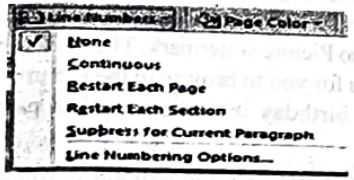
The Breaks button

Breaks gives you the option to format different sections of your document separately. You can insert page breaks or section breaks. If you would like one page with columns and another without this is the feature you would use by inserting a page break.



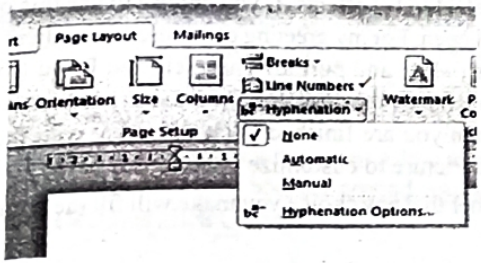
Line numbers

If you are editing a long document and need to make references or corrections. This is a great feature. When you make a selection you will see a line number in the left hand margin of your document. You can see in the drop down menu you have several options for the formatting of your line numbers.



Hyphenation

When you select an option from the dropdown menu it will hyphenate words that are at the edge of your document. This can be very useful when typing newsletters in a column format.



Watermark

Click the down arrow on the Watermark button. The Watermark button gives you a list of default watermarks you can put in your document. To use the default features simply scroll through the options with the side scroll bar then click on the selection you would like to place in your document.



The next option is to create a Custom Watermark. Click the Custom Watermark button. When the Printed Watermark window appears select the radio button next to Picture watermark. Then click select picture. Your explorer window will open for you to browse to the picture. It is also great if you want to do children's birthday invitations with a picture of your child as the background.

The Text watermark selection will allow you to customize the text, font, size and color to appear in the background

Page Color

Click the dropdown arrow next to Page color. You can select one of the colors provided, click more colors, or select fill effects.

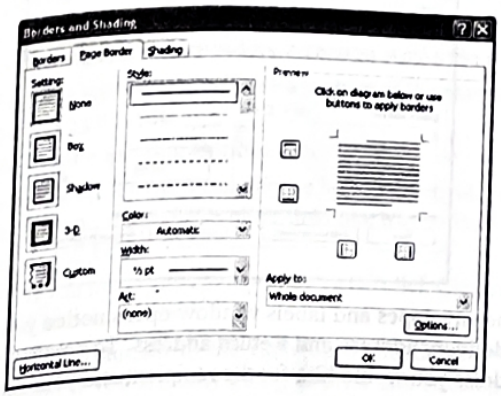
I have selected fill effects. If you choose to use this option the Fill Effects window will open. For my greeting card I used a Gradient fill effect. I choose to use 2 colors (white and purple) Then selected From Corner for the Shading styles. I then choose the direction I wanted to gradient to go from the Variants section. When you are finished click OK. Play with the other tabs, Texture, Pattern, and Picture to customize your card the way you want it.

Remember that any choice you make will fill the entire background of your document.



Page Borders

Click the Page Borders button.



The Borders and Shading window will open. This window gives you options to place a customized boarder around your document. The left had settings let you choose the type of boarder. Scroll down the style list to see all of your options. You can play with some of the options and preview them in the right side of the window. Browse the colors the width and maybe some of the art options. The Apply to: section on the right gives you the option to just put a boarder around a certain section, a single page or the whole document. The 4 little squares in the preview window let you customize where you want the boarder lines on your document.

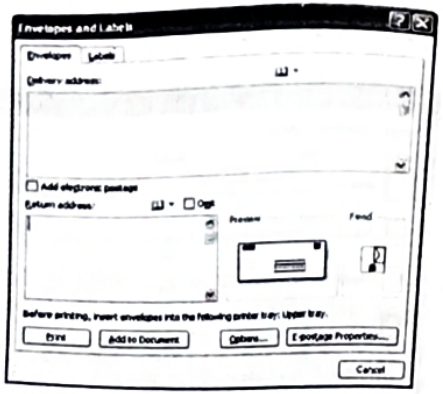
You don't have to have all 4 lines you can have just a line at the top or maybe in the left margin. If you don't want a boarder around your document and have tried some of the selections click Cancel.

MAILINGS MENU



Envelopes

. The Envelopes button in the Create section will open anot window where you can either create a single envelope or create a docum for the envelope to do a mail mergewhich we will cover in a minute. Click Envelopes button.



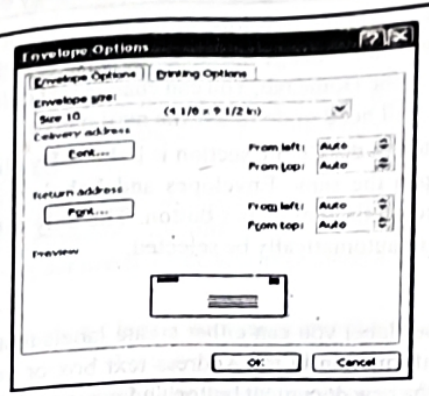
When the envelopes and labels window opens notice you have a place to enter your delivery address and Return address. To create a single envelope type the address you would like for the recipient and your return address and click the Print button. Make sure you have your envelope loaded in your printer before you click print. This will default to a #10 envelope and send the envelope to your printer without giving you any other options.

Notice above the Delivery address text box you will see a little icon of a book. If you click this icon it will open your outlook contacts and you are able to select one and it will automatically enter the selected person's address in the Delivery Address box.

To add electronic postage to a printed envelope you need to subscribe to a postage service for a fee.

Open the envelopes and labels window again if it closed after printing your envelope. If you check the Omit check box this will omit the return address from printing on your envelopes.

Click the Options button.



The Envelope Options window will open. In this window you can choose your envelope size by clicking the drop down arrow under Envelope size and choosing from the list of selections.

In the Delivery Address section you can change the font of the delivery address by clicking on the button and making your changes to the font styleand size in the window. The Return Address section works the same way.

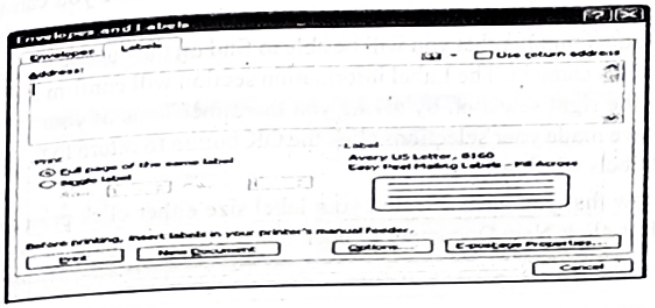
In the Preview section you will see a picture of the envelope you selected with the changes you made.

Now click on the Printing Options Tab.

In the printing options you can choose how your envelope will be loaded into your printer and if you have more than one tray to load paper what tray your envelopes will be in.

Click OK if you made any changes otherwise click Cancel to return to the Envelopes and Labels window.

Once you have returned to the Envelopes and Labels window you can either select Print if you are only going to print one envelope and you have entered your information in the text boxes or you can click add to document. The Add to Document button will put the envelope in your current Word document.

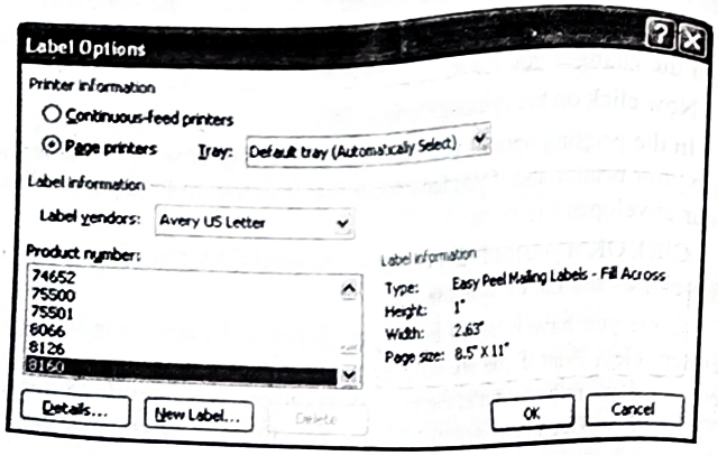


If you choose to add the envelope to the document it will keep all of
formats and allow you to change the envelope style with the tools you alre
know how to use in the Home tab. You can change text color, addgraphics, e
This is what you will need to do to use the mail merge.

The next button in the Create section is Labels. By clicking on the Labe
button it will open the same Envelopes and Labels windows that opene
when you clicked on the Envelopes button. The only difference will be th
the Labels tab will automatically be selected.

Label

To create your label you can either create labels that are all the same by
entering your information in the Address text box or you can create a new
document with the new document button and make each label different. In the
Print section you can select Full page of the same label if you have entered
information in the Address section or print a single label with the information.
If you choose to print a single label look at your page if labels and enter the
row and column of the next available label. In the label section is where you
can choose the type of label you are printing on. Click on the Label section.



The Label Options Window will open. This is where you can select the vendor you purchased the label from, Avery is the most common, then select the product number that you will be able to find on the outside of the package you labels came in. The Label information section will confirm that you have made the right selection by giving you the dimensions of your labels. Once you have made your selections click the OK button to return to the Envelopes and Labels window.

Now that you have selected your label size either click print to print the label or click New Document to open a Word 2007 page with the label size selected.

Start Mail Merge

Click the Start Mail Merge button then select Step by Step Mail Merge Wizard. You will see a window pane appear on the right side of your document. This is a 6 step process.

First select what type of document you will be creating the mail merge in. I am going to select envelopes for this tutorial. You can select what ever option will best serve your needs. Once you have made a selection click Next: Starting document.

In the next screen select Change document layout and click Next: Select recipients.

If you are making envelopes the envelopes option window will open. Select the size of envelope you are printing on and click OK.

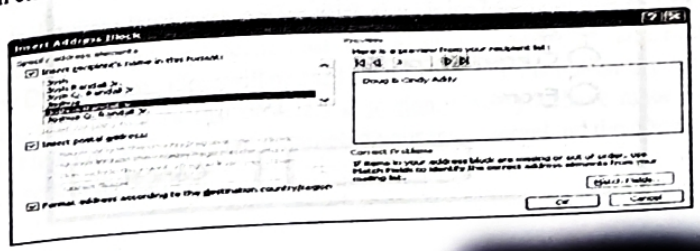
This will return you to the Mail Merge wizard with the page format changed to the size of the envelope.

Select recipients gives you three options:

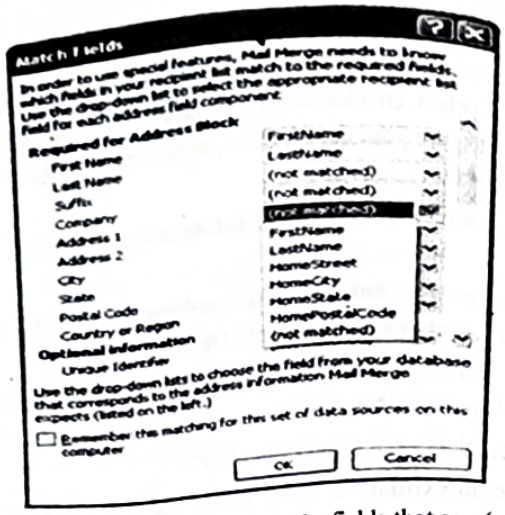
- Use an existing list which will let you select an excelspreadsheet or access database that you have already created toprint your mail merge.
- Select from Outlook Contacts which will let you open all contacts you have stored in Microsoft Outlook Contact List and select only the recipients you want to enter into your mail merge.
- Type a new list will open a New Address List window for you to enter your contacts. Once you are finished entering your contact list it will give you the option to save the list. The file defaults to My Data Source file in My Documents. By saving the list you are able to use the same list for all of you mail merge projects over and over again. The list can be modified and you don't have to use everyone in the list every time, you can pick and choose.

Once you have finished with your contact list click Next: Arrange your envelope.

Now place your cursor where you would like your address block to go. Then click Address Block



In the Insert Address Block window some of the fields in your recip
list may not all be matched up. If you don't see all the recipients informa
in the Preview box click the Match fields button.



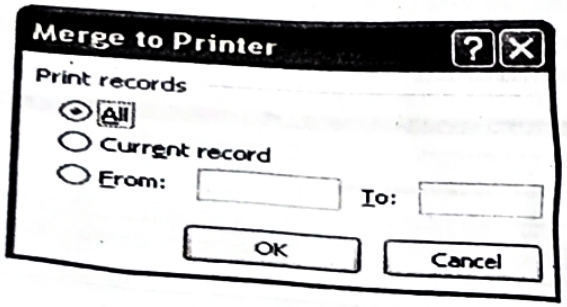
The Match Fields window will open. In the fields that say (not matched)
click the drop down arrow as shown in the print screen and select the according
field for that aspect of the address block.

If you are going to use this same list over again check the Remember this
matching for this set of data sources on this computer. Then select OK to
return to the Insert Address Block Window. Click OK again to continue with
the Mail Merge wizard.

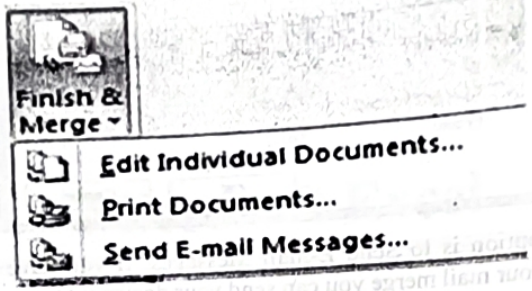
Click Next: Preview your envelope

This section of mail merge will let you click through each recipient you
have selected to see how their information will appear on your envelope. You
can also use the exclude this recipient button to filter your contacts as you
click through.

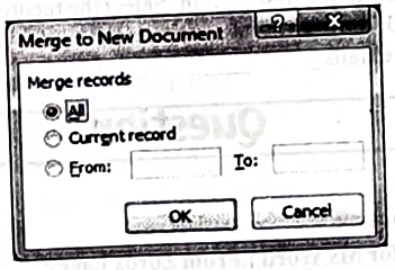
Click Next: Complete the merge



In the final step click the Print link and you will get the Merge to Printer
window where you can select to print all your envelopes at one time, just print
the Current envelope or select a range to print. Once you have made your
selection make sure your printer is ready and click OK.

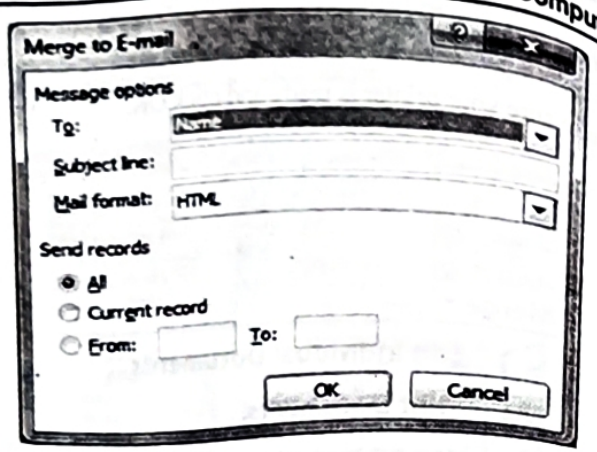


Now for your final step in completing your merge document. The Word
2007 Finish section of the mailings tab.. When you click finish you will be
given three options.



The first option is Edit Individual Documents. Click on this selection, a
new window will come up asking if you would like to view All, the Current
record, or a specific range of documents. Make your selection from the Merge
to New Document window and click OK. This will open a new Word document
with your mail merge displayed with the data you created. You can go through
and make changes to individual entries before you print. If you choose this
option from the finish section you can use the print key in the Office icon
because it has created a new document in the format you want.

To print from the Finish option click the Finish Merge button and select
Print document from the selection list. select send to printer. The same Merge
to New Document window will open. This will give you the option to print all
records, the current record or select a section. Once you have made your
choice click OK and you have completed your mail merge!and the document
will be sent to the printer.



The last option is to Send E-mail Messages. If you have used ema addresses in your mail merge you can send your document to your email li Select Send E-mail messages from the Finish button selections. In the Merg to E-mail window use the down arrow next to to: and select the title of yo used for your email list. Type a subject that will appear in each email and th email format you would like to send it in. Select the records you would like t send to and click OK. This will use your email client Outlook or Outlook express to send the emails.

Question

Q. Hyperlink

Q. From Zorox pages

Q. Shortcuts for Ms Word : From Zorox pages



6

Microsoft Excel

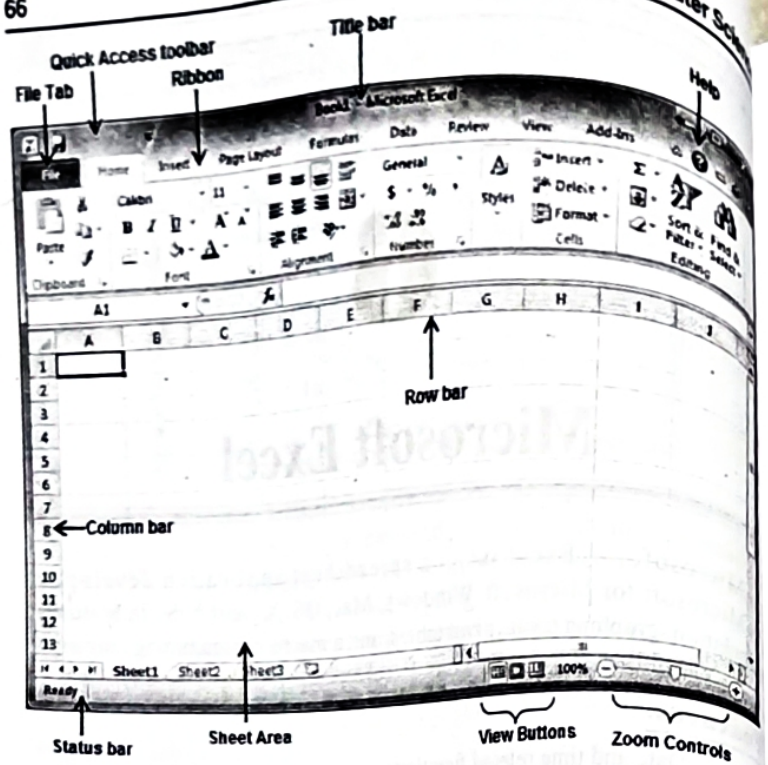
Microsoft Excel is a spreadsheet application developed by Microsoft for Microsoft Windows, Mac OS X, and iOS. It features calculation, graphing tools, pivot tables, and a macro programming language called Visual Basic for Applications. Excel forms part of Microsoft Office.

Features:

- Date and time related functions.
- Manipulation of character data.
- Database management.
- Keyboard macros to automate tasks.

Starting Ms Excel:

1. Click on the Start menu in the bottom left corner of the screen
2. Choose All Programs then Microsoft Office (from the sub-menu which appears) .
3. Finally click on Microsoft Excel



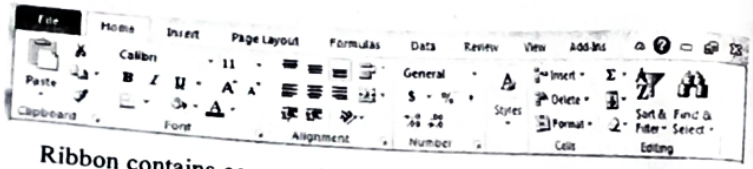
File Tab:

The File tab replaces the Office button from Excel 2007. You can click it to check Backstage view, which is the place to come when you need to open or save files, create new sheets, print a sheet, and do other file-related operations.

Quick Access Toolbar:

This you will find just above the File tab and its purpose is to provide a convenient resting place for the Excel most frequently used commands. You can customize this toolbar based on your comfort.

Ribbon:



Ribbon contains commands organized in three components:

- **Tabs** : They appear across the top of the Ribbon and contain groups of related commands. Home, Insert, Page Layout are example of ribbon tabs.

- **Groups** : They organize related commands; each group name appears below the group on the Ribbon. For example group of commands related to fonts or or group of commands related to alignment etc.
- **Commands** : Commands appear within each group as mentioned above.

Title bar:

This lies in the middle and at the top or the window. Title bar shows the program and sheet titles.

Help:

The Help Icon can be used to get excel related help anytime you like. This provides nice tutorial on various subjects related to excel.

Zoom Control:

Zoom control lets you zoom in for a closer look at your text. The zoom control consists of a slider that you can slide left or right to zoom in or out, and + buttons you can click to increase or decrease the zoom factor.

View Buttons:

The group of three buttons located to the left of the Zoom control, near the bottom of the screen, lets you switch among excel's various sheet views.

- **Normal Layout view:** This displays page in normal view.
- **Page Layout view:** This displays pages exactly as they will appear when printed. This gives a full screen look of the document.
- **Page Break view:** This shows a preview of where pages will break when printed.

Sheet Area:

The area where you enter data. The flashing vertical bar is called the insertion point and it represents the location where text will appear when you type.

Row Bar

Rows are numbered from 1 onwards and keeps on increasing as you keep entering data. Maximum limit is 1,048,576 rows.

Column Bar

Columns are numbered from A onwards and keeps on increasing as you keep entering data. After Z, it will start series of AA,AB and so on. Maximum limit is 16,384 columns.

Status Bar:

This displays sheet information as well as the insertion point loca
From left to right, this bar can contains the total number of pages and wo
in the document, language etc.

You can configure the status bar by right-clicking anywhere on it and
selecting or deselecting options from the provided list.

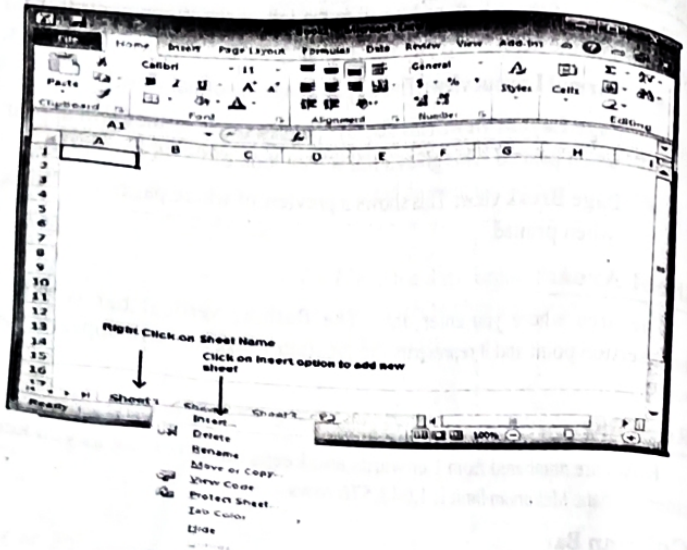
Dialog Box Launcher:

This appears as very small arrow in the lower-right corner of many grou
on the Ribbon. Clicking this button opens a dialog box or task pane th
provides more options about the group.

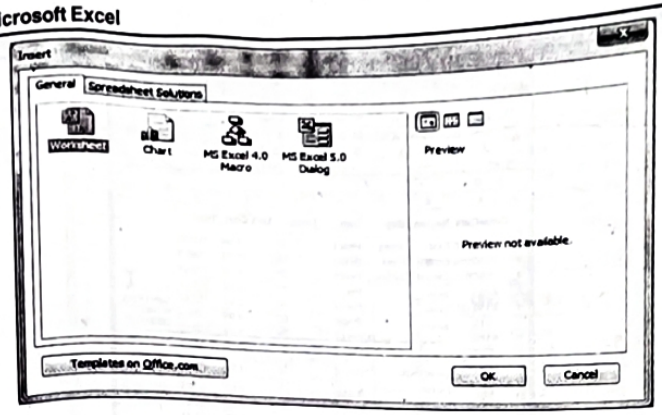
Creating New Worksheet

Three new, blank sheets always open when you start Microsoft Excel. Bu
suppose that you want start another new worksheet while you are working o
another worksheet, or you closed already opened worksheet and want to sta
a new worksheet. Here are the steps to create a new worksheet:

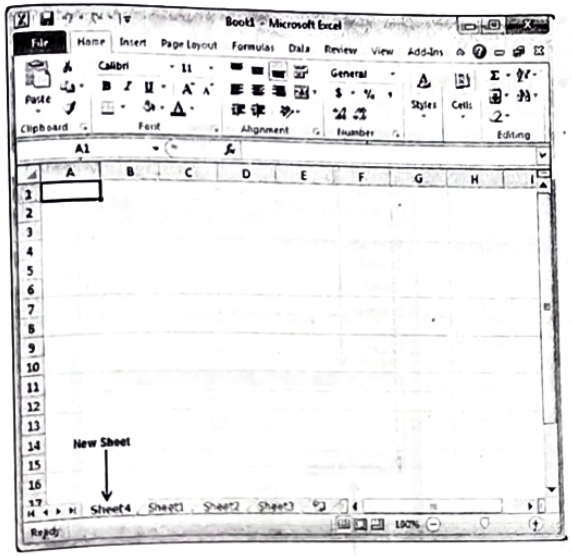
- Right Click the Sheet Name and select Insert option.



- Now you'll see the Insert dialog with select Worksheet option as selected from the general tab.
- Click Ok button



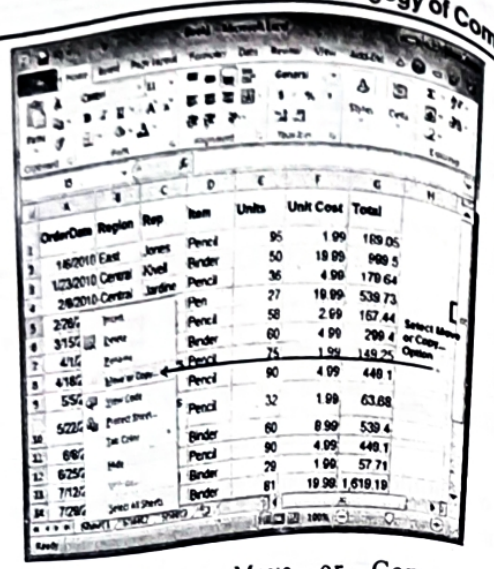
Now you should have your blank sheet as shown below ready to start typing your text.



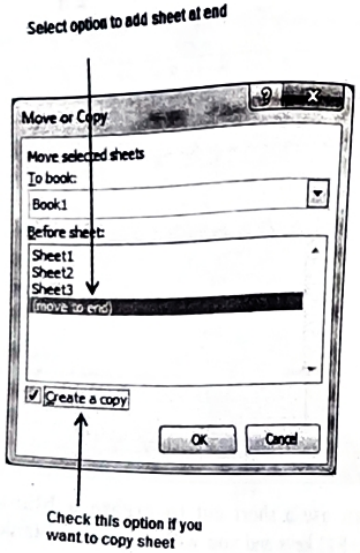
You can use a short cut to create a blank sheet anytime. Try using Shift+F11 keys and you will see a new blank sheet similar to above sheet is opened.

Copy Worksheet

- Right Click the Sheet Name and select Move or Copy option.

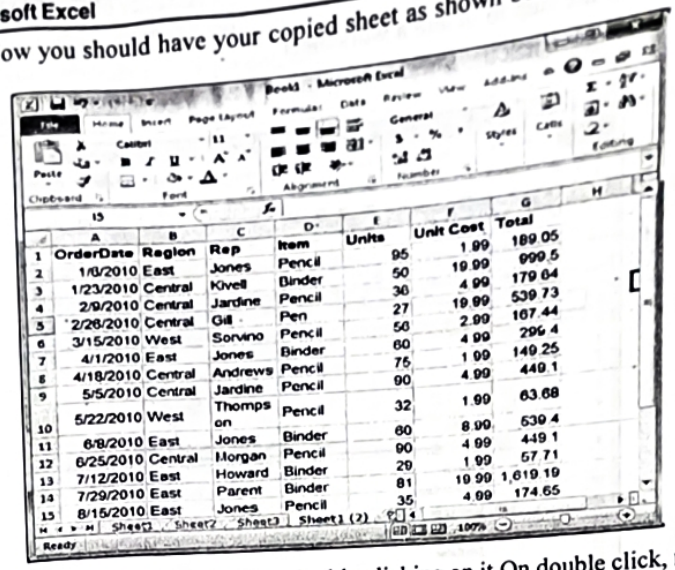


- Now you'll see the Move or Copy dialog select Worksheet option as selected from the general tab.
- Click Ok button



- Select Create a Copy Checkbox to create a copy of current sheet and Before sheet option as (move to end) so that new sheet gets created at end.
- Press Ok Button

Now you should have your copied sheet as shown below.



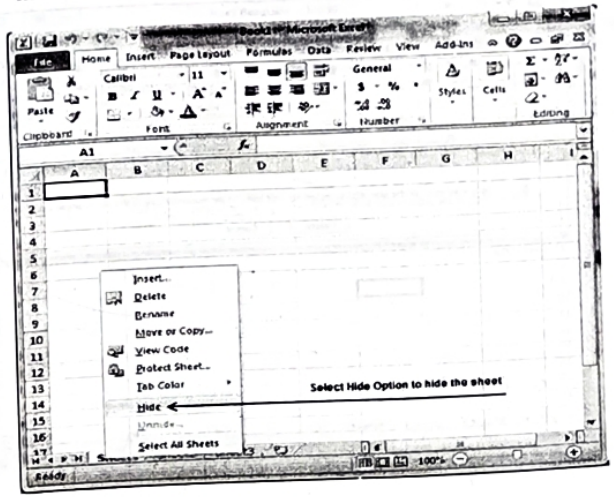
	OrderDate	Region	Rep	Item	Units	Unit Cost	Total
1	1/6/2010	East	Jones	Pencil	95	1.99	189.05
2	1/23/2010	Central	Kivell	Binder	50	19.99	999.5
3	2/9/2010	Central	Jardine	Pencil	36	4.99	179.64
4	2/26/2010	Central	Gill	Pen	27	19.99	539.73
5	3/15/2010	West	Sorvino	Pencil	56	2.99	167.44
6	4/1/2010	East	Jones	Binder	60	4.99	299.4
7	4/18/2010	Central	Andrews	Pencil	75	1.99	149.25
8	5/5/2010	Central	Jardine	Pencil	90	4.99	449.1
9	5/22/2010	West	Thompson	Pencil	32	1.99	63.68
10	6/8/2010	East	Jones	Binder	60	8.99	539.4
11	6/25/2010	Central	Morgan	Pencil	90	4.99	449.1
12	7/12/2010	East	Howard	Binder	29	1.99	57.71
13	7/29/2010	East	Parent	Binder	81	19.99	1,619.19
14	8/15/2010	East	Jones	Pencil	35	4.99	174.65

You can rename the sheet by double clicking on it.On double click, name become editable. Enter any name say Sheet5 and press Tab or Enter Key.

Hiding Worksheet

Here is the step to hide a worksheet

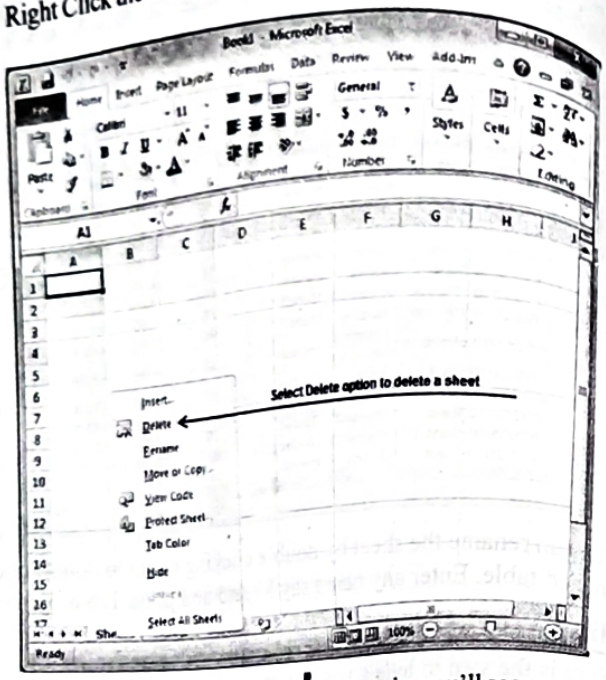
- Right Click the Sheet Name and select Hide option. Sheet will get hidden.



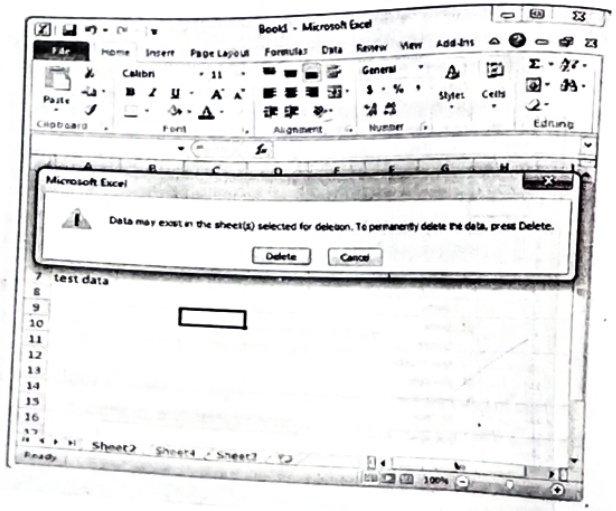
Delete Worksheet

Here is the step to delete a worksheet

- Right Click the Sheet Name and select Delete option.



- Sheet will get deleted if it is empty otherwise you'll see a confirmation message.

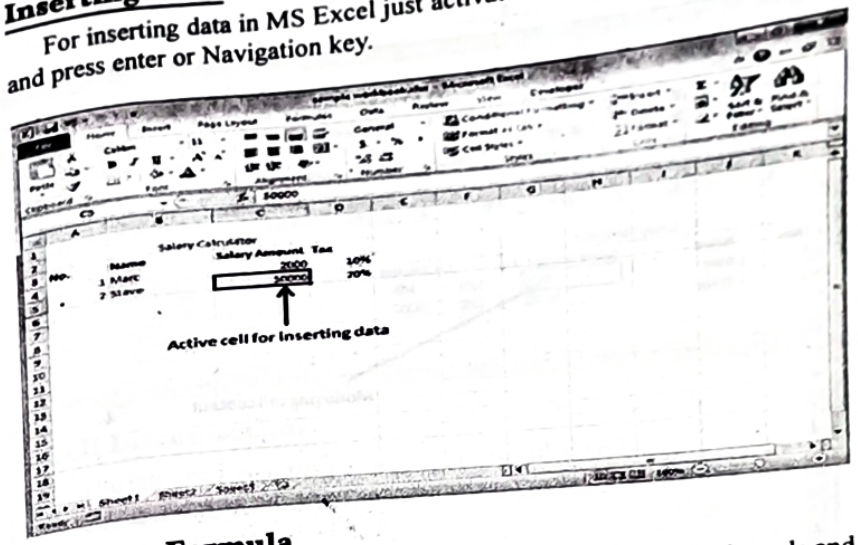


Step (2) Press Delete Button

Now your worksheet will get deleted.

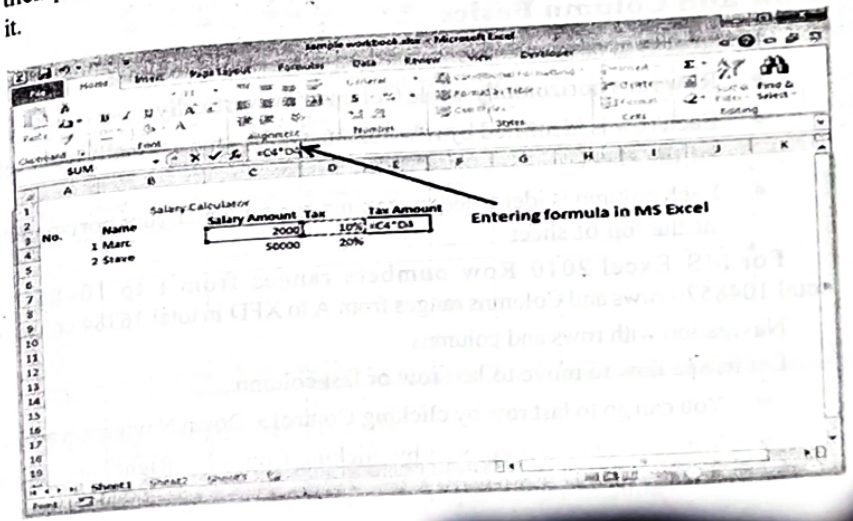
Inserting Data

For inserting data in MS Excel just activate the cell type text or number and press enter or Navigation key.



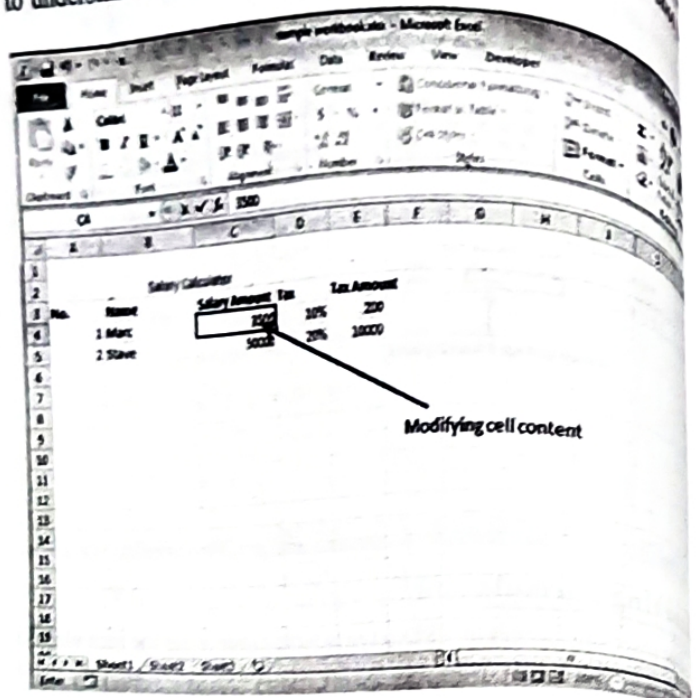
Inserting Formula

For inserting formula in MS Excel go to formula bar ,enter the formula and then press enter or navigation key. See the screen-shot below to understand it.



Modifying Cell Content

For modifying the cell content just activate the cell, enter a new v
then press enter or navigation key to see changes. See the screen
to understand it.



Row and Column Basics

MS Excel is in tabular format consisting of rows and columns.

- Row runs horizontally while Column runs vertically.
- Each row is identified by row number which runs vertically at the
  of the sheet.
- Each column is identified by column header which runs horizonta
  at the top of sheet

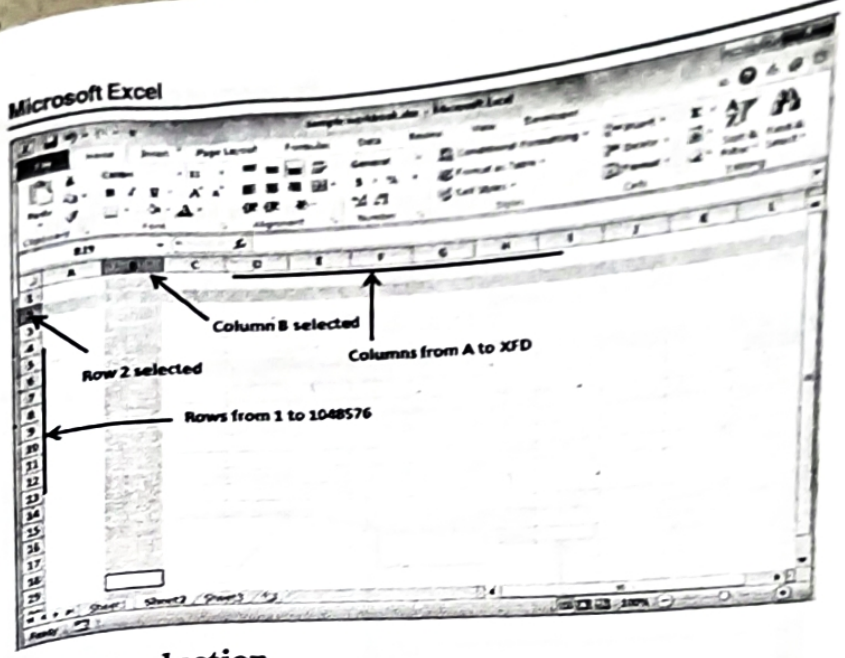
For MS Excel 2010 Row numbers ranges from 1 to 104857
total 1048576 rows and Columns ranges from A to XFD in total 16384 colu

Navigation with rows and columns

Let us see how to move to last row or last column.

- You can go to last row by clicking Control + Down Navigation arro
- You can go to last column by clicking Control + Right Navigatio
  arrow.

Microsoft Excel

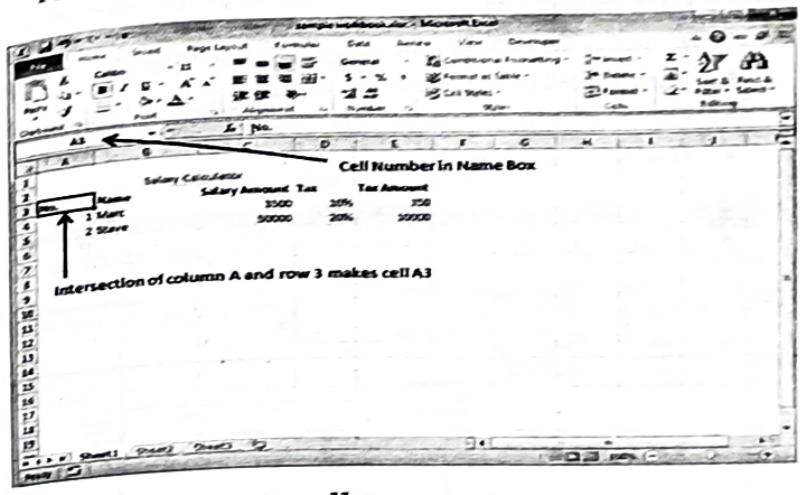


Cell Introduction

The intersection of rows and columns is called cell.

Cell is identified with Combination of column header and row number.

For example: A1, A2



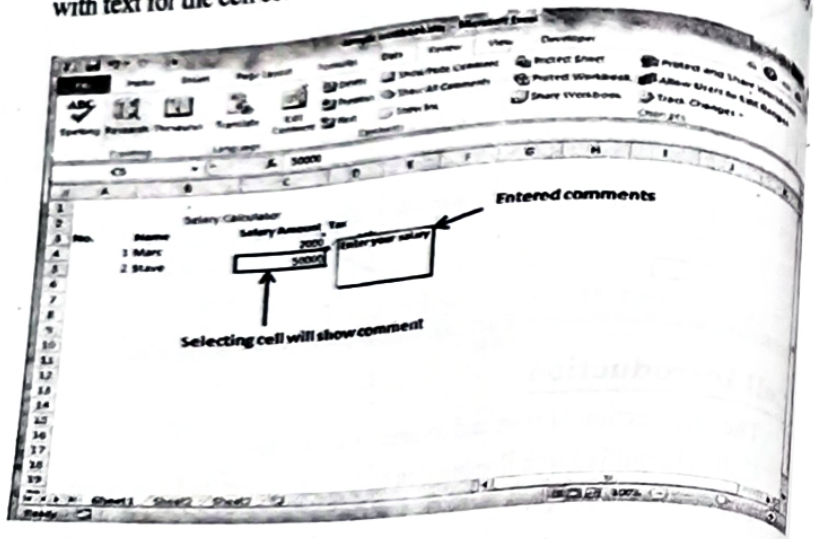
Adding comment to cell

Adding comment to cell helps in understanding the purpose of cell, what input it should have,etc. It helps in proper documentation

To add comment to cell select the cell and perform any of the action b

- Choose Review » Comments » New Comment
- Right-click the cell and choose Insert Comment from available opti
- Press Shift+F2

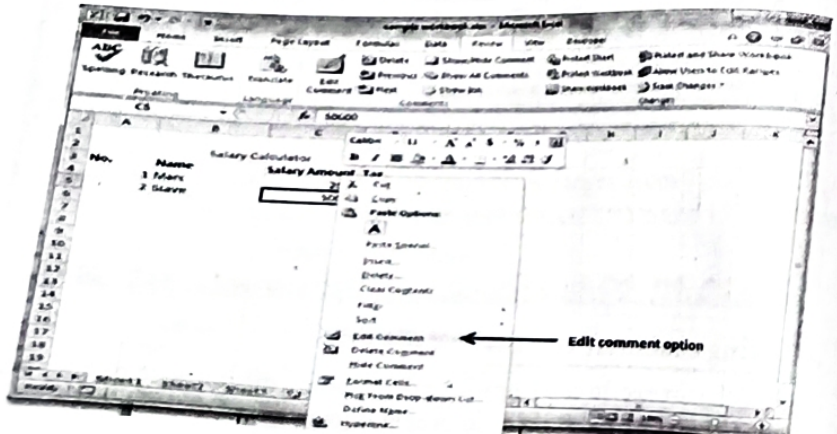
Initially comment consist of Computer's user name. You have to modify with text for the cell comment



Modifying comment

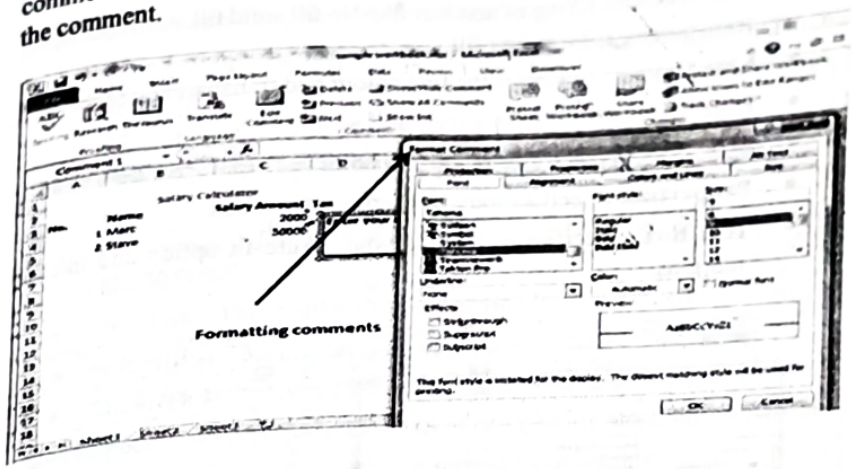
You can modify the comment you entered before as below.

- Select the cell on which comment appears.
- Right-click the cell and choose Edit Comment from available options.
- Modify the comment



Formatting comment

You can do several formatting of comments.For formatting comment Right click on cell » Edit comment » Select comment » Right click on it » Format comment With formatting of comment you can change color, font, size,etc of the comment.



Text Boxes

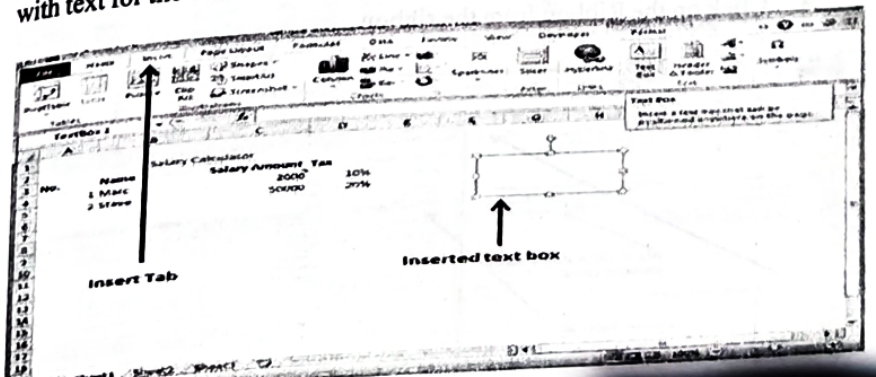
Text boxes are special graphic objects that combine text with a rectangular graphic object. Text boxes and cell comment are similar in that they display text in rectangular box but text boxes are always visible while cell comment become visible after selecting cell.

Adding text boxes

To add text box perform below actions.

- Choose Insert » Text Box » choose text box or draw it

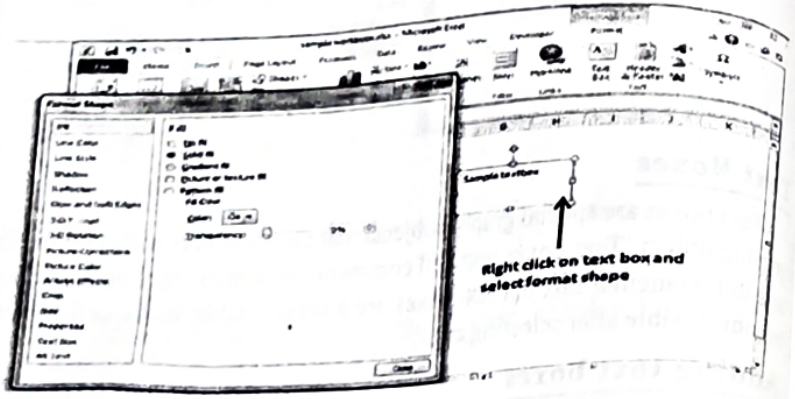
Initially comment consist of Computer's user name. You have to modify it with text for the cell comment



Formatting text box

After you added text box, you can format text box by changing the font size, font style, and alignment,etc. Let us see some of the important options there.

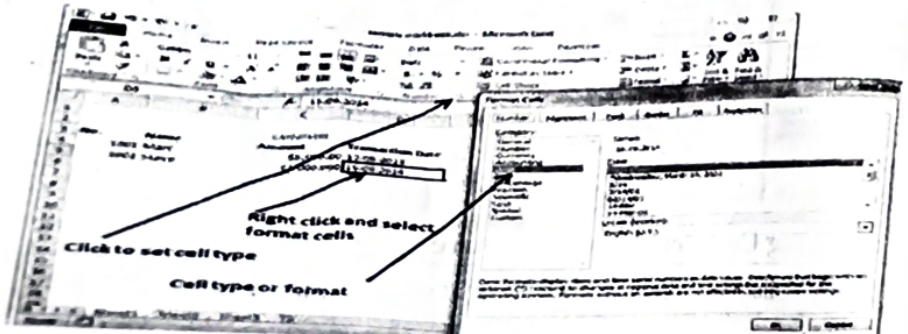
- **Fill:** Specifies filling of text box like No fill,solid fill. Also specifying transparency of text box fill.
- **Line Colour:** Specifies the line colour and transparency of the line
- **Line Style:** Specifies line style and width.
- **Size:** Specifies the size of the text box.
- **Properties:** Specifies some properties of text box.
- **Text Box:** Specifies text box layout , Auto-fit option and internal margins.



Formatting Cell

MS Excel Cell can hold different types of data like Numbers, Currency, Dates, etc..You can set the cell type in various ways as below:

- Right Click on the cell » Format cells » Number
- Click on the Ribbon from the ribbon



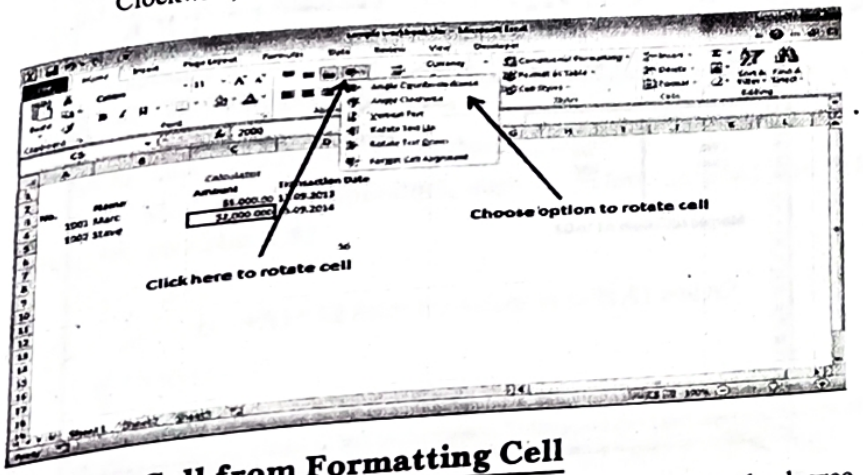
Various Cell formats

Below are various cell formats.

- **General :** This is default cell format of Cell.
- **Number:** This displays cell as number with separator
- **Currency :** This displays cell as currency i.e with currency sign.
- **Accounting :** Similar to Currency used for accounting purpose.
- **Date :** Various date formats are available under this like 17-09-2013, 17th-Sep-2013, etc
- **Time :** Various Time formats are avilable under this like 1.30PM, 13.30, etc
- **Percentage :** This displays cell as percentage with decimal places like 50.00%
- **Fraction :** This displays cell as fraction like 1/4 ,1/2 etc
- **Scientific :** This displays cell as exponential like 5.6E+01
- **Text :** This displays cell as normal text.
- **Special :** This is special formats of cell like Zip code, Phone Number
- **Custom :** You can use custom format by using this.

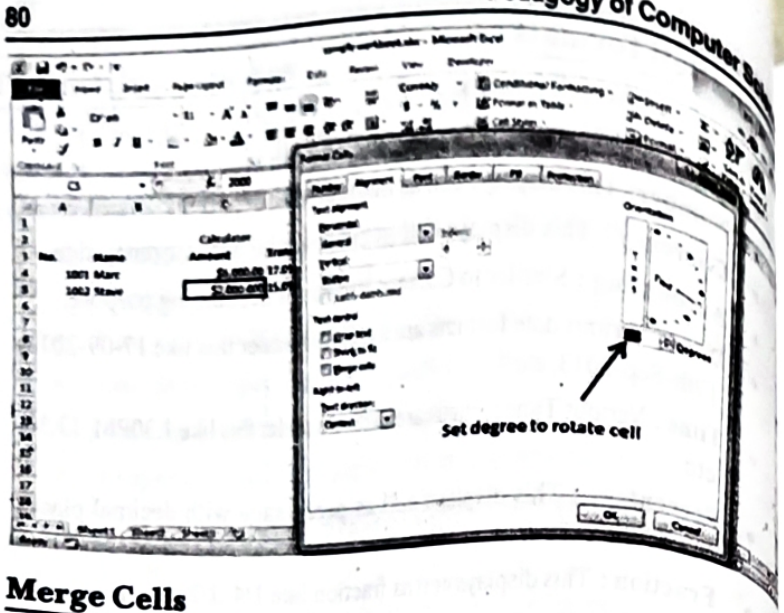
Rotating Cell From Home Tab

- Click on the orientation in the Home tab.
- Choose options available like Angle Counter Clockwise, Angle Clockwise, etc.



Rotating Cell from Formatting Cell

Right Click on the cell. Choose Format cells » Alignment » Set the degree for rotation

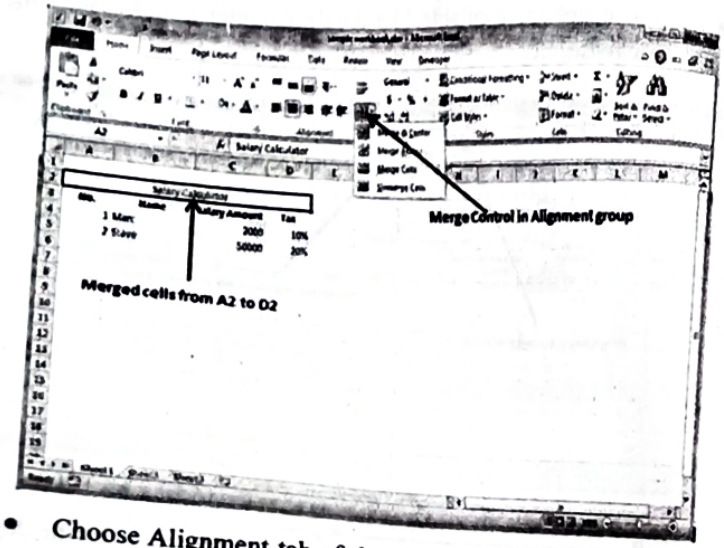


Merge Cells

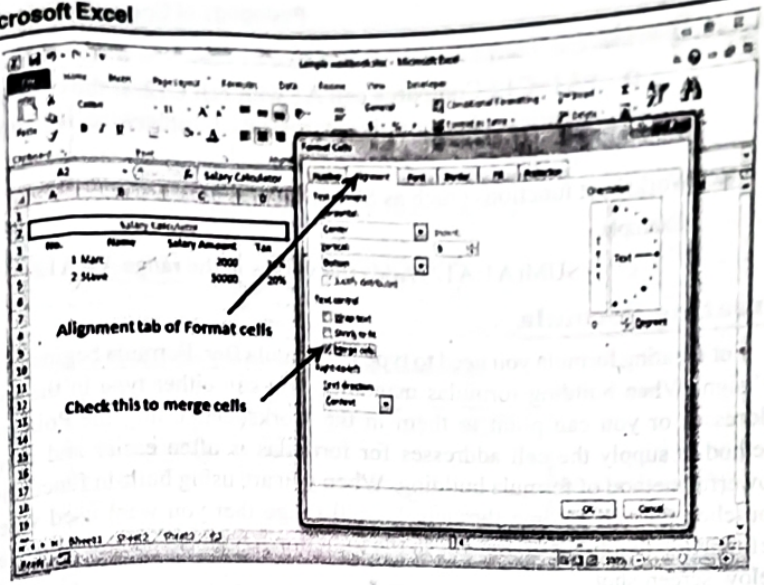
MS Excel enables you to merge two or more cells. When you merge cells you don't combine the contents of cells. Rather, you combine a group of cells into a single cell that occupies the same space.

You can merge cells by various ways as below

- Choose Merge & Center control on the Ribbon is simpler. To merge cells, select the cells that you want to merge and then click the Merge & Center button.



- Choose Alignment tab of the Format Cells dialogue box to merge cells



Formulas in MS Excel

Formulas are the Bread and butter of worksheet. Without formula worksheet will be just simple tabular representation of data. A formula consists of special code which is entered into a cell. It performs some calculations and returns a result, which is displayed in the cell.

Formulas use a variety of operators and worksheet functions to work with values and text. The values and text used in formulas can be located in other cells, which makes changing data easy and gives worksheets their dynamic nature. For example, you can quickly change the data in a worksheet and formulas works.

Elements of Formulas

A formula can consist of any of these elements:

- Mathematical operators, such as +(for addition) and *(for multiplication)

  Example:

  - =A1+A2 Adds the values in cells A1 and A2.

- Values or text

  Example:

  - =200*0.5 Multiplies 200 times 0.5. This formula uses only values, and it always returns the same result as 100.

- Cell references (including named cells and ranges)

Example:

- =A1=C12 Compares cell A1 with cell C12. If the cells are identical, the formula returns TRUE; otherwise, it returns FALSE.

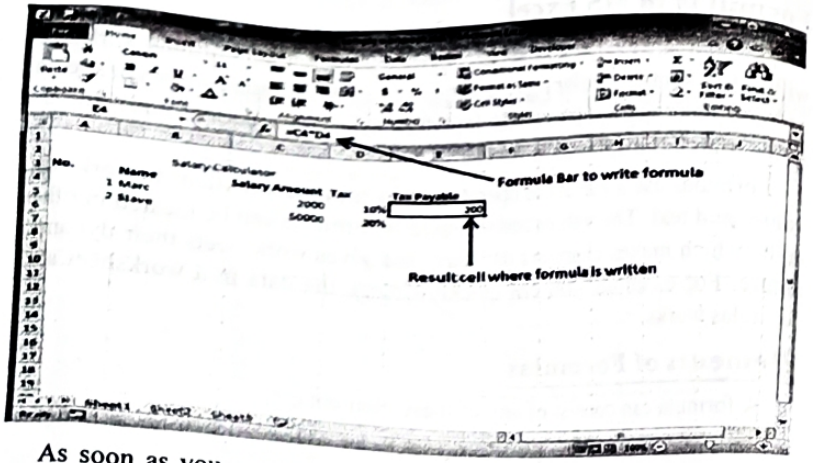
- Worksheet functions (such as SUMor AVERAGE)

Example:

- =SUM(A1:A12) Adds the values in the range A1:A12.

Creating Formula

For creating formula you need to type in Formula Bar. Formula begins with '=' sign. When building formulas manually, you can either type in the cell addresses or you can point to them in the worksheet. Using the Pointing method to supply the cell addresses for formulas is often easier and more powerful method of formula building. When you are using built-in functions, you click the cell or drag through the cell range that you want used when defining the function's arguments in the Function Arguments dialog box. See below screen shot.



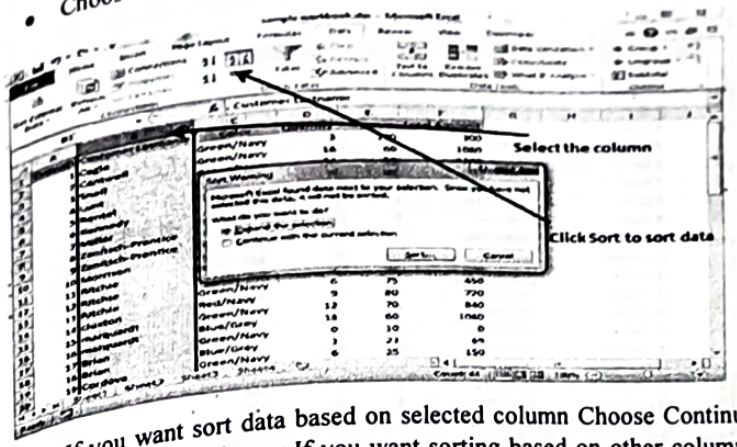
As soon as you complete a formula entry, Excel calculates the result, which is then displayed inside the cell within the worksheet (the contents of the formula, however, continue to be visible on the Formula bar anytime the cell is active). If you make an error in the formula that prevents Excel from being able to calculate the formula at all, Excel displays an Alert dialog box suggesting how to fix the problem.

Sorting in MS Excel

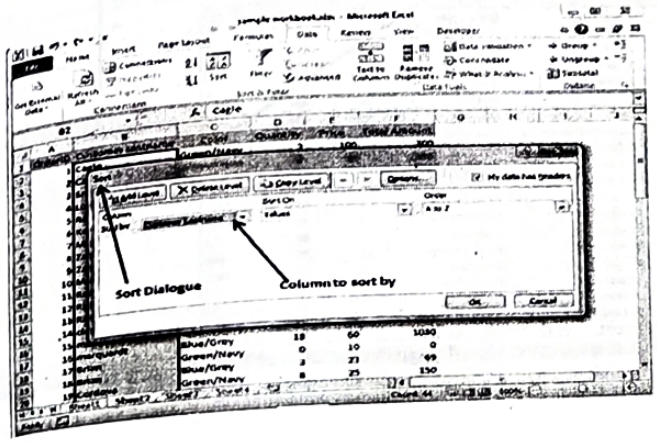
Sorting data in MS Excel rearranges the rows based on the contents of a particular column. You may want to sort a table to put names in alphabetical order. Or, maybe you want to sort data by Amount from smallest to largest or largest to smallest.

To Sort the data follow below steps.

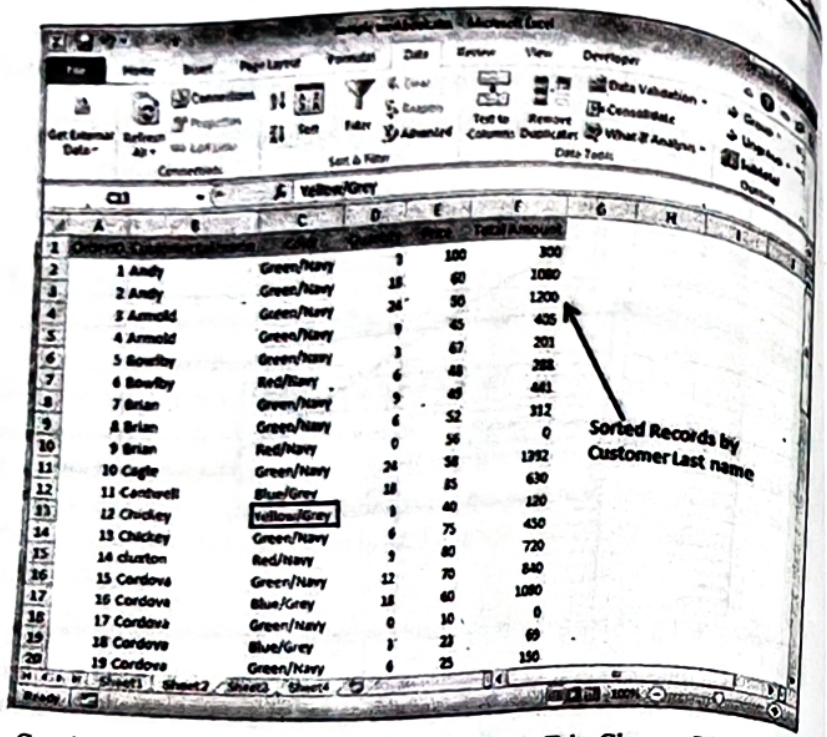
- Select the Column by which you want to sort data.
- Choose Data Tab » Sort Below dialog appears



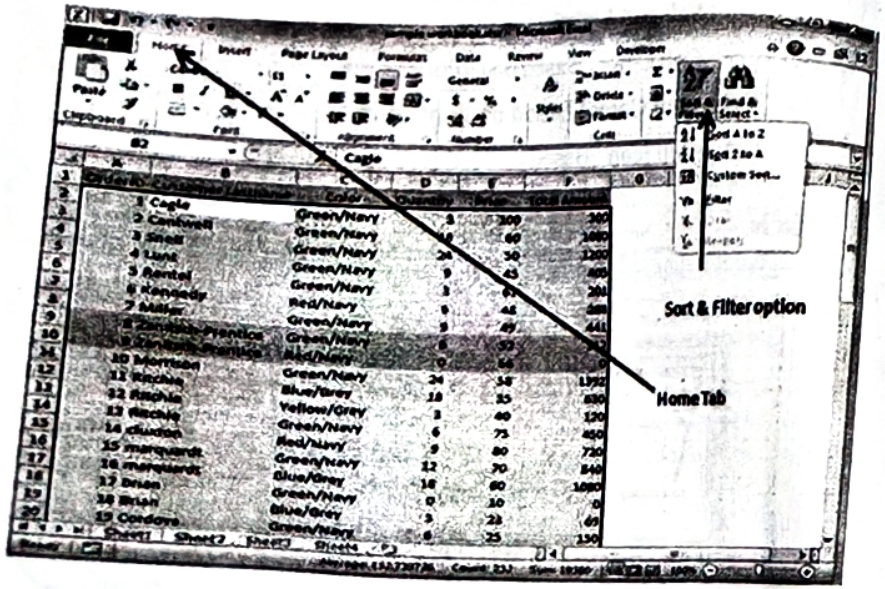
- If you want sort data based on selected column Choose Continue with the selection or If you want sorting based on other columns choose Expand Selection.
- You can Sort based on below Conditions.
  - Values : Alphabetically or numerically
  - Cell Color : Based on Color of Cell
  - Font Color : Based on Font color
  - Cell Icon : Based on Cell Icon



- Clicking Ok will sort the data.

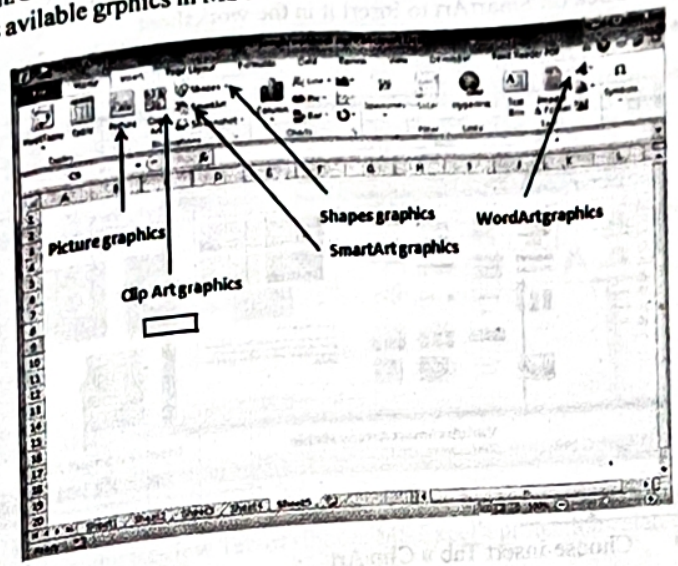


Sorting option is also avilable from the Home Tab. Choose Home Tab » Sort & Filter. You can see same dialog to sort records.



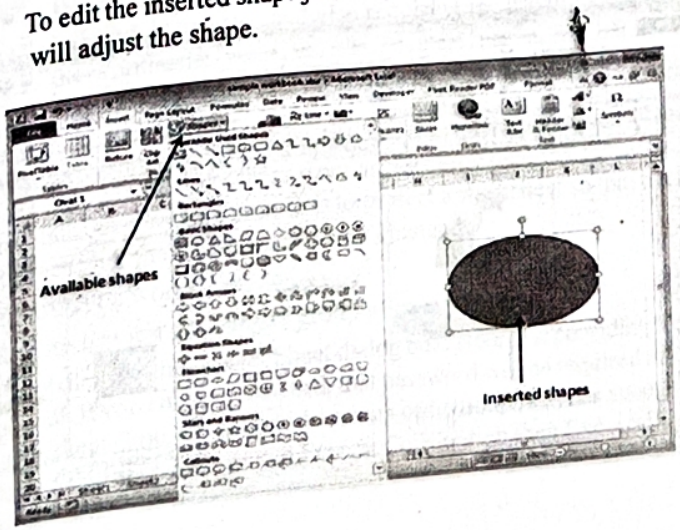
Graphic Objects in MS Excel

MS Excel supports various types of graphic objects like Shapes gallery, SmartArt, Text Box, and WordArt available on the Insert tab of the Ribbon.Graphics are available in the Insert Tab. See below screenshot for vaious avilable grphics in MS Excel 2010.



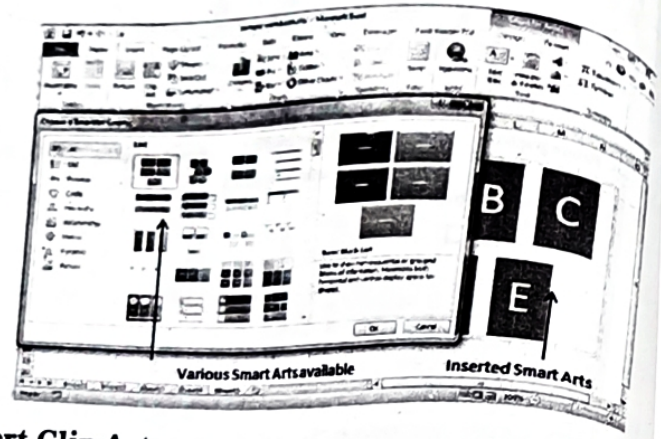
Insert Shape

- Choose Insert Tab » Shapes dropdown
- Select the shape you want to insert. Click on shape to insert it.
- To edit the inserted shape just drag the shape with the mouse. Shape will adjust the shape.



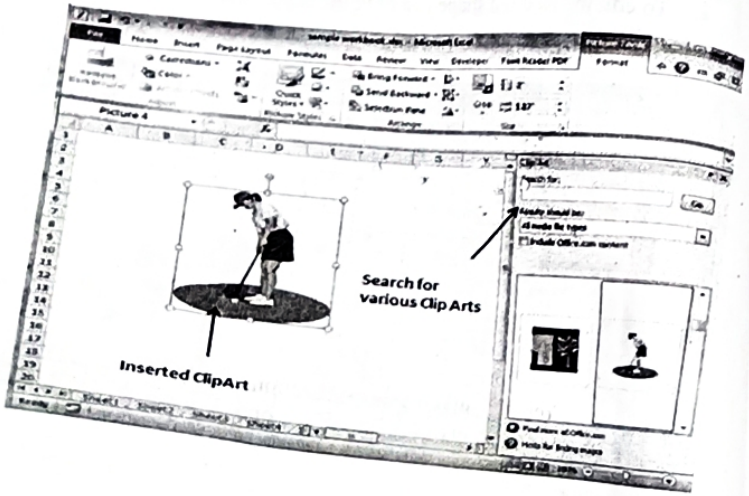
Insert Smart Art

- Choose Insert Tab » SmartArt
- Clicking SmartArt will open the SmartArt dialogue as below screen-shot. Choose from the list of available smart Arts
- Click on SmartArt to Insert it in the worksheet
- Edit the SmartArt as per your need



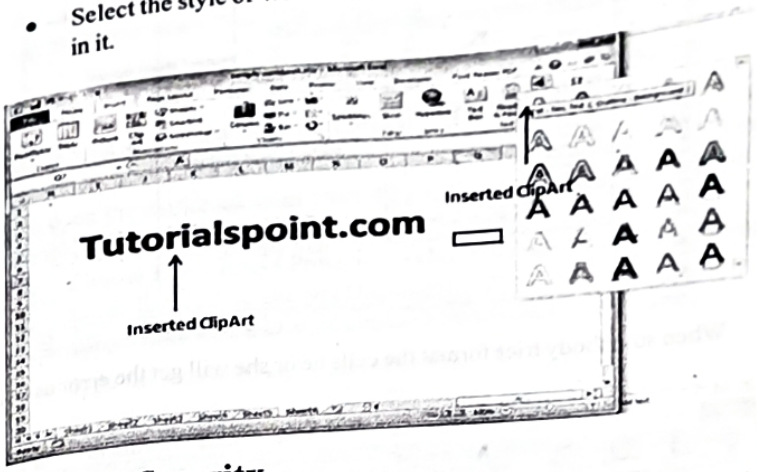
Insert Clip Art

- Choose Insert Tab » Clip Art
- Clicking Clip Art will open the search box as below screen-shot. Choose from the list of available Clip Arts
- Click on Clip Art to Insert it in the worksheet



Insert Word Art

- Choose Insert Tab » WordArt
- Select the style of WordArt which you like and click it to enter a text in it.



Workbook Security

We can apply security to the workbook by the concept of protection available in the Review Tab of ribbon. MS Excel's protection-related features fall into three categories.

- **Worksheet protection:** Protecting a worksheet from being modified, or restricting the modifications to certain users.
- **Workbook protection:** Protecting a workbook from having sheets inserted or deleted, and also requiring the use of password to open the workbook

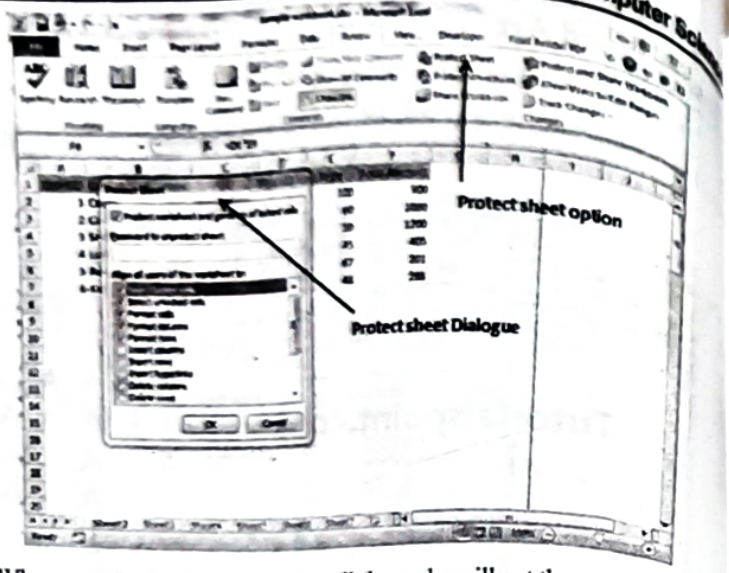
Protect Worksheet

You may want to protect a worksheet for a variety of reasons. One reason is to prevent yourself or others from accidentally deleting formulas or other critical data. A common scenario is to protect a worksheet so that the data can be changed, but the formulas can't be changed.

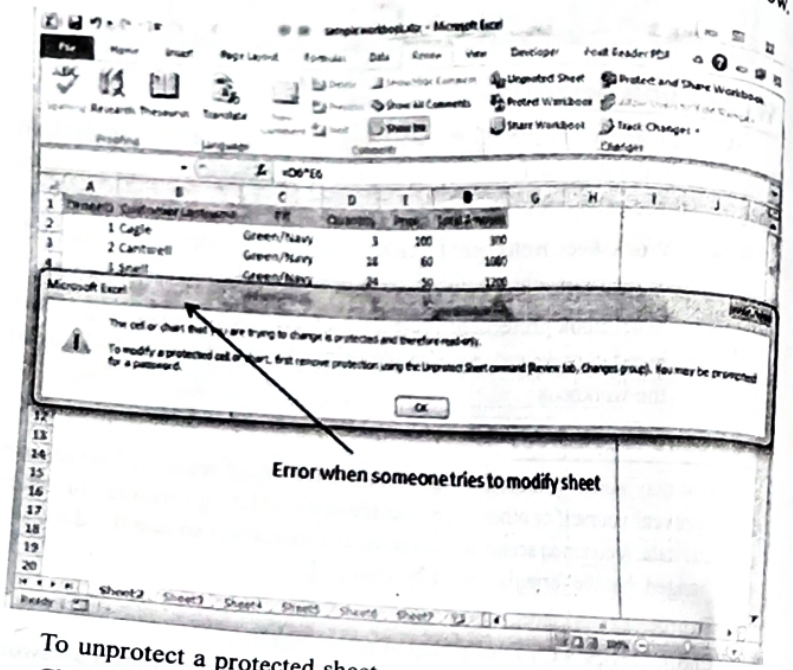
To protect a worksheet,

Choose Review » Changes group »Protect Sheet.

Excel displays the Protect Sheet dialog box. Note that providing a password is optional. If you enter a password, that password will be required to unprotect the worksheet. You can selected various option in which the sheet should be protected.Suppose we checked Format Cells option then Excel will not allow to format cells.



When somebody tries format the cells he or she will get the error as below.



To unprotect a protected sheet,

Choose Review » Changes group » Unprotect Sheet.

If the sheet was protected with a password, you're prompted to enter that password.

Protecting a Workbook

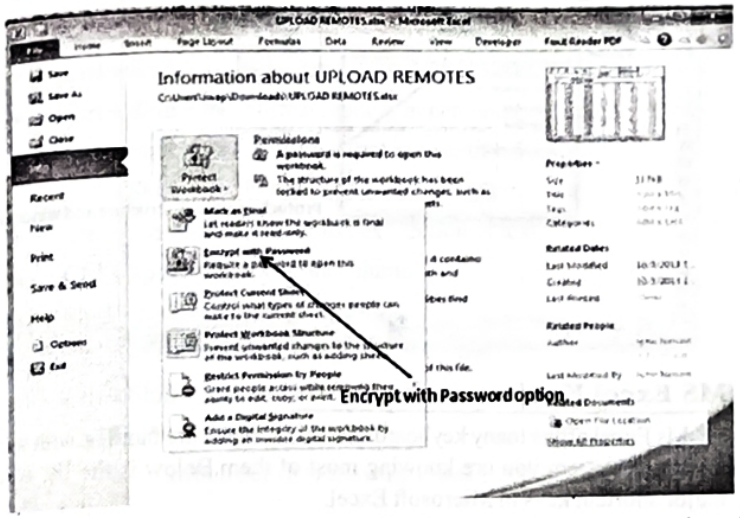
Excel provides three ways to protect a workbook.

- Require a password to open the workbook.
- Prevent users from adding sheets, deleting sheets, hiding sheets, and unhiding sheets.
- Prevent users from changing the size or position of windows.

Requiring a password to open a workbook

Excel lets you save a workbook with a password. After doing so, whoever tries to open the workbook must enter the password. To add a password to a workbook, follow these steps.

- Choose File » Info » Protect Workbook » Encrypt With Password. Excel displays the Encrypt Document dialog box.
- Type a password and click OK.
- Type the password again and click OK.
- Save the workbook.



To remove a password from a workbook, repeat the same procedure. In Step 2, however, delete the existing password symbols.

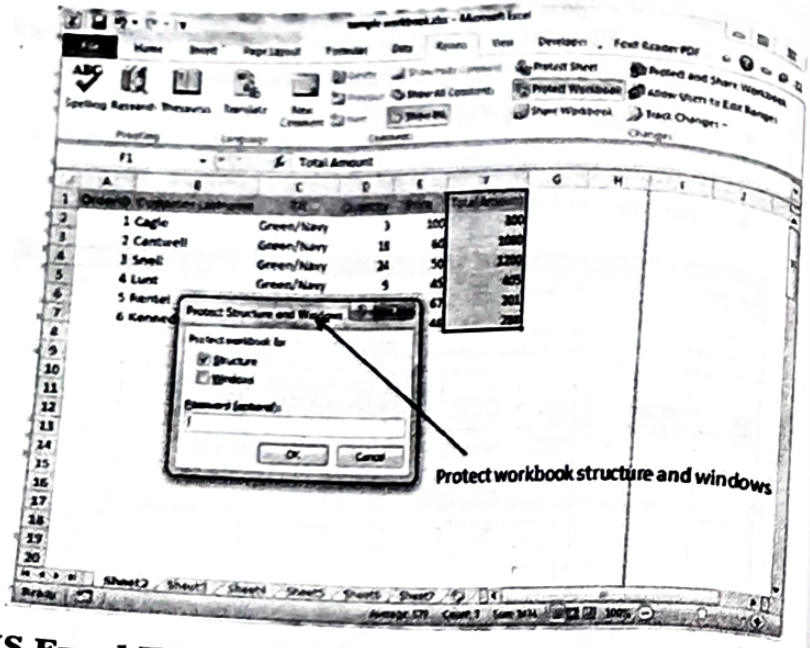
Protecting workbook's structure and Windows

To prevent others (or yourself) from performing certain actions in a workbook, you can protect the workbook's structure and windows. When a workbook's structure and windows is protected, the user may not Add a

sheet, Delete a sheet, Hide a sheet, unhide a sheet,etc and may not allowed to change size or position of a workbook's windows respectively.

To protect a worksheet's structure and windows follow below steps

- Choose Review » Changes group » Protect Workbook to display the Protect Workbook dialog box.
- In the Protect Workbook dialog box, select the Structure check box and Windows check box.
- (Optional) Enter a password.
- Click OK.



MS Excel Keyboard short-cuts

Ms Excel offers many keyboard short-cuts. If you are familiar with windows operating system you are knowing most of them.Below is the list of all the major shortcut keys in Microsoft Excel.

- Ctrl + A : Select all contents of the worksheet.
- Ctrl + B : Bold highlighted selection.
- Ctrl + I : Italic highlighted selection.
- Ctrl + K : Insert link.
- Ctrl + U : Underline highlighted selection.
- Ctrl + 1 : Change the format of selected cells.

- Ctrl + 5 : Strikethrough highlighted selection.
- Ctrl + P : Bring up the print dialog box to begin printing.
- Ctrl + Z : Undo last action.
- Ctrl + F3 : Open Excel Name Manager.
- Ctrl + F9: Minimize current window.
- Ctrl + F10 : Maximize currently selected window.
- Ctrl + F6 : Switch between open workbooks or windows.
- Ctrl + Page up : Move between Excel work sheets in the same Excel document.
- Ctrl + Page down : Move between Excel work sheets in the same Excel document.
- Ctrl + Tab : Move between Two or more open Excel files.
- Alt + = : Create a formula to sum all of the above cells
- Ctrl + ‘ : Insert the value of the above cell into cell currently selected.
- Ctrl + Shift + ! : Format number in comma format.
- Ctrl + Shift + $: Format number in currency format.
- Ctrl + Shift + # : Format number in date format.
- Ctrl + Shift + % : Format number in percentage format.
- Ctrl + Shift + ^ : Format number in scientific format.
- Ctrl + Shift + @ : Format number in time format.
- Ctrl + Arrow key : Move to next section of text.
- Ctrl + Space : Select entire column.
- Shift + Space : Select entire row.
- Ctrl + - : Delete the slected column or row.
- Ctrl + Shift + = : Insert a new column or row.
- Ctrl + Home : Move to cell A1.
- Ctrl + ~ : Switch between showing Excel formulas or their values in cells.
- F2 : Edit the selected cell.
- F3 : After a name has been created F3 will paste names.
- F4 : Repeat last action. For example, if you changed the color of text in another cell pressing F4 will change the text in cell to the same color.
- F5 : Go to a specific cell. For example, C6.

- F7 : Spell check selected text or document.
- F11 : Create chart from selected data.
- Ctrl + Shift + ; : Enter the current time.
- Ctrl + ; : Enter the current date.
- Alt + Shift + F1 : Insert New Worksheet.
- Alt + Enter : While typing text in a cell pressing Alt + Enter move to the next line allowing for multiple lines of text in one ce
- Shift + F3 : Open the Excel formula window.
- Shift + F5 : Bring up search box.



7

MS Access

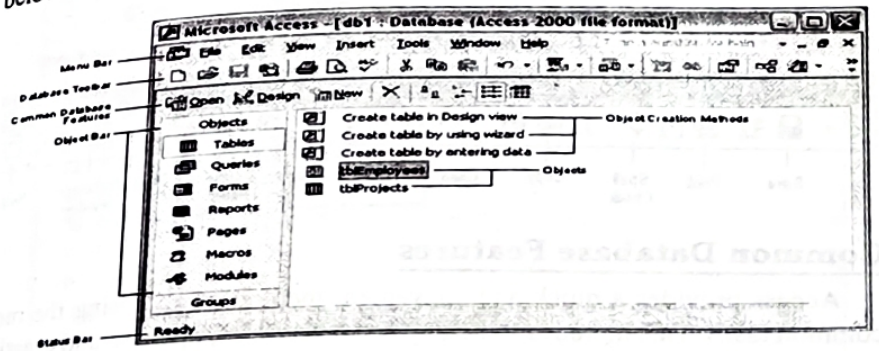
Microsoft Access is a **database creation and management** program. It handles data management tasks the same way as MS Word handles document management and MS Excel handles statistics . A **database** is a collection of data that is stored in a computer system. Databases allow their users to **enter, access,** and **analyze** their data quickly and easily.

Starting Access

1. On the PC, select Start, Programs, and Microsoft Access from the Start list.
2. Double-click on the icon of any Access database. When you double-click an Access database, Access opens with the database already loaded.

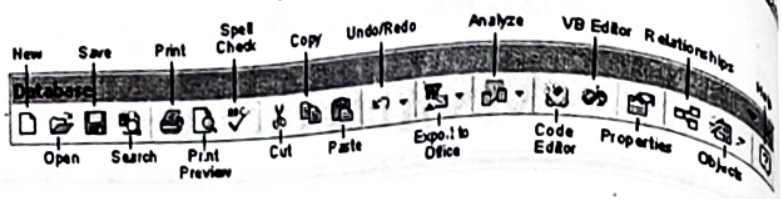
Components of the Access Window

Besides the usual window components (close box, title bar, scroll bars, etc.), an Access window has several unique elements identified in the figure below.



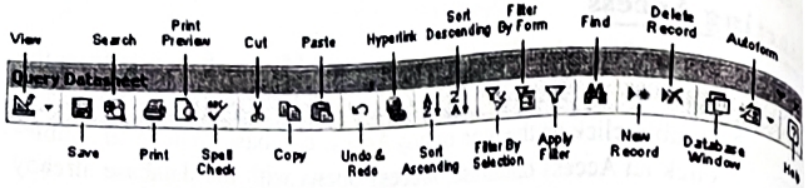
The Database Toolbar

The Database toolbar, located beneath the menu bar, has buttons f commonly performed tasks like accessing the Relationships window, ad Objects, Exporting to Office, and other operations. Access let's you custom the toolbar or even display multiple toolbars at the same time. The Stand Access XP toolbar appears undocked in the figure below.



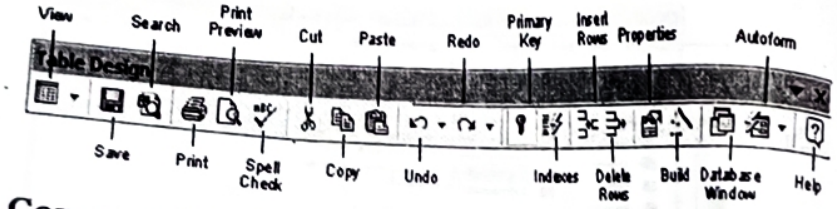
The Data sheet Toolbar

The Data sheet toolbar provides common tasks for editing an object i Data sheet view. The Database toolbar will automatically change into the Da sheet toolbar when this view is selected. The Data sheet tool bar exists betwee different objects, thus, this toolbar largely remains consistent.



The Design Toolbar

The Design toolbar provides common tasks for editing an object in Design view. The Database toolbar will automatically change into the Design toolbar when this view is selected. The Design tool bar exists between different objects, and thus, maintains much of the same functionality.

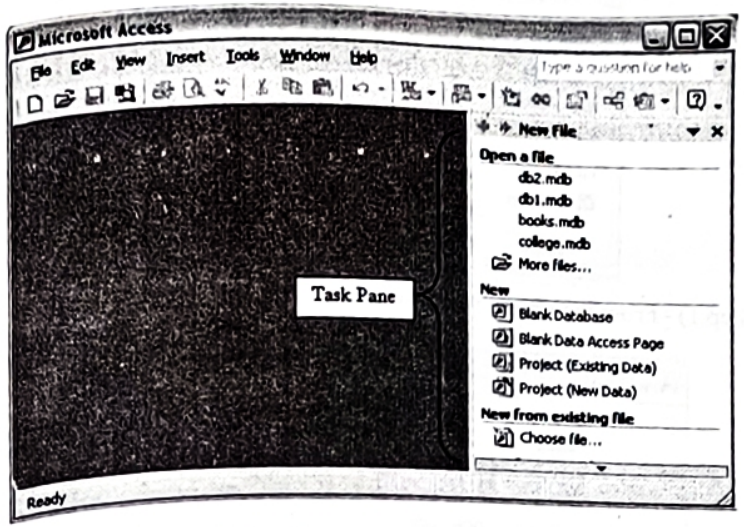


Common Database Features

Access provides a quick and convenient method of accessing the most common tasks. This includes switching between views, opening and creating new databases, and a few minor formatting issues

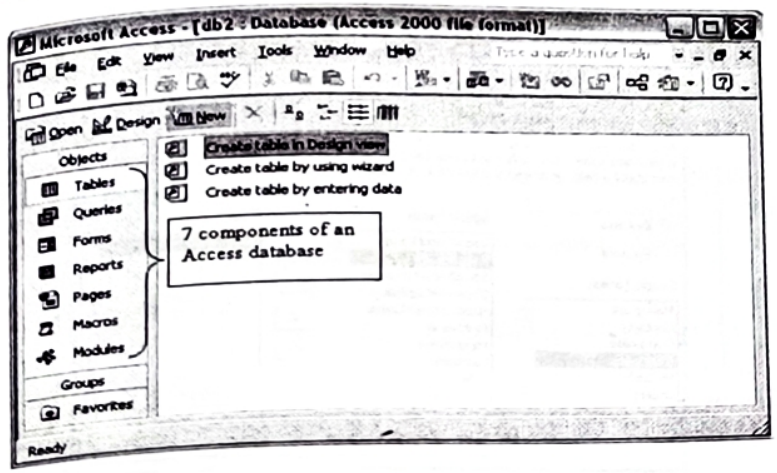
Creating a Database

When you start Access there are no databases open, but the Task Pane is visible and provides quick access to common options such as opening an existing database or creating a new database. To create a database, select Blank Database under the New subgroup.



Database Components

An Access database consists of seven different components. These are: tables, queries, forms, reports, pages, macros, and modules. Use the buttons in the database window shown below to create and modify these components. Each component listed is called an object.

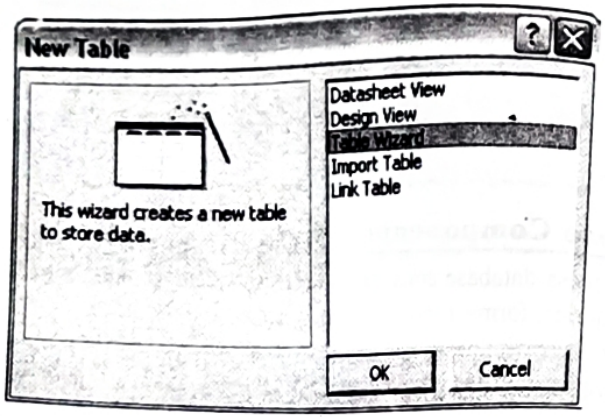


Creating Tables

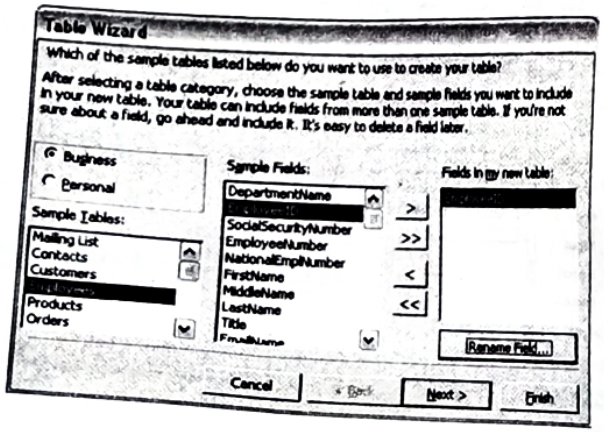
The purpose of a table is to store information. Tables are the building blocks of an access database. Access gives you multiple ways to make tables

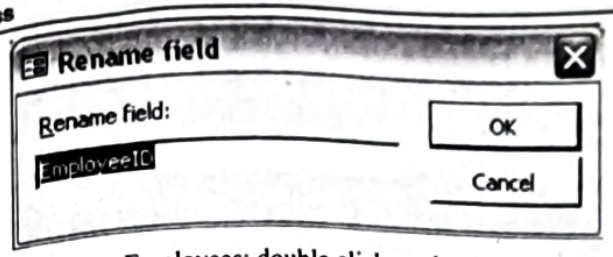


(Step 1) - From the object window select New.



(Step 2) - Choose Table Wizard. Choose OK.

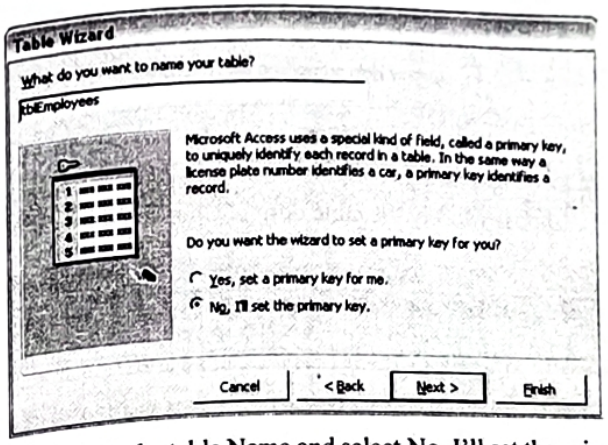




(Step 3) - Select Employees; double click on the fields that will be in the table. If that isn't the exact name of the field then you can select the Rename Field button and retype the field name.

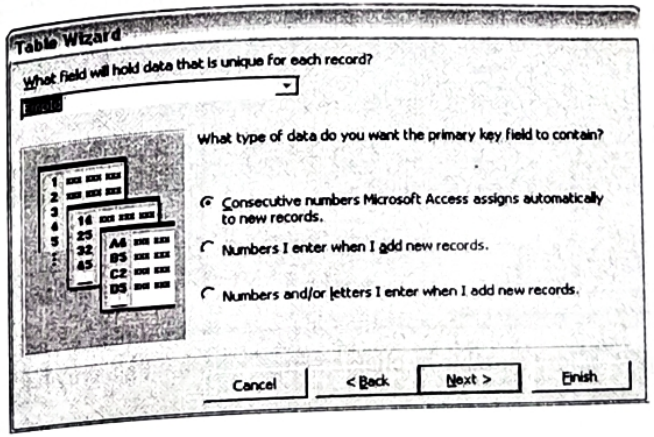
Choose OK

Choose Next

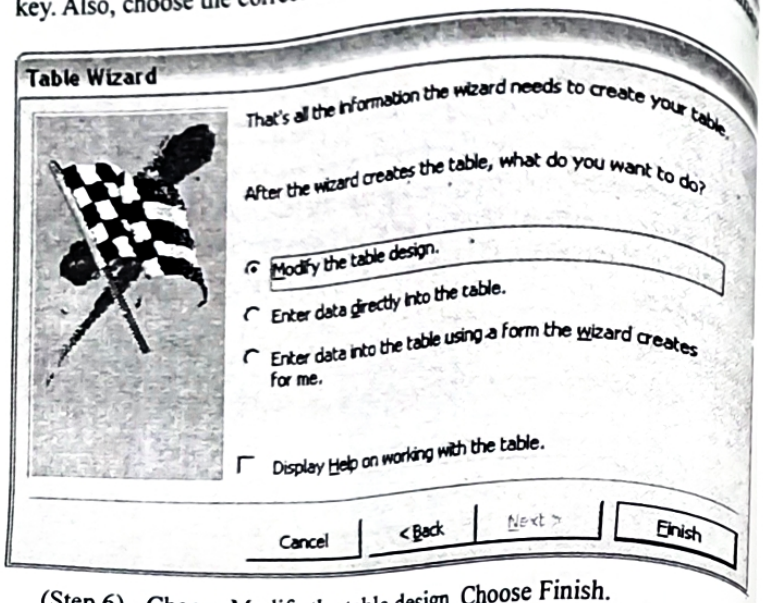


(Step 4) - Type in the table Name and select No, I'll set the primary key .

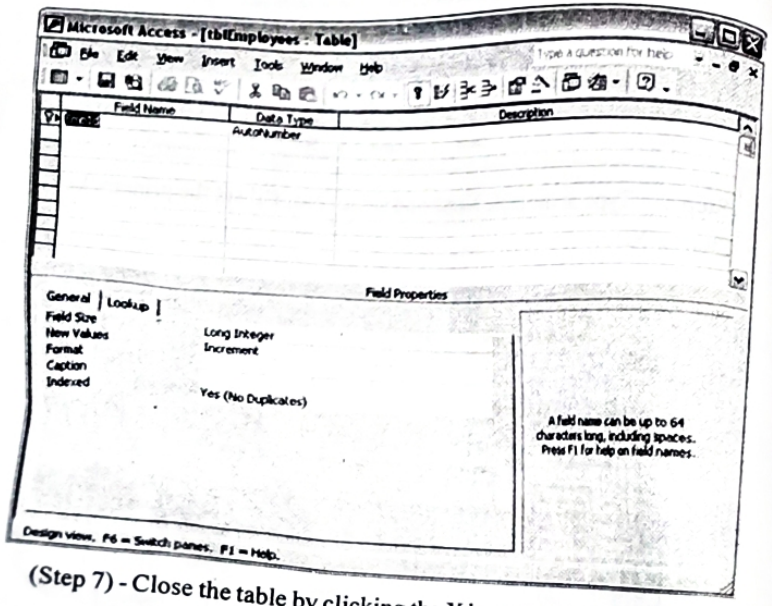
Choose Next .



(Step 5) - From the drop down list choose the field that will be the pri
key. Also, choose the correct data type. Choose Next .



(Step 6) - Choose Modify the table design. Choose Finish.

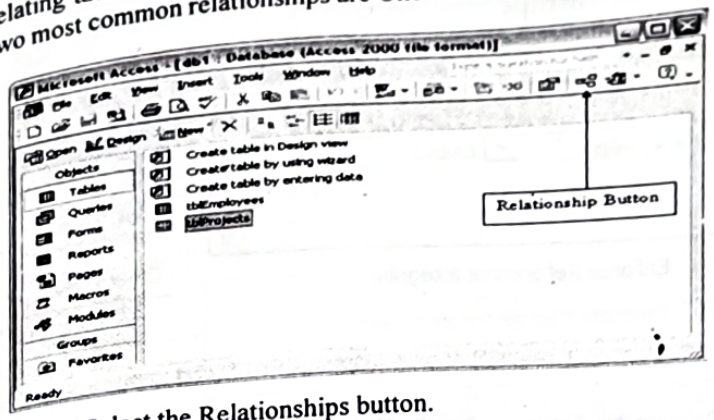


(Step 7) - Close the table by clicking the X button with a gray background.

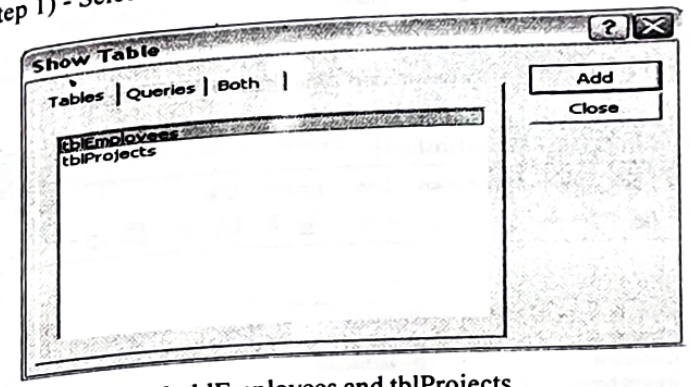
MS Access

Creating Relationships

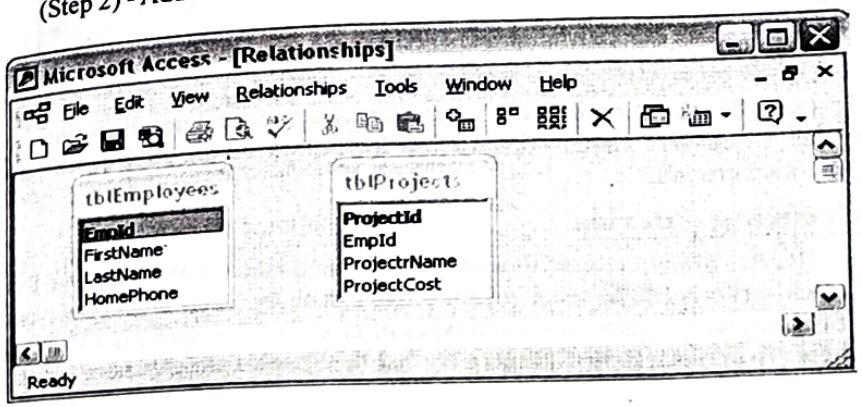
Relating tables together allows for queries to search in multiple tables. The two most common relationships are One-To-One and One-To-Many.



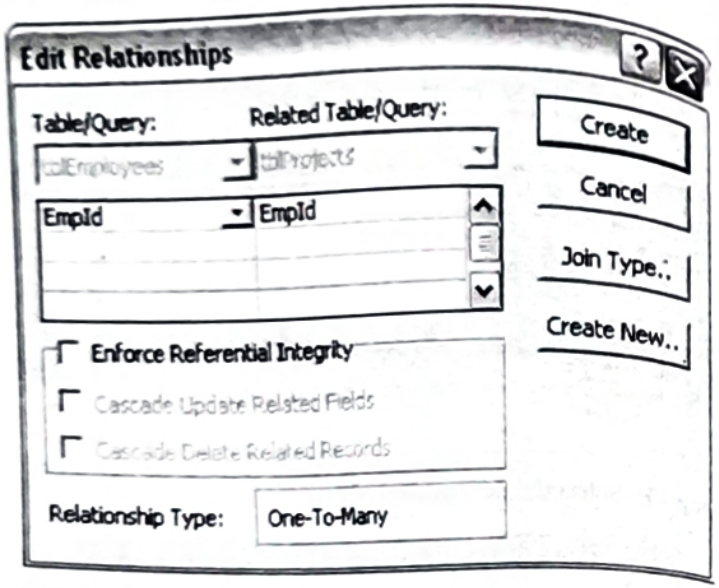
(Step 1) - Select the Relationships button.



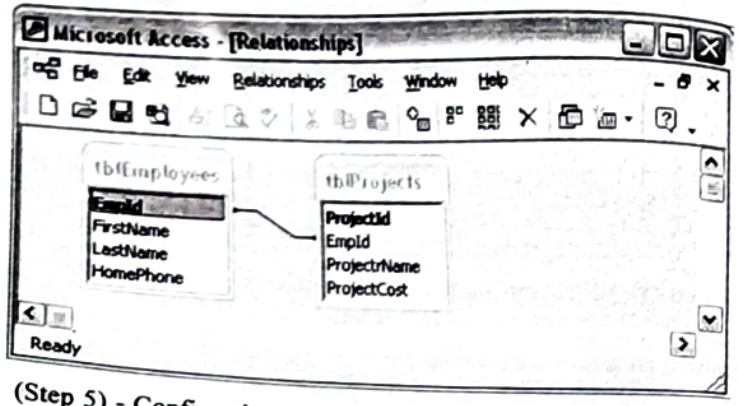
(Step 2) - Add both tblEmployees and tblProjects.



(Step 3) - Drag EmpId from tblEmployees and drop it on EmpId from tblProjects.



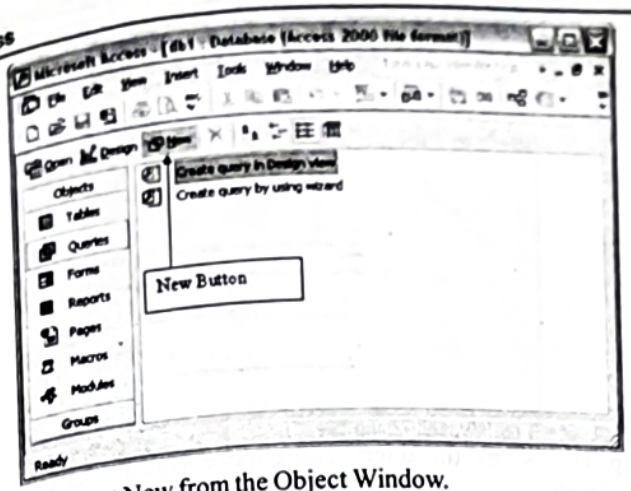
(Step 4) - Confirm the Relationship type then choose Create.



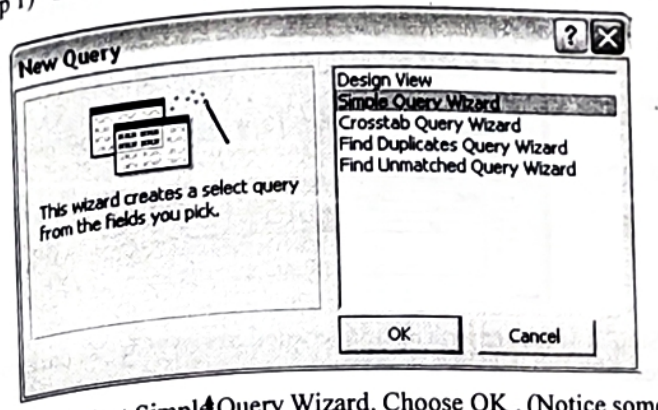
(Step 5) - Confirm the relationship by looking for a line connecting the tables. Close the Relationships window by clicking on the black X with the gray background.

Creating Queries

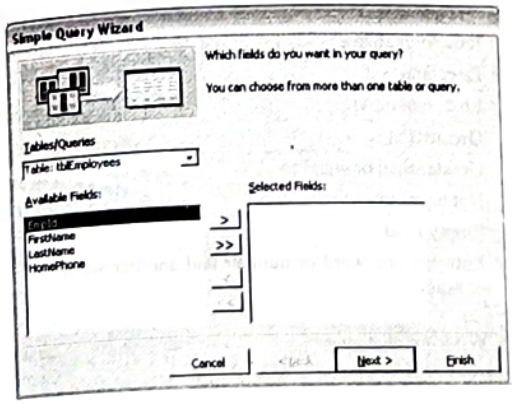
Queries allow the user to search data from a table(s) and then save that search. Criteria can be specified and saved in a query. There are several types of queries which perform several types of tasks. A select query is a standard query. To create a simple select query, use the Simple Query Wizard.



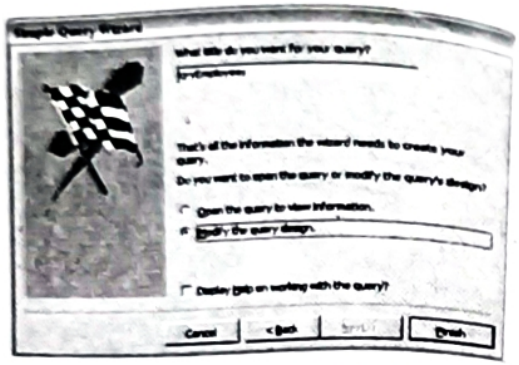
(Step 1) - Select New from the Object Window.



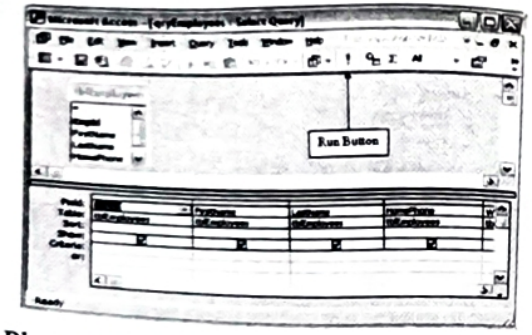
(Step 2) - Select Simple Query Wizard. Choose OK . (Notice some of the other types of queries available).



(Step 3) - Select the table or query you want to query from the Tables/Queries drop down list. Double click on the available fields you want to select. Choose Next .



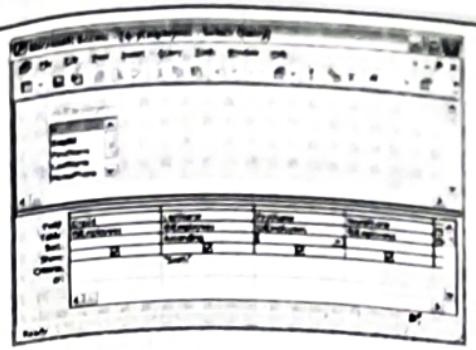
(Step 4) - Name the query and choose Modify the query design. Choose Finish.



(Step 5) - Place criteria in the query design view. Choose the Run button to see results.

Criteria for Queries

Condition	What it Does	Example
=	Exactly matches	=100, =smith
<	Less than	<100
<=	Less than or equal to	<=100
>	Greater than	>100
>=	Greater than or equal to	>= 100
<>	Not equal to	<>100, <>Texas
Is Null	Empty field	
Between X and Y	Between one word or number and another word or number	
*	Wildcard character	Smi* finds words that begin with Smi such as Smith and Smithsonian

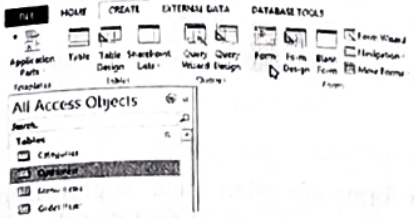


(Step 6) - Place criteria such as an ascending sort in the query and run the query.

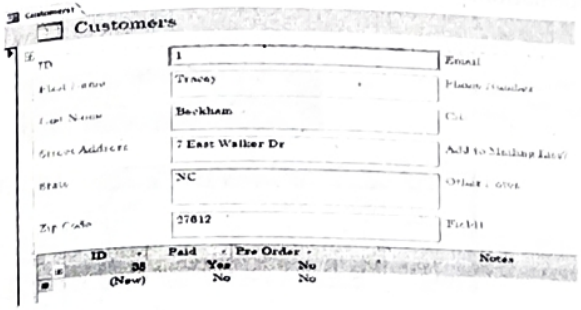
To create a form:

Access makes it easy to create a **form** from any table in your database. Any form you create from a table will let you **view the data** that's already in that table and **add new data**. Once you've created a form, you can modify it by adding additional fields and **design controls** like combo boxes.

1. In the Navigation pane, select the table you want to use to create a form. You do not need to open the table.
2. Select the **Create** tab, locate the **Forms** group, and click the **Form** command.



3. Your form will be created and opened in **Layout view**.
4.



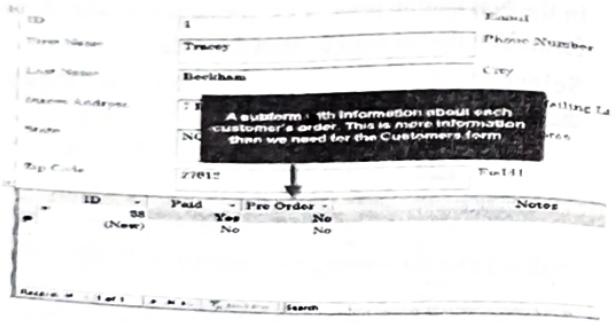
5. To save the form, click the **Save** command on the **Quick Access toolbar**. When prompted, type a **name** for the form, then click **OK**.



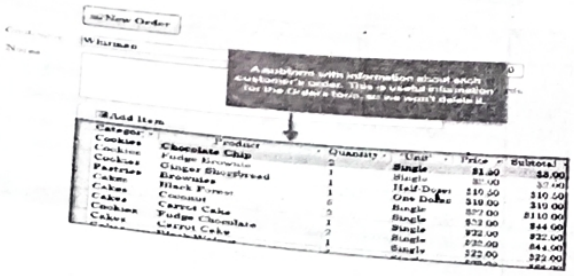
About sub forms

If you created a form from a table whose records are linked to another table, your form probably includes a **sub form**. A sub form is a **datasheet form** that displays linked records in a table-like format. For instance, the sub form included in the **Customers** form we just created displays linked customer **orders**.

We probably don't need to include this sub form because we just want to use the Customers form to enter and review contact information. If you find that you don't need a sub form, you can easily **delete** it. To do this, simply click it and press the **Delete** key on your keyboard.



However, sub forms are often quite helpful. Depending on the content and source of your form, you might find that the sub form contains useful information, like in the example below. In our **Orders** form, the sub form contains the name, quantity, and price of each item contained in the order, which is all useful information.

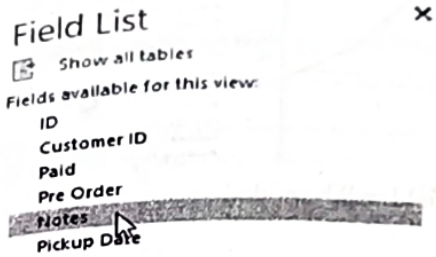


To add a field to a form:

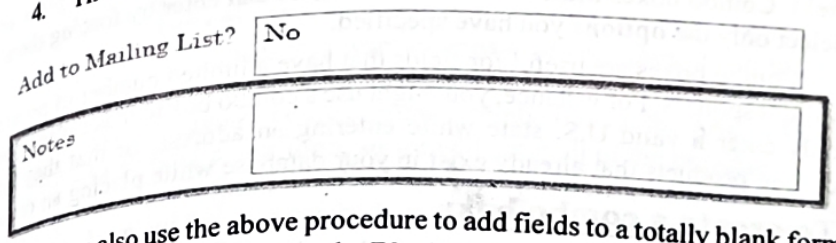
1. Select the **Design** tab, then locate the **Tools** group on the right side of the Ribbon.
2. Click the **Add Existing Fields** command.



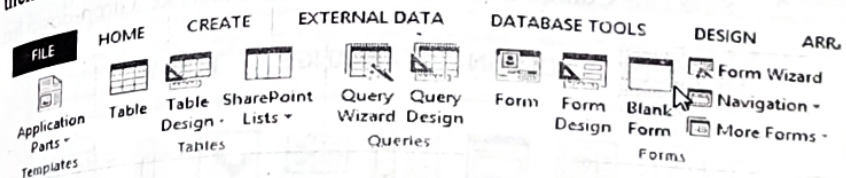
3. The **Field List** pane will appear. Double-click the desired field(s).



4. The field will be added.



You can also use the above procedure to add fields to a totally blank form. Simply **create a form** by clicking the **Blank Form** command on the **Create** tab, then follow the above steps to add the desired fields.

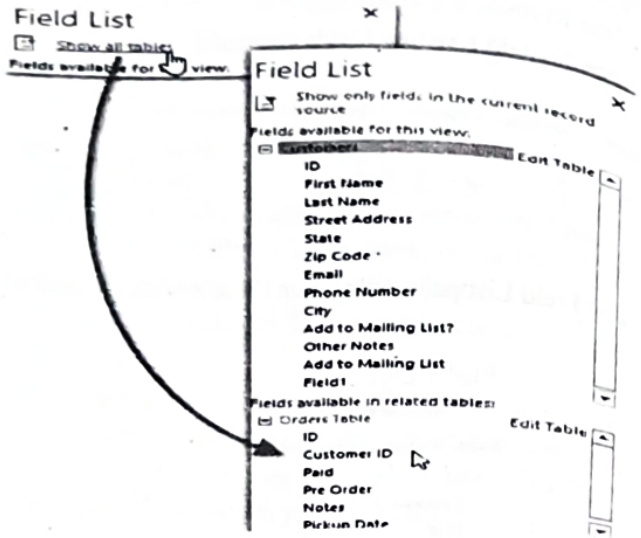


To add a field from a different table:

You can also add fields from **different tables** in your database to the form.

1. From the **Field List** pane, click **Show All Tables**.

2. Click the plus sign + next to the table that contains the field you want to add, then double-click the desired field.



3. The new field will be added.

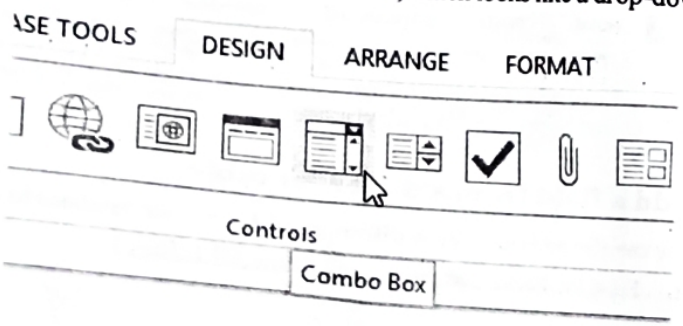
Combo boxes

A **combo box** is a drop-down list you can use in your form in place of a field. Combo boxes **limit** the information users can enter by forcing them to select only the **options** you have specified.

Combo boxes are useful for fields that have a limited number of possible valid responses. For instance, you might use a combo box to make sure people only enter a valid U.S. state while entering an address, or that they only choose products that already exist in your database while placing an order.

To create a combo box:

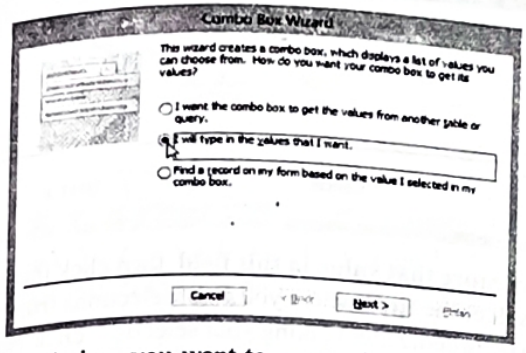
1. In **Form Layout** view, select the **Design** tab, then locate the **Controls** group.
2. Select the **Combo Box** command, which looks like a drop-down list.



3. Select the desired location for the combo box. A line will appear to indicate the location where your combo box will be created. In our example, we'll place it between the **City** field and the **Add to Mailing List?** fields.

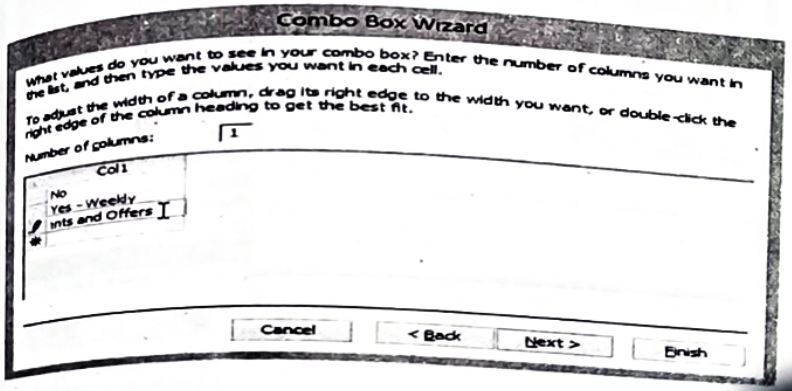


4. The **Combo Box Wizard** dialog box will appear. Select **I will type in the values that I want**, then click **Next**.

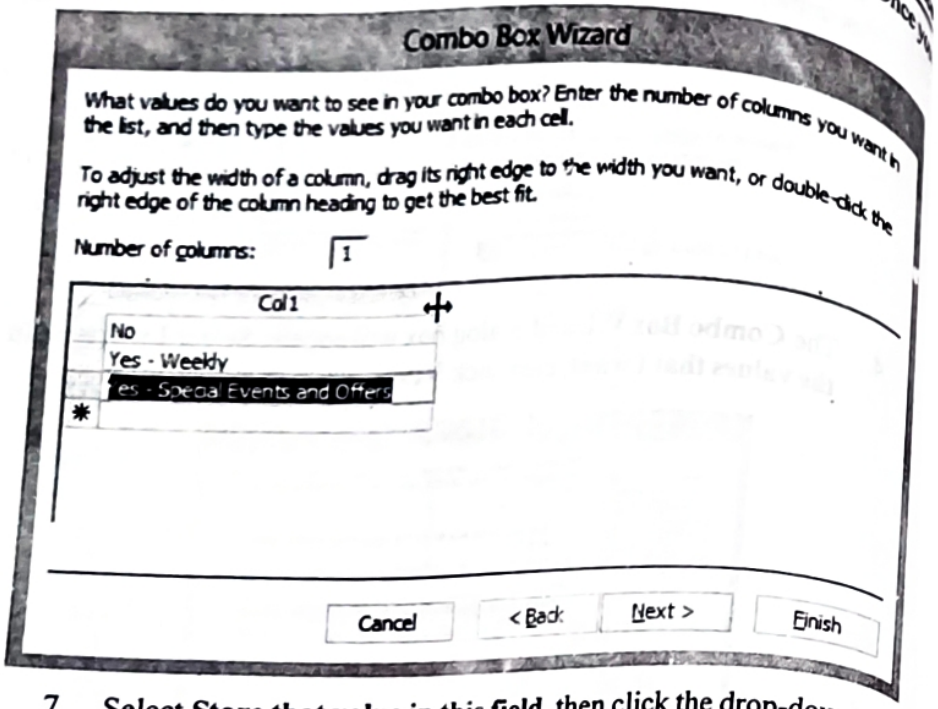


5. Type the choices you want to appear in your drop-down list. Each choice should be on its own row.

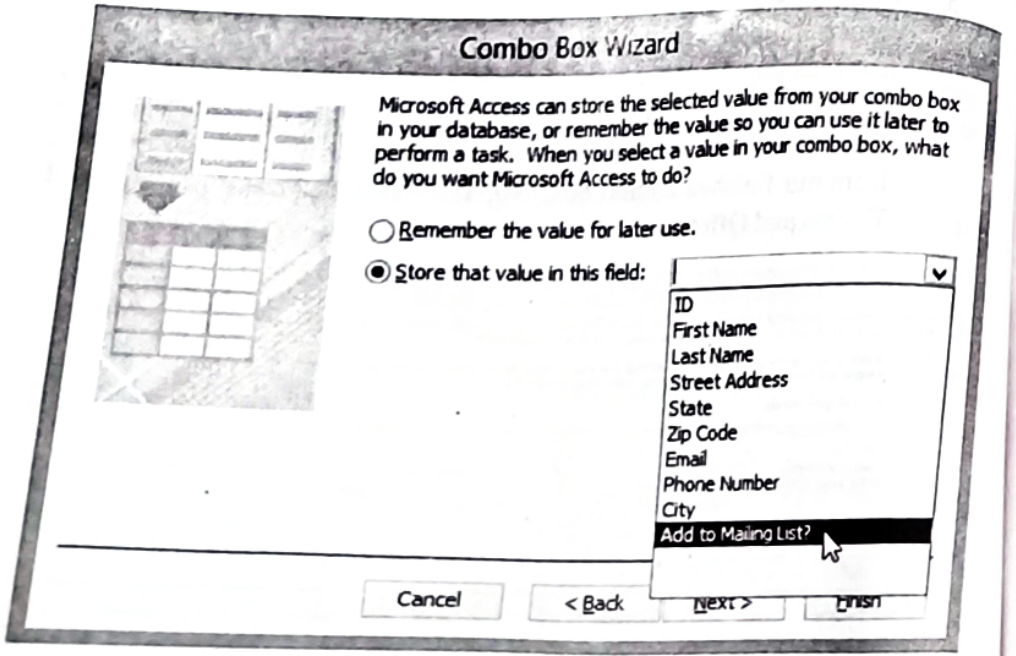
In our example, we are creating a combo box for the **Add to Mailing List?** field in our form, so we will enter all of the possible valid responses for this field. Users will be able to select one of three choices from our finished combo box: **No**, **Yes - Weekly**, and **Yes - Special Events and Offers**.



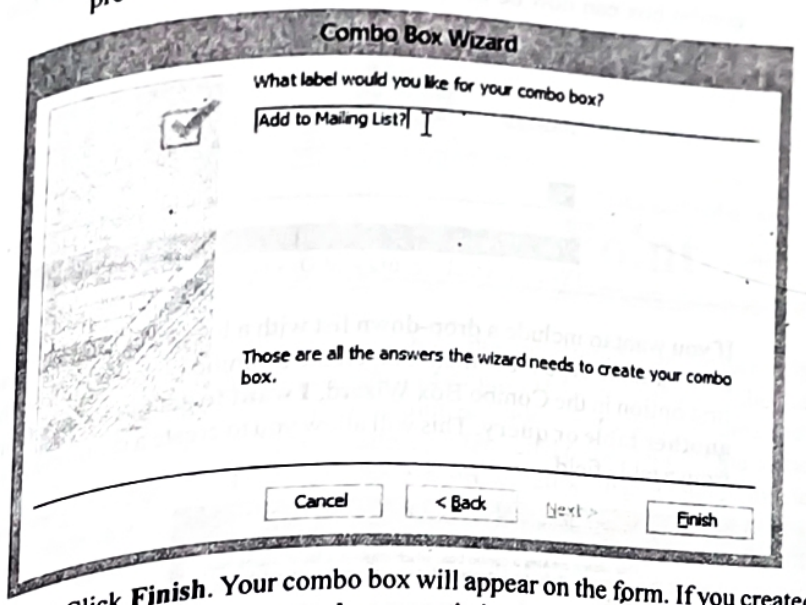
6. If necessary, resize the column so all of your text is visible. Once you are satisfied with your list, click **Next**.



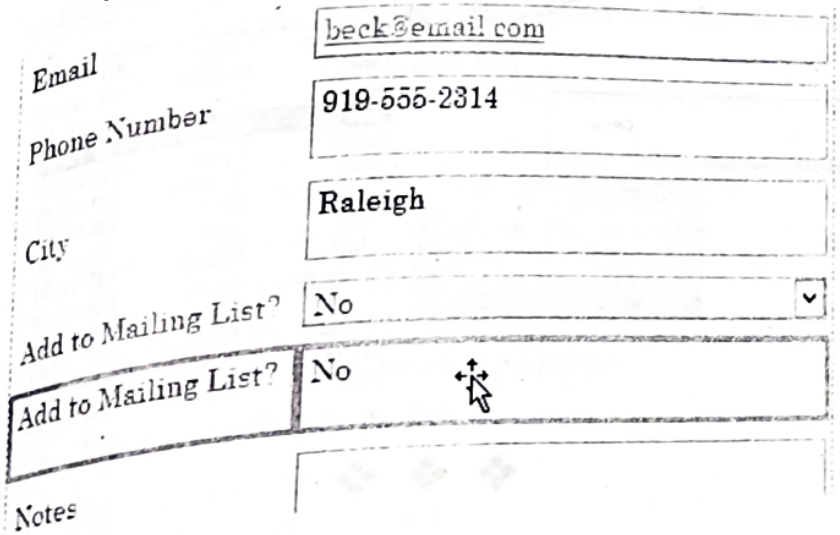
7. Select **Store that value in this field**, then click the drop-down arrow and **select the field** where you want selections from your combo box to be recorded. After making your selection, click **Next**.



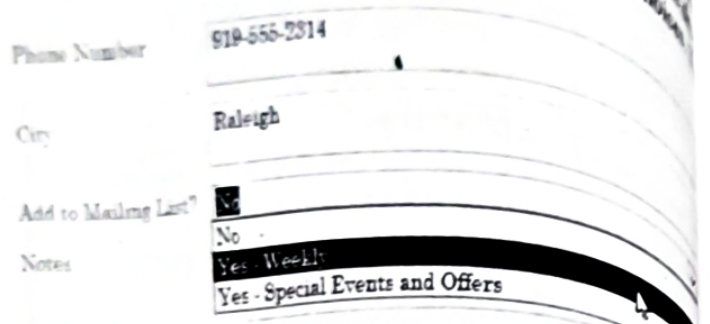
8. Enter the **label**—or **name**—that will appear next to your combo box. Generally, it's a good idea to use the name of the field you chose in the previous step.



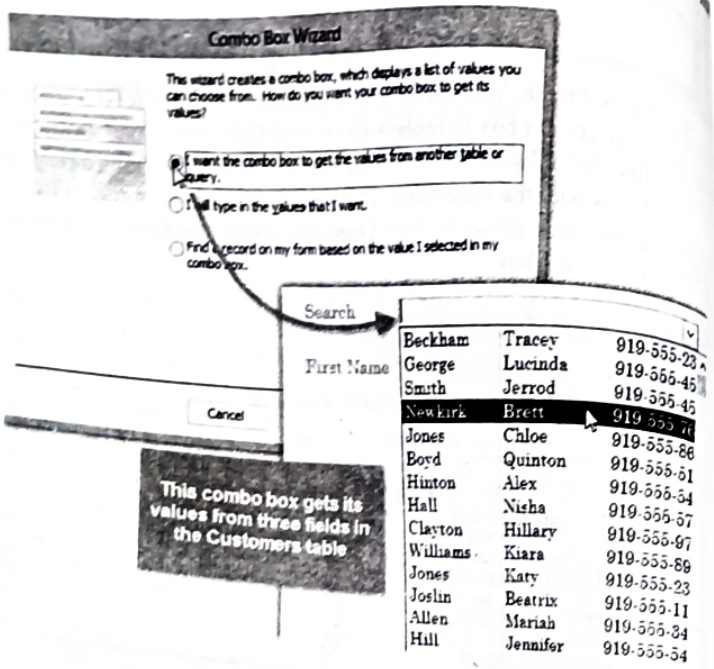
9. Click **Finish**. Your combo box will appear on the form. If you created your combo box to **replace** an existing field, you should **delete** the first field. In our example, you might notice that we now have two fields with the same name. These two fields send information to the same place, so we don't need them both. We'll **delete** the one without the combo box.



10. Switch to **Form** view to test your combo box. Simply click the down arrow and verify that the list contains the correct choices. The combo box can now be used to enter data.



If you want to include a drop-down list with a long list of options and don't want to type all of them out, create a combo box and choose the first option in the Combo Box Wizard, **I want to get the values from another table or query**. This will allow you to create a drop-down list from a table field.



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Microsoft PowerPoint

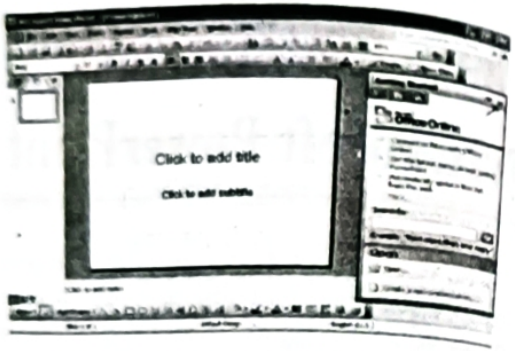
Microsoft PowerPoint is a slide show presentation program currently developed by Microsoft. PowerPoint presentations consist of a number of individual pages or "slides". PowerPoint provides numerous features that offer flexibility and the ability to create a professional presentation. One of the features provides the ability to create a presentation that includes music which plays throughout the entire presentation or sound effects for particular slides. In addition to the ability to add sound files, the presentation can be designed to run, like a movie, on its own. PowerPoint allows the user to record the slide show with narration and a laser pointer. The user may customize slide shows to show the slides in a different order than originally designed and to have slides appear multiple times. Microsoft also offers the ability to broadcast the presentation to specific users via a link and Windows Live.

Features:

- Power Point can be used to create black and white overhead transparencies
- It can be used to create coloured overhead transparencies.
- It can create 35mm slides.
- It can create slideshows for computer screen or projector.
- It contains six slide views for various purposes.
- It supports bullets and numbering for creating lists.
- It supports pictures for effective slide design.
- It has a support for scanners to input images.
- It supports graphs and organisation.

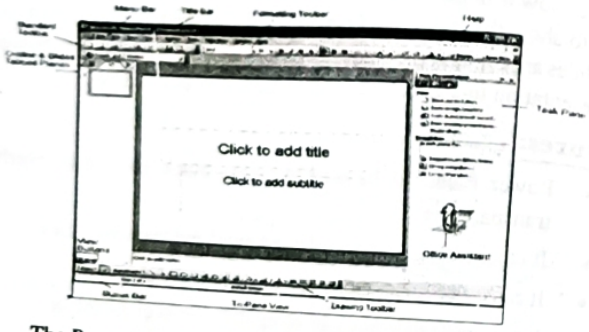
To start a PowerPoint program

- Click on the Start button, point to Programs, follow by Microsoft Office and click on Microsoft Office PowerPoint 2003.
- Immediately you will see the screen shown below. The right hand side Getting Started task pane provides help to you.



- If you are not using it, you can click on the Close icon to close it. You also can start by clicking on Create a new presentation… at the bottom of the task pane.

The PowerPoint 2003 screen elements:



The PowerPoint Window has toolbars and panes to help you quickly create presentations. Most of the toolbars are common in Office applications but may feature options unique to PowerPoint.

- Title Bar - displays the document name followed by a program name.
- Menu Bar - contains a list of options to manage and customize documents.
- Standard Toolbar - contains shortcut buttons for the most popular commands.

- Formatting Toolbar - contains buttons used for formatting.
- Status Bar - displays slide position and the type of design in PowerPoint.
- Drawing Toolbar - contains tools for drawing lines, shapes and objects.
- Task Pane - located on the right side of the computer screen, this pane allows you to select tasks in different categories and allows you to quickly enhance your slides in a few steps. It provides quick access to the most common actions and features in PowerPoint.
- Outline and Slides Tabbed Pane - allows the user to easily view the presentation in outline format (text), as well as a list of all the slides in the presentation (with visuals).
- Help - provides quick access to Help topics.

To enter text into a presentation

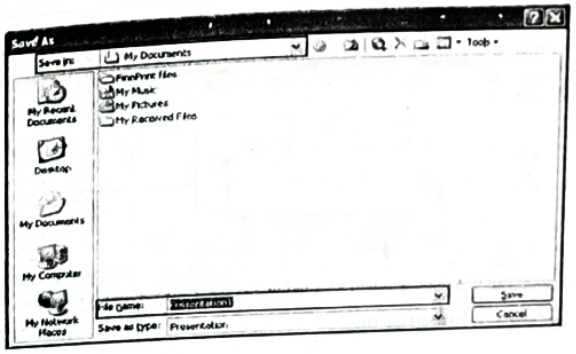
- From the PowerPoint slide pane, there is 'box' that labeled 'Click to add title'. Just simply click and enter the text there.
- For example, you may enter "This is my first presentation."
- Then click on 'Click to add subtitle' and you also can enter some text there.

Saving and Closing a presentation

This feature allows you to store new or existing presentations on disk. If you not save the file, you will be unable to view the presentation in the future. Once saved, you can re-open the file for viewing or editing.

To save a presentation

- From File menu,click Save.

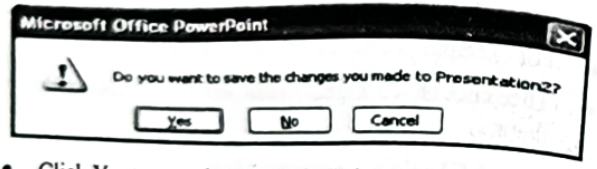


- If it is a new file, the Save As dialog box displayed, ensure that you are located in the folder/disk drive of your choice by clicking the arrow to the right of the Save in: drop down box and navigating to your required location.
- Enter the file name in the File name: text box. The default file name is Presentation1, you can use it or type in a new file name.
- Let say we key in First presentation for the file name, click on the Save button to save. Note: Now the presentation is saved to My Documents folder.

To close a presentation

- From the File menu, click close

  OR click Close Window icon.
- If unsaved changes have been made to your presentation the dialog box below is displayed, giving you the chance to save the presentation prior to closing.



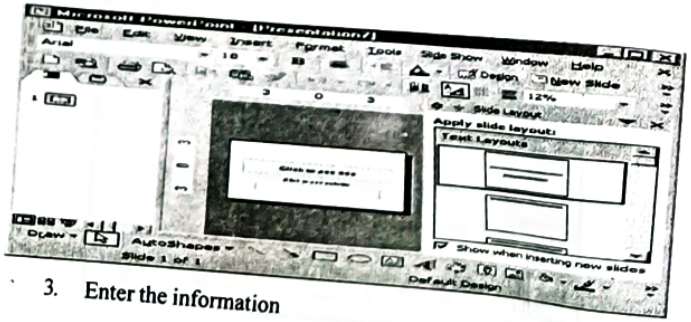
- Click Yes to save the presentation before closing

  OR click No to close without saving changes

  OR click on Cancel to cancel the operation.

Create a Title Slide

1. Open PowerPoint.
2. Choose Blank Presentation on the Task pane. You will be presented with a Title slide.



3. Enter the information

Insert a New Slide

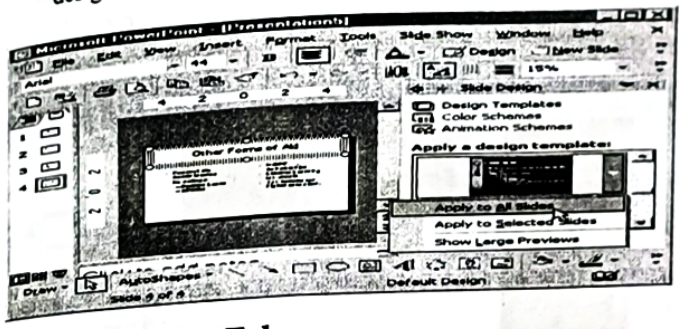
1. Click the New Slide icon 
2. Click the Title and Text icon.



Enter the information

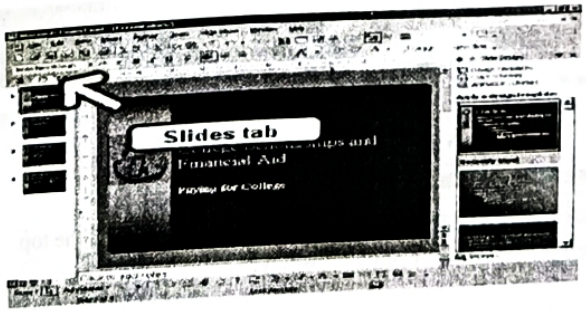
Apply a Design Template

1. Click the design icon  . Design templates will appear on the left side of the screen.
2. Scroll down to view the design templates.
3. Right-click the design template you want to apply. A context menu will appear. Choose Apply to All Slides. We used the Lock and Key design template.

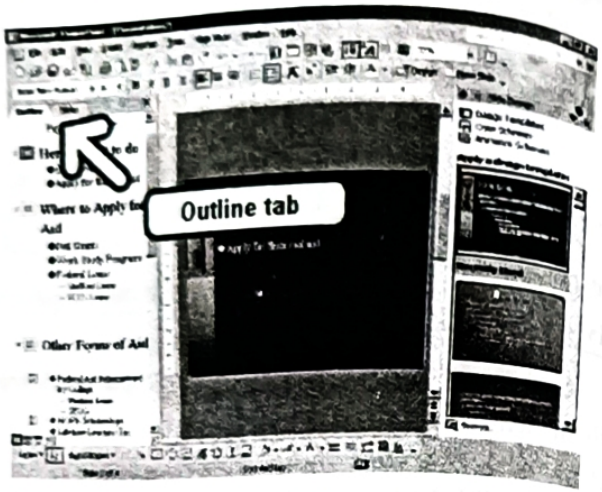


Outline and Slides Tab

1. Use the Slides tab to view thumbnails of your slide.

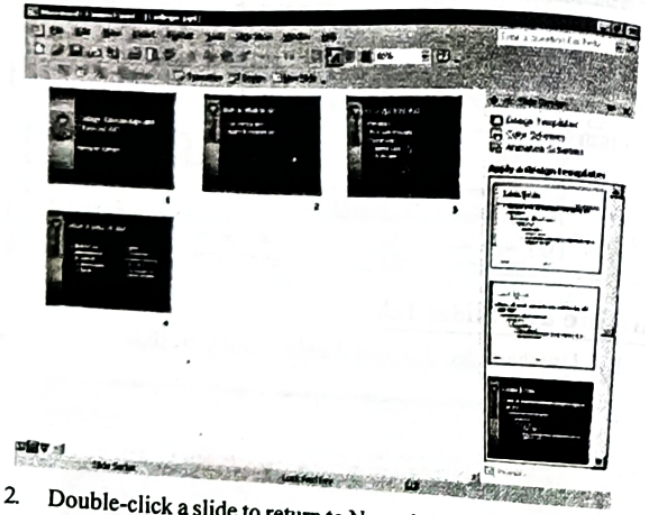


2. Click the Outline tab to view the text of your presentation as an outline.



Slide Sorter View

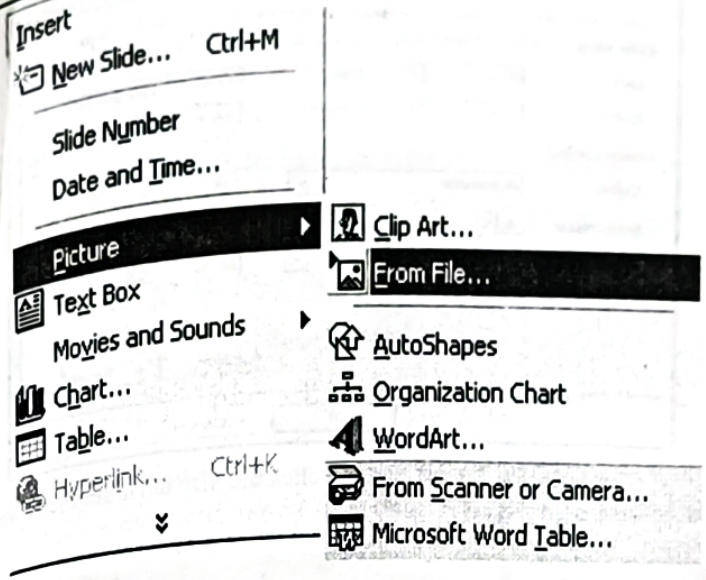
1. Choose View > Slide Sorter from the menu to move to Slide Sorter view.



2. Double-click a slide to return to Normal view.

To insert an image

Click Insert > Picture from the PowerPoint menu bar at the top. The Picture submenu should display:



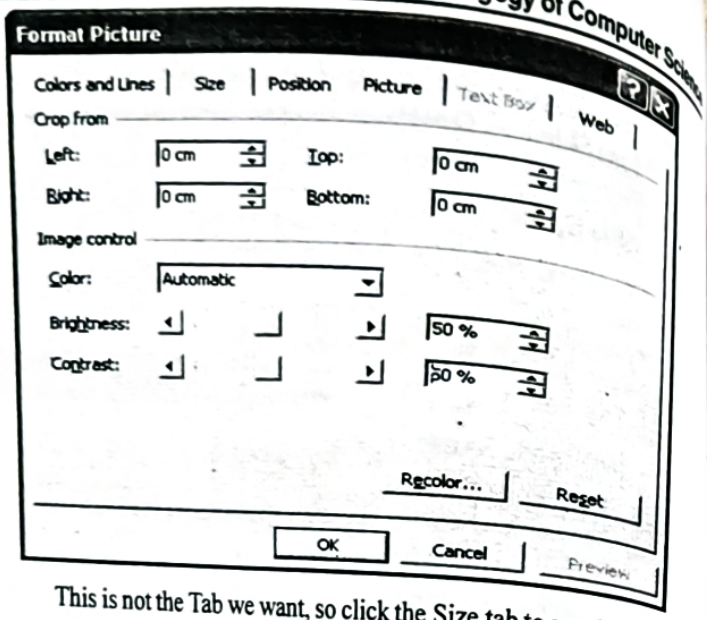
Resize and Move an Image

The picture looks a bit big for the slide, and there's not much room for the text we want to add. To resize the image, make sure the image is selected. If it is, you'll see white squares or circles around the edges, as in the previous image.

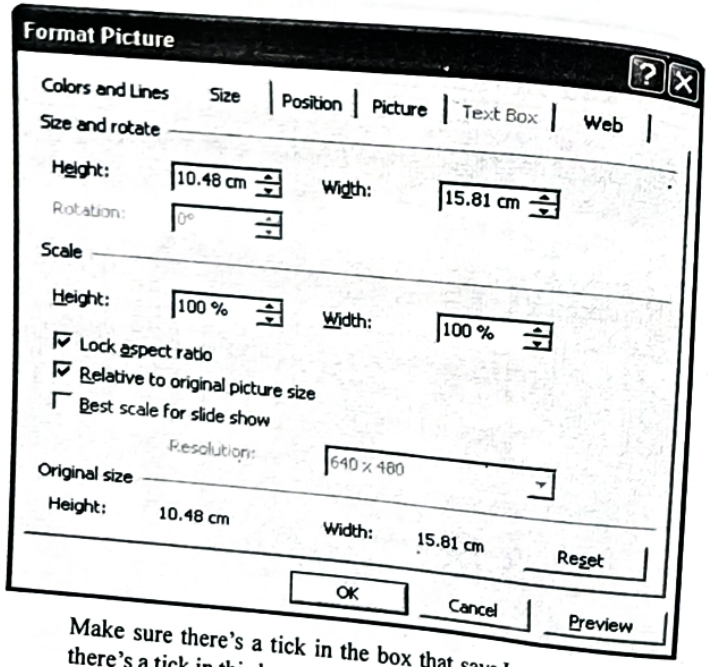
With the image selected, click it with the right mouse button. You'll then see the following menu:



Click on Format Picture, and you'll see the following dialogue box appear:



This is not the Tab we want, so click the Size tab to see the following settings:

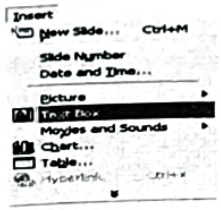


Make sure there's a tick in the box that says Lock aspect ratio. If there's a tick in this box, when you change the height, the width will change automatically to match. That way, you don't end up with an odd-shaped image.

On the Size tab, change the Scale > Height from 100% to 80%. You'll see the other values change by themselves. Click the Preview button at the bottom to see what the image looks like at this size. If you're happy with the size of your image, click OK.

To add a new text box

Click Insert from the menu bar at the top. From the Insert menu, click Text Box:

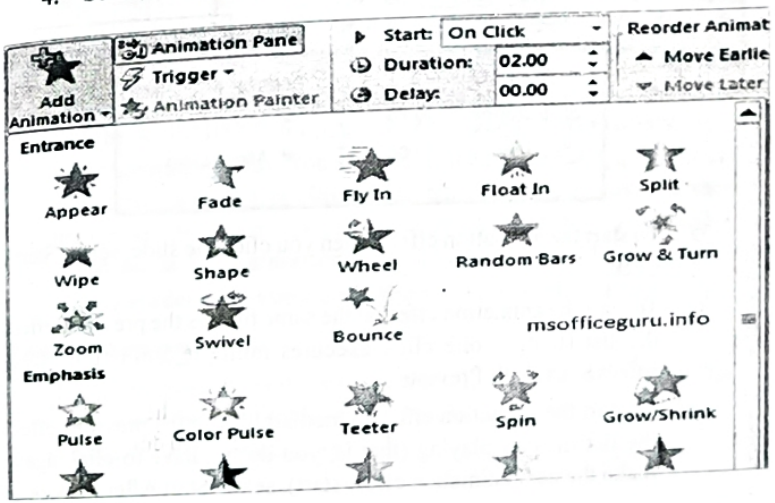


To insert Animation

You can apply animation on both texts and images in PowerPoint Presentation. Animation in slide makes your presentation interesting to your audience.

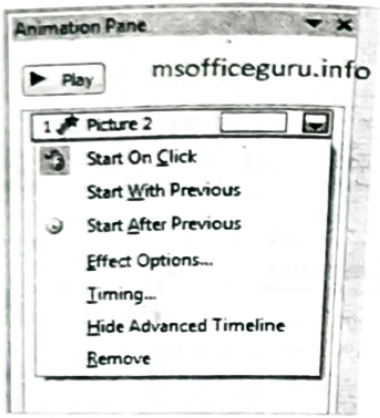
To add animation effects on Presentation, follow these steps:

1. Open the slide you wish to add Animation in.
2. Select the **text** or **image** by clicking on it.
3. Select the **Animation** Tab on the ribbon and then click **Add Animation** button.
4. Select the animation you want from the drop down option.



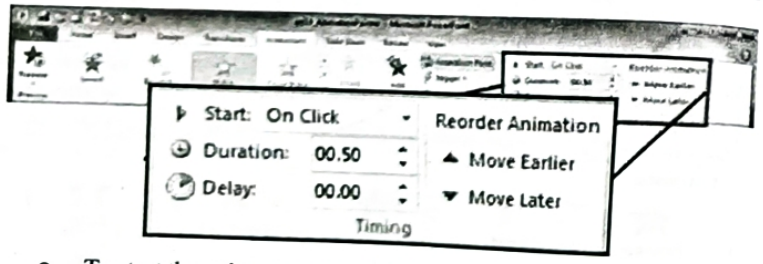
5. Hover your mouse on any of the option provided to select animation types by clicking on it.
6. Click **Animation Pane** button in the **Advance Animation** group.
7. Click to drop down arrow on any of the chosen animation which appears here as Pictures.

   Here you can control the effects of the animation types you've chosen.
8. Click the **Play** button to see effect.



Set the start time for an animation effect

1. On the slide, click the text or object that contains the animation effect for which you want to set the start timing.
2. On the **Animations** tab, in the **Timing** group, do one of the following:



- To start the animation effect when you click the slide, select Start On Click.
- To start the animation effect at the same time as the previous effect in the list (that is, one click executes multiple animation effects), select Start With Previous.
- To start the animation effect immediately after the previous effect in the list finishes playing (that is, you do not have to click again to make the next animation effect start), select Start After Previous.

Delay the start of an animation effect

1. On the slide, click the text or object that contains the animation effect for which you want to set a delay or other timing option.
2. On the **Animations** tab, in the **Timing** group, do one or more of the following:

- To create a delay between the end of one animation effect and the start of a new animation effect, enter a number in the **Delay** box.
- To specify the length of an animation effect, enter a number in the **Duration** box.

Repeat or rewind an animation effect

To make an animation effect or sequence of effects repeat or return to its original position, on the **Animations** tab, in the **Animation** group, click the **Show Additional Effect Options** launcher, click the **Timing** tab, and then do one or more of the following:

- To repeat an animation effect, select an option in the **Repeat** list.
- To automatically return an animation effect to its original look and location after it plays, select the **Rewind when done playing** check box. For example, after the "fly out" exit effect plays, the item reappears on the slide in its original location.

Reorder animation effects

Animated objects on a slide display a number indicating the order in which the object's animation plays. When there are two or more animation effects, you can change the order in which each plays by doing one of the following:

- On the slide, click an animation, and then on the **Animations** tab, in the **Timing** group, under **Reorder Animation**, click **Move Earlier** or **Move Later**.
- On the **Animations** tab, in the **Advanced Animation** group, click **Animation Pane**. You can change the order by dragging objects up or down in the list, or click on the item you want to move and then use the **Re-Order**arrows on the **Animation Pane**. You can also click an object in the **Animation Pane** and then in the **Timing**group, under **Reorder Animation**, click **Move Earlier** or **Move Later**.

To Add a sound

To prevent possible problems with links, it is a good idea to copy the sounds into the same folder as your presentation before you add the sounds to your presentation.

1. In the pane that contains the Outline and Slides tabs, click the **Slides** tab.
2. Click the slide to which you want to add a sound.
3. On the **Insert** tab, in the **Media Clips** group, click the arrow under **Sound**.



4. Do one of the following:

- Click **Sound from File**, locate the folder that contains the file, and then double-click the file that you want to add.
- Click **Sound from Clip Organizer**, scroll to find the clip that you want in the **Clip Art** task pane, and then click it to add it to the slide.

TIP You can preview a clip before adding it to your presentation. In the **Clip Art** task pane, in the**Results** box that displays the available clips, move your mouse pointer over the clip's thumbnail. Click the arrow that appears, and then click **Preview/Properties**.

Top of Page

1. On the slide, click the sound icon .
2. Under **Sound Tools**, on the **Options** tab, in the **Play** group, click **Preview**. You can also double-click the sound icon.

Choose between Automatically or When Clicked

When you insert a sound, you are prompted with a message asking how you want the sound to start: automatically (**Automatically**) or when you click the sound (**When Clicked**).

- To automatically start the sound when you show the slide, click **Automatically**.

  The sound plays automatically when you show the slide unless there are other media effects on the slide. If there are other effects, such as an animation, the sound plays after that effect.
- To manually start the sound when you click it on the slide, click **When Clicked**.

  When you insert a sound, a play trigger effect is added. This setting is known as a trigger because, to play the sound, you have to click something specific, as opposed to just clicking the slide.

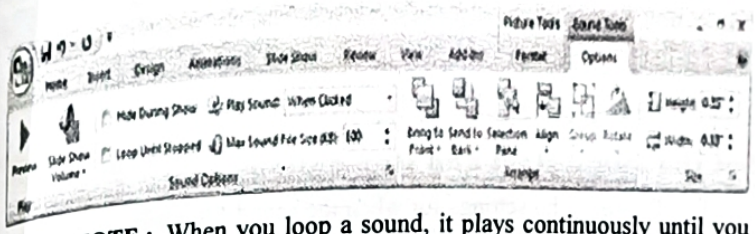
NOTE : Multiple sounds are added on top of each other and play in the order in which they were added. If you want each sound to start when you click it, drag the sound icons off of each other after you insert them.

Play a sound continuously

You can play a sound continuously during just one slide or across many slides.

Play a sound continuously for one slide

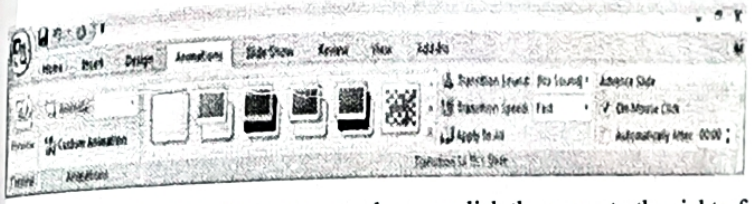
1. Click the sound icon .
2. Under **Sound Tools**, on the **Options** tab, in the **Sound Options** group, select the **Loop Until Stopped** check box.



NOTE : When you loop a sound, it plays continuously until you advance to the next slide.

Play a sound across multiple slides

1. On the **Animations** tab, in the **Animations** group, click **Custom Animation**.



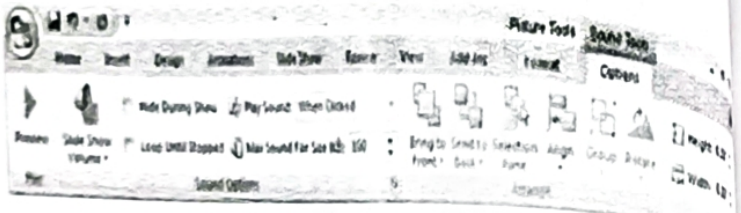
2. In the **Custom Animation** task pane, click the arrow to the right of the selected sound in the **Custom Animation** list, and then click **Effect Options**.
3. On the **Effect** tab, under **Stop playing**, click **After**, and then select the total number of slides on which the file should play.

NOTE : The sound file should be as long as the specified display times of the slides. You can see the length of the sound file on the **Sound Settings** tab, under **Information**.

Hide the sound icon

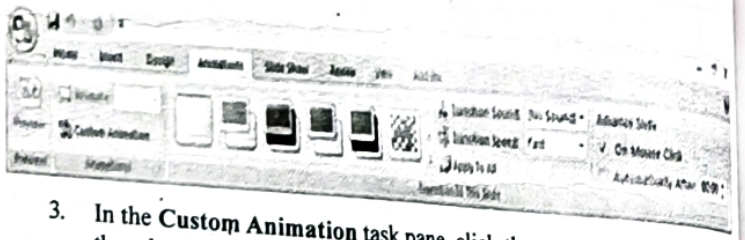
Important : Use this option only if you set the sound to p automatically, or if you created some other kind of control, such a trigger, to click to play the sound. (A trigger is something on y slide, such as a picture, shape, button, paragraph of text, or text b that sets off an action when you click it.) Note that the sound icon always visible in Normal view unless you drag it off the slide.

1. Click the sound icon .
2. Under **Sound Tools**, on the **Options** tab, in the **Sound Options** grou select the **Hide During Show** check box.



Set the sound start and stop options

1. To adjust the settings for when the sound file plays or stops, click the sound icon .
2. On the **Animations** tab, in the **Animations** group, click **Custom Animation**.



3. In the **Custom Animation** task pane, click the arrow to the right of the selected sound in the **Custom Animation** list, and then click **Effect Options**.
4. Do one of the following:

Choose when a sound starts playing

On the **Effect** tab, under **Start playing**, do one of the following:

- To start the sound file immediately, click **From beginning**.
- To start the sound file from the last track played on the CD, click **From last position**.

- To start the sound file after a time delay, click **From time**, and then enter the total number of seconds for the delay.

Choose when a sound stops playing

On the **Effect** tab, under **Stop playing**, do one of the following:

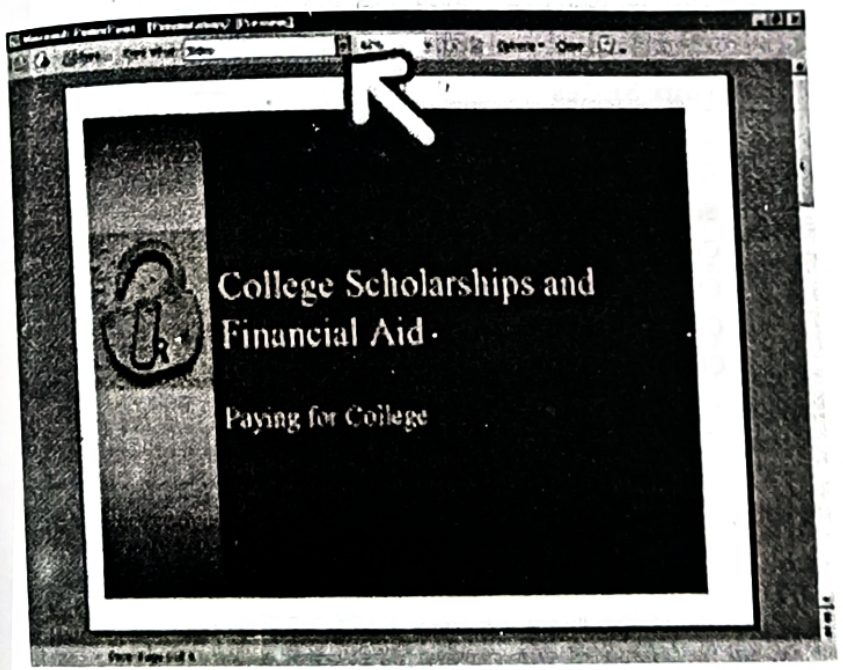
- To stop the sound file with a mouse click of this slide, click **On click** (the default).
- To stop the sound file after this slide, click **After current slide**.
- To keep the sound file playing for several slides, click **After**, and then enter the total number of slides that the file should play on.

Run Your Slide Show

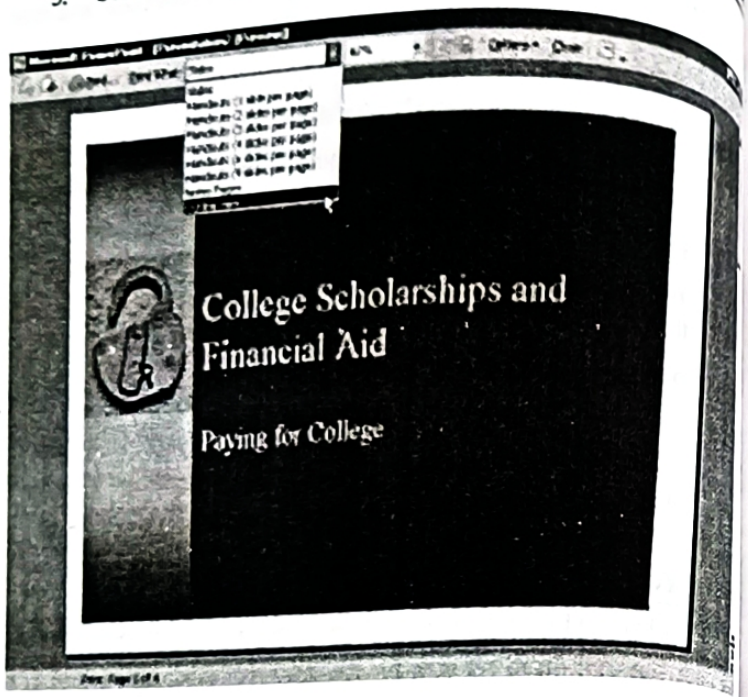
1. Press F5 to run the Slide Show.
2. Use the arrow keys on your keyboard to move forward and backward through your slides.
3. Use the Esc key to return to Normal view.

Print Your Outline

1. Choose File > Print Preview from the menu.
2. Click the down arrow next to the Print What icon.



3. Select Outline view.



4. Click the Print icon.
5. Click Close.

Print Your Slides

1. Choose *File* > *Print Preview* from the menu.
2. Click the down arrow next to the Print What icon.
3. Select the slides you want to print.
4. Click the down arrow next to Options. A menu will appear.
5. Choose *Color/Grayscale* > *Pure Black and White*.
6. Click the Print icon.
7. Click Close.

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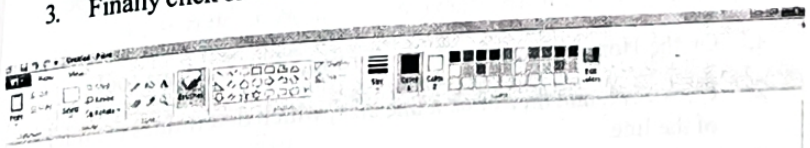
9

Ms Paint

Paint (formerly Paintbrush for Windows) is a simple computer graphics program that has been included with all versions of Microsoft Windows. It is often referred to as MS Paint or Microsoft Paint. The program mainly opens and saves files as Windows bitmap (24-bit, 256 color, 16 color, and monochrome, all with the.bmp extension), JPEG, GIF (without animation or transparency, although the Windows 98 version, a Windows 95 upgrade, and the Windows NT4 version did support the latter),PNG (without alpha channel), and single-page TIFF. The program can be in color mode or two-color black-and-white, but there is no grayscale mode.

To start Paint:

1. Click on the Start menu in the bottom left corner of the screen
2. Choose All Programs then Accessories (from the sub-menu which appears)
3. Finally click on Paint.



Pencil tool

Use the Pencil tool to draw thin, free-form lines or curves.

1. On the Home tab, in the Tools group, click the Pencil tool.
2. In the Colors group, click Color 1, click a color, and then drag the pointer in the picture to draw.

   To draw using the Color 2 (background) color, right-click while you drag the pointer.

Brushes

Use the Brushes tool to draw lines that have a different appearance and texture—it's like using different artistic brushes. By using different brushes, you can draw free-form and curving lines that have different effects.

1. On the Home tab, click the down arrow under Brushes.
2. Click the artistic brush that you want to use.
3. Click Size, and then click a line size, which determines the thickness of the brush stroke.
4. In the Colors group, click Color 1, click a color, and then drag the pointer to paint.

   To paint using the Color 2 (background) color, right-click while you drag the pointer.

Line tool

Use the Line tool to draw a straight line. When using this tool, you can choose the thickness of the line, as well as the appearance of it.

1. On the Home tab, in the Shapes group, click the Line tool.
2. Click Size, and then click a line size, which determines the thickness of the line.
3. In the Colors group, click Color 1, click a color, and then drag the pointer to draw the line.

   To draw a line that uses the Color 2 (background) color, right-click while you drag the pointer.
4. (Optional) To change the line style, in the Shapes group, click Outline, and then click a line style.

Curve tool

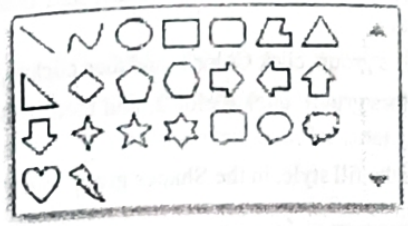
Use the Curve tool to draw a smooth, curved line.

1. On the Home tab, in the Shapes group, click the Curve tool.
2. Click Size, and then click a line size, which determine the thickness of the line.
3. In the Colors group, click Color 1, click a color, and then drag the pointer to draw the line.

   To draw a line that uses the Color 2 (background) color, right-click while you drag the pointer.
4. After you have created the line, click the area in the picture where you want the arc of the curve to be, and then drag the pointer to adjust the curve.

Drawing different shapes

You can use Paint to add different shapes in a picture. The ready-made shapes range from traditional shapes—rectangles, ellipses, triangles, and arrows—to fun and unusual shapes, such as a heart, lightning bolt, or callouts (to name a few). If you want to make your own custom shape, you can use to the Polygon tool to do this.



Shapes in Paint

Ready-made shapes

You can use Paint to draw different types of ready-made shapes. Here's a list of them:

- Line
- Curve
- Oval
- Rectangle and Rounded rectangle
- Triangle and Right triangle

- Diamond
- Pentagon
- Hexagon
- Arrows (Right arrow, Left arrow, Up arrow, Down arrow)
- Stars (Four-point star, Five-point star, Six-point star)
- Callouts (Rounded rectangular callout, Oval callout, Cloud callout)
- Heart
- Lightning bolt

1. On the Home tab, in the Shapes group, click a ready-made shape.
2. To draw the shape, drag the pointer.

   To draw a shape with equal sides, press and hold the Shift key as you drag the mouse. For example, to draw a square, click the Rectangle ▭, and then press and hold the Shift key and drag the mouse.
3. With the shape still selected, you can do one or more of the following to change its appearance:

- To change the line style, in the Shapes group, click Outline, and then click a line style.

  If you don't want your shape to have an outline, click Outline, and then click No outline.
- To change the outline size, click Size, and then click a line size (thickness).
- In the Colors group, click Color 1, and then click a color for the outline.
- In the Colors group, click Color 2, and then click a color to fill the shape.
- To change the fill style, in the Shapes group, click Fill, and then click a fill style.

  If you don't want your shape to be filled, click Fill, and then click No fill.

Polygon tool

Use the Polygon tool ⬠ to make a custom shape with any number of sides.

1. On the Home tab, in the Shapes group, click the Polygon tool ⬠.
2. To draw a polygon, drag the pointer to draw a straight line. Then, click each point where you want additional sides to appear.

   To create sides with 45- or 90-degree angles, press and hold the Shift key as you create each sides.
3. Connect the last line to the first line to finish drawing the polygon and to close the shape.
4. With the shape still selected, you can do one or more of the following if you want to change the appearance of it:

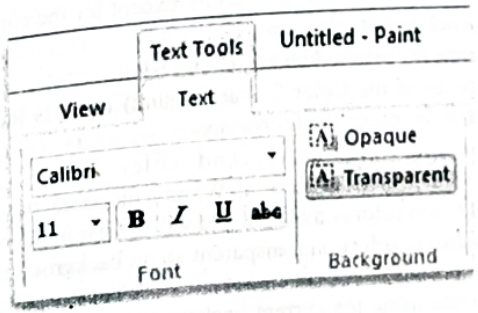
- To change the line style, in the Shapes group, click Outline, and then click a line style.
- If you don't want your shape to have an outline, click Outline, and then click No outline.
- To change the outline size, click Size, and then click a line size (thickness).
- In the Colors group, click Color 1, and then click a color for the outline.
- In the Colors group, click Color 2, and then click a color to fill the shape.
- To change the fill style, in the Shapes group, click Fill, and then click a fill style.

  If you don't want your shape to be filled, click Fill, and then click No fill.

Text tool

Use the Text tool **A** to enter text in the picture.

1. On the Home tab, in the Tools group, click the Text tool **A**.
2. Drag the pointer in the drawing area where you want to add text.
3. Under Text Tools, on the Text tab, in the Font group, click the font face, size, and style.



The Font group

4. In the Colors group, click Color 1, and then click a color for the text.
5. Type the text that you want to add.
6. (Optional) If you want the background of the text area to be filled in the Background group, click Opaque. In theColors group, click Color 2, and then click a background color for the text area.
7. (Optional) If you want to change the appearance of some of the text in the text box, select the text you want to change, and then choose a new font face, size, style, or color for the selected text.

Selecting and editing objects

In Paint, you might want to make a change to part of a picture or an object. To do this, you need to select the part of the picture that you want to change, and then make the edit. Some changes you can make include the following: resizing an object, moving or copying an object, rotating it, or cropping the picture to only show the selected item.

Select tool

Use the Select tool to select part of the picture that you want to change.

1. On the Home tab, in the Image group, click the down arrow under Select.
2. Do one of the following, depending on what you want to select.

- To select any square or rectangular part of the picture, click Rectangular selection, and then drag the pointer to select the part of the picture you want to work with.
- To select any irregularly shaped part of the picture, click Free-form selection, and then drag the pointer to select the part of the picture you want to work with.
- To select the whole picture, click Select all.
- To select everything in the picture except for the currently selected area, click Invert selection.
- To delete the selected object, click Delete.

3. Determine if the Color 2 (background) color is included in your selection by doing the following:

- To include the background color with your selection, clear Transparent selection. When you paste the selection, the background color is included and will appear in the pasted item.
- To make the selection transparent so no background color is in the selection, click Transparent selection. When you paste the selection, any areas using the current background color will be transparent, which will allow the rest of the picture to appear in its place.

Crop

Use Crop to crop a picture so only the part you selected appears in your picture. Cropping lets you change the picture so only the selected object or person is visible.

1. On the Home tab, in the Image group, click the arrow under Select, and then click the kind of selection you want to make.
2. Drag the pointer to select the part of the picture you want to show.
3. In the Image group, click Crop.
4. To save the cropped picture as a new file, click the Paint button , point to Save as, and then click the file type for the current picture.
5. In the File name box, type a new file name, and then click Save. Saving the cropped image as a new picture file prevents overwriting the original picture file.

Rotate

Use Rotate to rotate the whole picture or a selected part of it.

- Depending on what you want to rotate, do one of the following:
- To rotate the whole picture, on the Home tab, in the Image group, click Rotate, and then click the rotation direction.
- To rotate an object or part of a picture, on the Home tab, in the Image group, click Select. Drag the pointer to select the area or object, click Rotate, and then click the rotation direction.

Erasing part of a picture

Use the Eraser tool to erase areas of your picture.

1. On the Home tab, in the Tools group, click the Eraser .
2. Click Size, click an eraser size, and then drag the eraser over the area of the picture that you want to erase. Any areas that you erase will reveal the background color (Color 2).

Resizing a picture or part of it

Use Resize to resize the whole image or to resize an object or part of a picture. You can also skew an object in the picture so that it appears slanted.

Hide all

Resize the whole picture

1. On the Home tab, in the Image group, click Resize.
2. In the Resize and Skew dialog box, select the Maintain aspect ratio check box so that the resized picture will have the same aspect ratio as the original.
3. In the Resize area, click Pixels, and then enter a new width in the Horizontal box or new height in the Vertical box. Click OK.

   If the Maintain aspect ratio check box is selected, you only need to enter the horizontal value (width) or vertical value (height). The other box in the Resize area is updated automatically.

   For example, if a picture is 320 x 240 pixels and you want to make it half that size with the same aspect ratio, in theResize area, with the Maintain aspect ratio check box selected, enter 160 in the Horizontal box. The new picture size will be half the original size at 160 x 120 pixels.

Resize part of the picture

1. On the Home tab, click Select, and then drag the pointer to select the area or object.
2. On the Home tab, in the Image group, click Resize.
3. In the Resize and Skew dialog box, select the Maintain aspect ratio check box so that the resized part will have the same aspect ratio as the original.
4. In the Resize area, click Pixels, and then enter a new width in the Horizontal box or new height in the Vertical box. Click OK.

   If the Maintain aspect ratio check box is selected, you only need to enter the horizontal value (width) or vertical value (height). The other box in the Resize area is updated automatically.

   For example, if the part you selected is 320 x 240 pixels and you want to make it half that size with the same aspect ratio, in the Resize area, with the Maintain aspect ratio check box selected, enter 160 in the Horizontal box. The part will be half the original size at 160 x 120 pixels.

Change the drawing area size

- Do one of the following, depending on how you want to resize the drawing area:
- To resize the drawing area and make it larger, drag one of the small white boxes on the edge of the drawing area to the desired size.
- To resize the drawing area by entering a specific size, click

the Paint button , and then click Properties. In the Width and Height boxes, enter the new width and height, and then click OK.

Skew an object

1. On the Home tab, click Select, and then drag the pointer to select the area or object.
2. Click Resize.
3. In the Resize and Skew dialog box, type the amount to skew the selected area (in degrees) in the Horizontal and Vertical boxes in the Skew (Degrees) area, and then click OK.

Moving and copying objects

After you select an object, you can cut or copy the selected item. This lets you use one object many times in your picture if you want, or move an object (when it's selected) to a new part of your picture.

Cut and paste

Use Cut to cut a selected object and paste it in another part of your picture. When you cut a selected area, the area that is cut is replaced with the background color. Therefore, if your picture has a solid background color, you might want to change the Color 2 color to match the background color before cutting the object.

1. On the Home tab, in the Image group, click Select, and then drag the pointer to select the area or object you want to cut.
2. In the Clipboard group, click Cut.
3. In the Clipboard group, click Paste.
4. With the object still selected, move it to a new place in your picture where you want it to appear.

Copy and paste

Use Copy to copy a selected object in Paint. This is useful if you have lines, shapes, or text that you want to appear multiple times in your picture.

1. On the Home tab, in the Image group, click Select, and then drag the pointer to select the area or object you want to copy.
2. In the Clipboard group, click Copy.
3. In the Clipboard group, click Paste.

4. With the object still selected, move it to a new place in your picture where you want the copy to appear.

Paste a picture into Paint

Use Paste from to paste an existing picture file into Paint. After you paste the picture file, you can edit it without changing the original (as long as you save the edited picture with a different file name than the original).

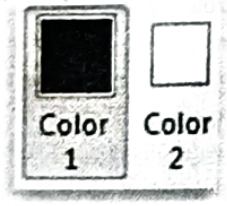
1. In the Clipboard group, click the arrow under Paste, and then click Paste from.
2. Find the picture file that you want to paste into Paint, click it, and then click Open.

Working with color

There are a number of tools to help you work specifically with color in Paint. They let you use the colors you want when you're drawing and editing in Paint.

Color boxes

The Color boxes indicate the current Color 1 (foreground color) and Color 2 (background color) colors. How they're used depends on what you're doing in Paint.



The Color boxes

- When using the color boxes, you can do one or more of the following:
- To change the selected foreground color, on the Home tab, in the Colors group, click Color 1, and then click a color square.
- To change the selected background color, on the Home tab, in the Colors group, click Color 2, and then click a color square.
- To paint with the selected foreground color, drag the pointer.
- To paint with the selected background color, right-click while you drag the pointer.

Color picker

Use the Color picker tool to set the current foreground or background color. By picking a color from the picture, you can make sure that you're using the color you want when drawing in Paint, so your colors match.

1. On the Home tab, in the Tools group, click Color picker .
2. Click the color in your picture that you want to set as the foreground color, or right-click the color in your picture that you want to set as the background color.

Fill with color

Use the Fill with color tool to fill the entire picture or an enclosed shape with color.

1. On the Home tab, in the Tools group, click Fill with color .
2. In the Colors group, click Color 1, click a color, and then click inside the area to fill it.
3. To remove the color and replace it with the background color instead, click Color 2, click a color, and then right-click the area to fill it.

Editing colors

Use Edit colors to pick a new color. Mixing colors in Paint lets you choose the exact color that you want to use.

1. On the Home tab, in the Colors group, click Edit colors.
2. In the Edit Colors dialog box, click a color in the color pallette, and then click OK.

The color will appear in one of the color boxes, so you can use that color in Paint.

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Viewing your picture

Changing the view in Paint lets you choose how you want to work with the picture. You can zoom in on a certain part of the picture or the whole picture if you want. Conversely, you can zoom out if the picture is too large. In addition, you can show rulers and gridlines as you work in Paint, which can help you work better in Paint.

Magnifier

Use the Magnifier tool to zoom in on a part of your picture.

1. On the Home tab, in the Tools group, click the Magnifier, move the magnifier, and then click to zoom in on the part of the image shown in the square.

   Drag the horizontal and vertical scroll bars on the bottom and right side of the window to move around the picture.
2. To reduce the zoom level, right-click the Magnifier again.

Zoom in and out

Use Zoom in and Zoom out to see a larger or smaller view of your image. For example, you might be editing a small part of it and need to zoom in to see it. Or the opposite might be true; your picture might be too large to fit on the screen, so you need to zoom out to view all of it.

In Paint, there are few different ways to zoom in or out, depending on what you want to do.

1. To increase the zoom level, on the View tab, in the Zoom group, click Zoom in.
2. To reduce the zoom level, on the View tab, in the Zoom group, click Zoom out.
3. To view the picture in the Paint window at its actual size, on the View tab, in the Zoom group, click 100%.

Tip

- To zoom in and out on a picture, you can also click the Zoom in or Zoom out buttons on the Zoom slider at the bottom of the Paint window to increase or decrease the zoom level.



The Zoom slider

Rulers

Use the Rulers to view a horizontal ruler at the top of the drawing area and a vertical ruler on the left side of the drawing area. The rulers let you view the dimensions of your picture, which can be helpful when resizing pictures.

1. To show rulers, on the View tab, in the Show or hide group, select the Rulers check box.
2. To hide rulers, clear the Rulers check box.

Gridlines

Use the Gridlines to align shapes and lines when you're drawing in Paint. Gridlines are useful because they can help provide a visual reference for the sizes of objects as you draw, and they can help you align objects.

1. To show gridlines, on the View tab, in the Show or hide group, select the Gridlines check box.
2. To hide gridlines, clear the Gridlines check box.

Full screen

Use Full screen to view your picture full screen.

1. To view the picture on the entire screen, on the View tab, in the Display group, click Full screen.
2. To exit full screen and go back to the Paint window, click the picture.

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Saving and using your picture

When editing in Paint, you should save your work frequently so you don't accidentally lose it. After you save your picture, you can use it on your computer or share it with others in e mail.

Save a picture for the first time

When you save a new picture for the first time, you'll need to give it a file name.

1. Click the Paint button, and then click Save.
2. In the Save as type box, select the file format you want.
3. In the File name box, type a name, and then click Save.

Open a picture

Instead of starting with a new picture, you might want to open an existing picture and edit in Paint.

1. Click the Paint button, and then click Open.
2. Find the picture you want to open in Paint, click it, and then click Open.

Set your picture as your desktop background

You can also set the picture, so it's used as the desktop background on your computer.

1. Click the Paint button , and then click Save.
2. Click the Paint button , point to Set as desktop background, and then click one of the desktop background settings.

Send your picture by e mail

If you have an e mail program installed and configured on your computer, you can attach your picture to an e mail message, and then share it with others through e mail.

1. Click the Paint button , and then click Save.
2. Click the Paint button , and then click Send in e mail.
3. In the e mail message, enter the person's e mail address, type a short message, and then send the e mail message that has the picture attached.

❖ ❖ ❖

10

Computer virus

A computer virus is a malware program that, when executed, replicates by inserting copies of itself (possibly modified) into other computer programs, data files, or the boot sector of the hard drive; when this replication succeeds, the affected areas are then said to be "infected". Viruses often perform some type of harmful activity on infected hosts, such as stealing hard disk space or CPU time, accessing private information, corrupting data, displaying political or humorous messages on the user's screen, spamming their contacts, logging their keystrokes, or even rendering the computer useless. However, not all viruses carry a destructive payload or attempt to hide themselves—the defining characteristic of viruses is that they are self-replicating computer programs which install themselves without user consent. Here is a list of different types of computer viruses and what they do.

1. Macro Viruses

These viruses infect the files created using some applications or programs that contain macros such as doc, pps, xls and mdb. They automatically infect the files with macros and also templates and documents that are contained in the file. They hide in documents shared through e-mail and networks. Macro viruses include:

- Relax
- bablas
- Melissa.A
- 097M/Y2K

2. Memory Resident Viruses

They usually fix themselves inside the computer memory. They get activated every time the OS runs and end up infecting other opened files.

They hide in RAM. Memory Resident Viruses Include:

- CMJ
- meve
- randex
- mrklunky

3. Overwrite Viruses

These types of viruses delete any information in a file they infect, leaving them partially or completely useless once they are infected. Once in the computer, they replaces all the file content but the file size doesn't change. Overwrite Viruses Include:

- Trj.Reboot
- way
- trivial.88.D

4. Direct Action Viruses

These viruses mainly replicate or take action once they are executed. When a certain condition is met, the viruses will act by infecting the files in the directory or the folder specified in the AUTOEXEC.BAT. The viruses are generally found in the hard disk's root directory, but they keep on changing location. Direct Action Viruses Include:

- Vienna virus

5. Directory Virus

Also known as cluster virus or file system virus. They infect the computer's directory by changing the path indicating file location. They are usually located in the disk but affect the entire directory. Directory Viruses Include:

- dir-2 virus

6. Web Scripting Virus

Most web pages include some complex codes in order to create an interactive and interesting content. Such a code is often exploited to cause certain undesirable actions. They mostly originate from the infected web pages or browsers. Web Scripting Viruses Include:

- JS.Fortnight – a virus that spreads via malicious emails.

7. Multipartite Virus

These type of viruses spread in many different ways. Their actions vary depending on the OS installed and presence of certain files. They tend to hide in the computer's memory but do not infect the hard disk. Multipartite Viruses Include:

- flip
- invader
- tequila

8. FAT Viruses

These viruses attack the file allocation table (FAT) which is the disc part used to store every information about the available space, location of files, unusable space etc. FAT Viruses Include:

- the link virus

9. Companion Viruses

These types of viruses infect files just like the direct action and the resident types. Once inside the computer, they 'accompany' other existing files. Companion Viruses Include:

- Asimov.1539
- stator and terrax.1069

10. Polymorphic Virus

They encode or encrypt themselves in a different way every time they infect your computer. They use different encryption and algorithms. This makes it difficult for the antivirus software to locate them using signature or string searches (since they are very different in each encryption).Polymorphic Viruses Include:

- Marburg
- tuareg
- Satan bug
- elkern

11. Worm

This program is very similar to a virus and has the ability to self-replicate leading to negative effects on your computer. Worm Viruses Include:

- lovgate.F
- sobig.D
- trile.C
- PSWBugbear.B
- Mapson

12. Trojans

Trojans can illegally trace important login details of users online. For example E-Banking is very common among users, therefore, vulnerability of

tracing your login details whenever your PC is working without any strong powerful antivirus installed.

13. Email Virus

This is a virus spread via an email. Such a virus will hide in an email and when the recipient opens the mail.

14. Browser Hijacker

This virus can spread in many different ways including a voluntary download. If infects certain browser functions especially in form of re-directing the user automatically to certain sites. A good example is

- the cool web search

15. Boot Infectors

They include the boot sector plus master boot record types. All the viral codes can be separate location; however they infect the hard disks or the floppy. Boot Infectors Include:

- The brain virus -it is the very first wild virus to be created.

From the above we have seen, the many types of computer viruses and their effects are very harmful and can completely damage your system. Always make sure your system is up to date. Also install antivirus software. The antivirus program protects your computer and the personal information in it.

History of Virus

The following is a history of some of the most famous viruses and malware ever:

1949 – 1966 – Self-Reproducing Automata: Self-replicating programs were established in 1949, to produce a large number of viruses, John von Neumann, whose known to be the "Father of Cybernetics", wrote an article on the "Theory of Self-Reproducing Automata" that was published in 1966.

1959 – Core Wars: A computer game was programmed in Bell Laboratory by Victor Vysottsky, H. Douglas McIlroy and Robert P Morris. They named it Core Wars. In this game, infectious programs named organisms competed with the processing time of PC.

1971 – The Creeper: Bob Thomas developed an experimental self-replicating program. It accessed through ARPANET (The Advanced Research Projects Agency Network) and copied to a remote host systems with TENEX operating system. A message displayed that "I'm the creeper, catch me if you can!". Another program named Reaper was created to delete the existing harmful program the Creaper.

1974 – Wabbit (Rabbit): This infectious program was developed to make multiple copies of itself on a computer clogging the system reducing the

performance of the computer.

1974 – 1975 – ANIMAL: John Walker developed a program called ANIMAL for the UNIVAC 1108. This was said to be a non-malicious Trojan that is known to spread through shared tapes.

1981- Elk Cloner: A program called the "Elk Cloner" was developed by Richard Skrenta for the Apple II Systems. This was created to infect Apple DOS 3.3. These programs started to spread through files and folders that are transferred to other computers by floppy disk.

1983 – This was the year when the term "Virus" was coined by Frederick Cohen for the computer programs that are infectious as it has the tendency to replicate.

1986 – Brain: This is a virus also known as the "Brain boot sector", that is compatible with IBM PC was programmed and developed by two Pakistani programmers Basit Farooq Alvi, and his brother, Amjad Farooq Alvi.

1987- Lehigh: This virus was programmed to infect command.com files from Yale University.

1988 – The Morris Worm: This type of worm was created by Robert Tappan Morris to infect DEC VAX and Sun machines running BSD UNIX through the Internet. This is best known for exploiting the computers that are prone to buffer overflow vulnerabilities.

1990 – Chameleon The first family of polymorphic virus called the Chameleon was developed by Ralf Burger.

1995 – Concept: This virus name Concept was created to spread and attack Microsoft Word documents.

1996 – Laroux: A macro virus known as Laroux was developed to infect Microsoft Excel Documents.

1999 – Happy99: This type of worm was developed to attach itself to emails with a message Happy New Year. Outlook Express and Internet Explorer on Windows 95 and 98 were affected.

2000 – ILOVEYOU: The virus is capable of deleting files in JPEGs, MP2, or MP3 formats.

2001 – Anna Kournikova: This virus was spread by emails to the contacts in the compromised address book of Microsoft Outlook. The emails purported to contain pictures of the very attractive female tennis player, but in fact hid a malicious virus.

2002 – LFM-926: This virus was developed to infect Shockware Flash files.

2002 –Beast or Rat: This is backdoor Trojan horse and is capable of infecting all versions of Windows OS.

2004 – MyDoom: This infectious worm also called the Novang. This was developed to share files and permits hackers to access to infected computers. It is known as the fastest mailer worm.

2005 – Samy XXA: This type of virus was developed to spread faster and it is known to infect the Windows family.

2006 – OSX/Leap-A: This was the first ever known malware discovered against Mac OS X.

Nyxem: This type of worm was created to spread by mass-mailing, destroying Microsoft Office files.

2007 – Storm Worm: This was a fast spreading email spamming threat against Microsoft systems that compromised millions of systems.

Zeus: This is a type of Trojan that infects used capture login credentials from banking web sites and commit financial fraud.

2008 – Koobface: This virus was developed and created to target Facebook and MySpace users.

2010 – Kenzero: The is a virus that spreads online between sites through browsing history.

2013 – Cryptolocker: This is trojan horse encrypts the files infected machine and demands a ransom to unlock the files.

2014 – Backoff: Malware designed to compromise Point-of-Sale (POS) systems to steal credit card data

Harmful effects of computer virus

The computer virus effects the system in the following way:

- **Replication**

  One of the primary purposes of a computer virus is to infect as many other systems as possible. In order to do this, the virus replicates itself by attaching to other files on your computer. A common method of spreading to other computers is by sending out email messages with a infected attachments to everyone in your address book. If you find that the free space on your computer is rapidly decreasing or people are receiving infected email from you, it is very possible that your computer has a virus.

- **Reduced Computer Performance**

  While computers can become slower over time due to the amount of available hard drive space decreasing, it is also possible for a virus to drastically reduce performance. The boot time of an infected computer is often much slower than usual and programs take much longer to launch as well. You might also notice an increase in crashes and freezes when working with the infected computer. It is also not

uncommon for the infected computer to restart unexpectedly or display strange error messages.

- **Corrupted Data**

  The data on a computer that is infected by a virus often becomes corrupted. This is either through the virus attaching itself to files which renders these files unusable in the process or by maliciously destroying the data. Files or folders are either deleted outright or become inaccessible. When attempting to launch applications, you might receive error messages about the file not being found or not being valid. In some cases, this can lead to the operating system not starting due to missing or corrupted files.

- **Unusual Browser Activity**

  While pop-ups are on the Internet are normal, if you repeatedly receive the same ones no matter what Web page you are viewing it could be due to a virus. Once your computer is infected, the virus might also change your browser startup page to a website that contains other malicious code. The virus also sometimes blocks access to security websites with updates or information on how to remove it. These types of viruses often attempt to install further malware on your computer by displaying links – disguised as system messages – to software that will purportedly clean the infection.

Prevention from computer virus

We can secure our data and protect our computer by adopting the following:

1. Install quality antivirus

Many computer users believe free antivirus applications, such as those included with an Internet service provider's bundled service offering, are sufficient to protect a computer from virus or spyware infection. However, such free anti-malware programs typically don't provide adequate protection from the ever-growing list of threats.

Instead, all Windows users should install professional, business-grade antivirus software on their PCs. Pro-grade antivirus programs update more frequently throughout the day (thereby providing timely protection against fast-emerging vulnerabilities), protect against a wider range of threats (such as rootkits), and enable additional protective features (such as custom scans). Some antivirus software are:

➢ **Norton Antivirus 2014**

Norton Antivirus is one of the best Antivirus known in the industry. Norton received an Editor's Choice honour in this showdown between several

different antivirus options. While it is a bit on the expensive side, it is one of the most trusted names in the biz. If you run Windows, this is one of the best options available to you. Here is some positive and negative features of this antivirus.

Positive aspects:

- Compatible with Windows Vista, Windows XP, Windows 7, and Windows 8
- Blocks malware URLs
- Fairly easy to use
- New technology can deal with corrupted critical files
- Good default balance between scan speed and security (you can adjust this in settings)

Negative aspects:

- More expensive than other Editor's Choice antivirus recipients from PC Mag
- PC Mag wrote that the scanner disabled two infested test systems
- Reviews indicate that, for big malware infestations, you'll still likely need to spend some time on the phone with tech support
- Doesn't appear to be available with more than three licenses
- Some protection features are not available in Windows 8-style browsing mode

➢ **Bitdefender Internet Security 2014**

Featured on Lifehacker's list of the Five Best Desktop Antivirus Applications, Bitdefender Internet Security is one of the most widely regarded antivirus solutions out there. The Internt Security suite comes with a whole host of features to protect you, including a firewall and parental controls. Here is some positive and negative features of this antivirus

Positive aspects:

- Great for parents
- Tons of tools
- Attractive interface
- At least one user has reported Bitdefender found a virus ESET Smart Security overlooked
- Guards your online transactions

Negative aspects:

- Quite expensive
- Multiple Amazon user reviews complain about poor customer service

- Some users have complained that computer freezes up when updates are pushed
- Navigation isn't always intuitive
- Some users may prefer the free version

➢ **McAfee Antivirus Plus 2014**

McAfee AntiVirus Plus 2014 has gotten praise from CNET for offering the kind of support that a free antivirus package just can't beat. Additionally, PC Mag gave this software a four-star review. In particular, PC Mag noted that this software was an "effective tool.' Here is some positive and negative features of this antivirus.

Positive aspects:

- Rescue CD very helpful
- Includes remote management, file shredder, and system tuneup
- Fairly easy set-up
- Trusted name
- Relatively inexpensive, especially if you find it discounted online

Negative aspects:

- Firewall has holes
- You might spend more time dealing with tech support than you'd like
- You may want to install an additional malware scanner
- Rescue CD option may not be helpful to those who lack an optical drive
- McAfee won't let you transfer a subscription from one machine to another

➢ **Kaspersky Internet Security for Mac**

Featured on Ars Technica, Kaspersky Internet Security for Mac comes from the same lab that helped people to realize that Macs weren't invulnerable to viruses. Targeted towards Mac users, this software also protects against PC and Linux malware in real-time. Here is some positive and negative features of this antivirus

Positive aspects:

- Looks and feel jives with your Mac's layout
- Protects against Mac, PC and Linux malware in real-time
- Helps keep your Internet shopping secure
- Lets you monitor and limit your children's Internet usage
- Virtual Keyboard protects you from keyloggers

Negative aspects:

- Not free
- Can make some sites run slowly
- Hard to schedule scans
- Can slow down system start up
- Controls lack customization options

➢ **Panda Antivirus Pro 2014**

Featured on a TechRadar list of the best home antivirus suites, Panda Antivirus Pro 2014 has a Windows 8-inspired interface that makes the software really easy to navigate. There are plenty of robust features here, and the software itself is pretty cheap, as far as antivirus software goes. Here is some positive and negative features of this antivirus

Positive aspects:

- Tile navigation makes it easy to find what you need
- Multiple scan options
- Vulnerability scanner checks for missing updates or patches
- Panda's huge virus detection database is located in the Cloud
- Runs quietly in the background

Negative aspects:

- It may take a little time to get the settings just right
- Could have more comprehensive features and protection
- Requires minimum of Pentium 300 MHz or faster
- Would be nice to have multiple options for buying additional licenses
- For some people, paying more will always make them feel more secure

2. Install real-time anti-spyware protection

Many computer users mistakenly believe that a single antivirus program with integrated spyware protection provides sufficient safeguards from adware and spyware. Others think free anti-spyware applications, combined with an antivirus utility, deliver capable protection from the skyrocketing number of spyware threats.

Unfortunately, that's just not the case. Most free anti-spyware programs do not provide real-time, or active, protection from adware, Trojan, and other spyware infections. While many free programs can detect spyware threats once they've infected a system, typically professional (or fully paid and licensed) anti-spyware programs are required to prevent infections and fully remove those infections already present.

3. Keep anti-malware applications current

Antivirus and anti-spyware programs require regular signature and database updates. Without these critical updates, anti-malware programs are unable to protect PCs from the latest threats.

Computer users must keep their antivirus and anti-spyware applications up to date. All Windows users must take measures to prevent license expiration, thereby ensuring that their anti-malware programs stay current and continue providing protection against the most recent threats. Those threats now spread with alarming speed, thanks to the popularity of such social media sites as Twitter, Facebook, and My Space.

4. Perform daily scans

Occasionally, virus and spyware threats escape a system's active protective engines and infect a system. The sheer number and volume of potential and new threats make it inevitable that particularly inventive infections will outsmart security software. In other cases, users may inadvertently instruct anti-malware software to allow a virus or spyware program to run.

Regardless of the infection source, enabling complete, daily scans of a system's entire hard drive adds another layer of protection. These daily scans can be invaluable in detecting, isolating, and removing infections that initially escape security software's attention.

5. Disable autorun

Many viruses work by attaching themselves to a drive and automatically installing themselves on any other media connected to the system. As a result, connecting any network drives, external hard disks, or even thumb drives to a system can result in the automatic propagation of such threats.

Computer users can disable the Windows autorun feature by following Microsoft's recommendations, which differ by operating system.

6. Disable image previews in Outlook

Simply receiving an infected Outlook e-mail message, one in which graphics code is used to enable the virus' execution, can result in a virus infection. Prevent against automatic infection by disabling image previews in Outlook.

7. Don't click on email links or attachments

It's a mantra most every Windows user has heard repeatedly: Don't click on email links or attachments. Yet users frequently fail to heed the warning.

Whether distracted, trustful of friends or colleagues they know, or simply fooled by a crafty email message, many users forget to be wary of links and attachments included within email messages, regardless of the source. Simply

clicking on an email link or attachment can, within minutes, corrupt Windows, infect other machines, and destroy critical data.

Users should never click on email attachments without at least first scanning them for viruses using a business-class anti-malware application. As for clicking on links, users should access Web sites by opening a browser and manually navigating to the sites in question.

8. Surf smart

Many business-class anti-malware applications include browser plug-ins that help protect against drive-by infections, phishing attacks (in which pages purport to serve one function when in fact they try to steal personal, financial, or other sensitive information), and similar exploits. Still others provide "link protection," in which Web links are checked against databases of known-bad pages.

Whenever possible, these preventive features should be deployed and enabled. Unless the plug-ins interfere with normal Web browsing, users should leave them enabled. The same is true for automatic pop-up blockers, such as are included in Internet Explorer 8, Google's toolbar, and other popular browser toolbars.

Regardless, users should never enter user account, personal, financial, or other sensitive information on any Web page at which they haven't manually arrived. They should instead open a Web browser, enter the address of the page they need to reach, and enter their information that way, instead of clicking on a hyperlink and assuming the link has directed them to the proper URL. Hyperlinks contained within an e-mail message often redirect users to fraudulent, fake, or unauthorized Web sites. By entering Web addresses manually, users can help ensure that they arrive at the actual page they intend.

But even manual entry isn't foolproof. Hence the justification for step 10: Deploy DNS protection. More on that in a moment.

9. Use a hardware-based firewall

Technology professionals and others argue the benefits of software- versus hardware-based firewalls. Often, users encounter trouble trying to share printers, access network resources, and perform other tasks when deploying third-party software-based firewalls. As a result, I've seen many cases where firewalls have simply been disabled altogether.

But a reliable firewall is indispensable, as it protects computers from a wide variety of exploits, malicious network traffic, viruses, worms, and other vulnerabilities. Unfortunately, by itself, the software-based firewall included with Windows isn't sufficient to protect systems from the myriad robotic attacks affecting all Internet-connected systems. For this reason, all PCs

connected to the Internet should be secured behind a capable hardware-based firewall.

10. Deploy DNS protection

Internet access introduces a wide variety of security risks. Among the most disconcerting may be drive-by infections, in which users only need to visit a compromised Web page to infect their own PCs (and potentially begin infecting those of customers, colleagues, and other staff).

Another worry is Web sites that distribute infected programs, applications, and Trojan files. Still another threat exists in the form of poisoned DNS attacks, whereby a compromised DNS server directs you to an unauthorized Web server. These compromised DNS servers are typically your ISP's systems, which usually translate friendly URLs such as yahoo.com to numeric IP addresses like 69.147.114.224.

Users can protect themselves from all these threats by changing the way their computers process DNS services. While a computer professional may be required to implement the switch, Open DNS offers free DNS services to protect users against common phishing, spyware, and other Web-based hazards.



11

Bloom's Taxonomy of Educational Objectives

Introduction

A teacher's task is to try to continually move students to higher levels of human learning and development. Planning for this development occurs through content and activities, moving students through advancing levels once the basic steps are mastered. These various levels are defined in Benjamin Bloom's taxonomies or classification systems of educational objectives. In 1956, Benjamin Bloom along with a group of like-minded educators developed a framework for classifying educational goals and objectives into a hierarchical structure representing different forms and levels of learning. This framework was published as Bloom's Taxonomy of Educational Objectives and consisted of the following three domains:

i) Cognitive domain (thinking/intellectual operations)

ii) Affective domain (feeling, attitudes and values)

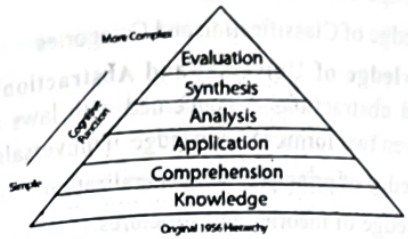
iii) Psychomotor domain (doing or performing)

Each of three domains mentioned above can be further split up into categories which are also in a hierarchical order.

A. Cognitive domain (B.S.Bloom, 1956)

Cognitive Objectives stress more that the pupils should acquire more and more knowledge. Since in the behaviour related to cognitive aspect psychological processes like recall and recognition remain active, efforts are made to develop this aspect more through various school subject. Bloom has suggested in his book "Taxonomy of Educational Objectives of Cognitive

Domain", that it is essential to cross the six stages of cognitive domain in order to develop cognitive domain by cognitive objectives. These classes or stages are—



1. Knowledge
2. Comprehension
3. Application
4. Analysis
5. Synthesis
6. Evaluation

The following lines are throwing light on the six categories of cognitive domain.

1. Knowledge Objective. The cognitive objectives are concerned with the development of recall and recognition activities of the pupils with the help of terms, facts, informations and theories. From content's viewpoint, following are the three levels in the knowledge category.

(i) Knowledge of Specifics. Knowledge of specific means recalling of specific terminology, facts and information. The knowledge of specific is also divided into two:

(1) Knowledge of terminology

(2) Knowledge of specific facts.

The knowledge of terminology is the knowledge of verbal and non-verbal references. These have normal signs and these include defining specific terms, description of their qualities, relationships and their parts so that the general meaning of the various terms may be acquired. Contrary to this, the specific facts means the knowledge of events, dates, places and the persons.

(ii) Knowledge of Ways and Means—Dealing with Specifies. In this, appropriate decisions are taken and the criticism is carried out by studying systematically the various ways and means of the knowledge. Bloom has divided the ways and means dealing with specifics into the following five categories—

(a) Knowledge of Conventions

(b) Knowledge of Trends and Sequences

(c) Knowledge of Criteria

(d) Knowledge of Methodology

(e) Knowledge of Classification and Categories

(iii) Knowledge of Universal and Abstractions. The knowledge of universals and abstractions is concerned with laws and principles. Prof. Bloom has given two forms of knowledge of universals—

(a) Knowledge of principles and generalization

(b) Knowledge of theories and structures.

2. Comprehension. Comprehension means understanding of new knowledge to the pupils. The pupils who have comprehension of the contents, i.e., the recalling and recognition abilities can carry on the activities of translation, interpretation and extrapolation on the basis of comprehension objective. In short, comprehension activities have three levels—

(i) Translation (converting from one form to another)

(ii) Interpretation (explaining or summarizing materials)

(iii) Extrapolation (extending the meaning beyond data)

3. Application. After knowledge and comprehension, application is followed. The application objective has also three levels—

(i) generalization of laws and principles

(ii) diagnosis of pupils' weaknesses

(iii) use of contents or terms and laws by the pupils in their own statements.

4. Analysis. After knowledge, comprehension and application, analysis is followed. The analysis objective includes division of the contents into its elements and these are mutually related. The analysis objective has three levels—

(i) analysis of elements (identifying the parts)

(ii) analysis of relationships (identifying the relationship)

(iii) analysis of organized principles (identifying the way the parts are organized)

5. Synthesis. Synthesis is termed as the creative objective. Its reason is that the elements analysed in this step are assembled to give a complete picture and a new format is prepared. This develops the creative abilities of the pupils. The synthesis has also three levels –

(i) production of unique communication

(ii) production of a plan or proposed set of operations after synthesizing the elements

(iii) derivations of a set of abstract relations.

6. Evaluation. Evaluation is the highest level of the cognitive domain. It is a continuous process. In this, after making critical decisions regarding the laws of contents, principle and facts, it is explored by tests or other types of norms that-

(i) whether the determined teaching objectives have been achieved or not, if yes, to what extent?

(ii) whether the learning experiences created in the classroom proved effective or not amongst pupils?

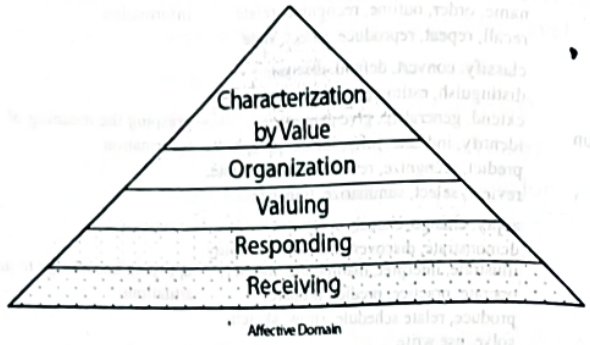
(iii) how fairly the teaching objectives have been achieved?

Bloom's Original Taxonomy of the Cognitive Domain

Cognitive Level	Illustrative Verbs	Definitions
Knowledge	arrange, define, describe, duplicate, identify, label, list, match, memorize, name, order, outline, recognize, relate, recall, repeat, reproduce, select, state	remembering previously learned information
Comprehension	classify, convert, defend, discuss, distinguish, estimate, explain, express, extend, generalize, give example(s), identify, indicate, infer, locate, paraphrase, predict, recognize, rewrite, report, restate, review, select, summarize, translate	grasping the meaning of information
Application	apply, change, choose, compute, demonstrate, discover, dramatize, employ, illustrate, interpret, manipulate, modify, operate, practice, predict, prepare, produce, relate schedule, show, sketch, solve, use write	applying knowledge to actual situations
Analysis	analyze, appraise, breakdown, calculate, categorize, classify, compare, contrast, criticize, derive, diagram, differentiate, discriminate, distinguish, examine, experiment, identify, illustrate, infer, interpret, model, outline, point out, question, relate, select, separate, subdivide, test	breaking down objects or ideas into simpler parts and seeing how the parts relate and are organized
Synthesis	arrange, assemble, categorize, collect, combine, comply, compose, construct, create, design, develop, devise, explain, formulate, generate, plan, prepare, propose, rearrange, reconstruct, relate, reorganize, revise, rewrite, set up, summarize, synthesize, tell, write	rearranging component ideas into a new whole
Evaluation	appraise, argue, assess, attach, choose, compare, conclude, contrast, defend, describe, discriminate, estimate, evaluate, explain, judge, justify, interpret, relate, predict, rate, select, summarize, support, value	making judgments based on internal evidence or external criteria

(b) Affective or Feeling Domain

Affective objective is concerned with the interests, emotions, mental tendencies and values of the pupils. The development of affective domain is not an easy task. These are first concerned with a particular person and then with other persons. It is not an easy task to understand their nature and determined elements. Since our interests, sentiments and mental tendencies are taken as the criteria for our personality, therefore, in education these occupy important place. It is the duty of the teacher to develop maximum the affective domain of the pupils by affective objectives i.e., their interest, emotions, mental tendencies and sentiments. Bloom and Krathwohl has divided affective objectives into the following categories that lists levels of commitment (indicating affect) from lowest to highest in order to develop the affective domain of the pupils:



1. Receiving
2. Responding
3. Valuing
4. Organization
5. Characterization of a Value System

1. Receiving. Receiving means pupils' will to receive. Receiving is directly concerned with the sensitivity of the pupils which occurs in the presence of some activity or stimulus. Receiving has the following three levels:

(i) Awareness of the phenomena
(ii) Willingness to receive phenomena
(iii) Controlled or selected scheme

2. Responding. Responding is the next stage of the receiving stage. In this, pupils actively receive new knowledge under the influence of motivation. Responding has three levels:

(i) Acquiescence in responding

(ii) Willingness to respond
(iii) Satisfaction in response

3. Valuing. Valuing means those values in which the pupils have their belief and they give special importance to those in their life. Valuing has three levels. These are—

(i) Acceptance of a value
(ii) Preference for a value
(iii) Commitment

4. Organization. When such a situation changes before the pupils in which there is more than one value is appropriate, then they organize these received values in an order or sequence. In such situation pupil thinks which value he should retain.

5. Characterization of a Value System. Characterization of a value system is that level in which the consistency in the hierarchy of values of the pupil occurs. At this level, the teacher can characterize the knowledge of the value system of the pupils very easily. The characterization of a value system has two levels. These are—

(i) Generalized set
(ii) Characterization

	Illustrative Verbs	Definitions
Affective Level		
Receiving	Accept, attend, develop, recognize	Being aware of or attending to something in the environment
Responding	Complete, comply, cooperate, discuss, examine, obey, respond	Showing some new behaviors as a result of experience.
Valuing	Accept, defend, devote, pursue, seek	Showing some definite involvement or commitment.
Organization	Codify, discriminate, display, order, organize, systematize, weigh	Integrating a new value into one's general set of values, giving it some ranking among one's general priorities.
Characterization of a Value System	Internalize, verify	Acting consistently with the new value.

Psychomotor or Kinesthetic domain

The psychomotor domain concerns things students might physically do. Although no taxonomy of this domain was compiled by Bloom and his

coworkers, several competing taxonomies have been created over the years since Bloom's original books.

Simpson (1972) built this taxonomy on the work of Bloom and others:

- **Perception** - Sensory cues guide motor activity.
- **Set** - Mental, physical, and emotional dispositions that make one respond in a certain way to a situation.
- **Guided Response** - First attempts at a physical skill. Trial and error coupled with practice lead to better performance.
- **Mechanism** - The intermediate stage in learning a physical skill. Responses are habitual with a medium level of assurance and proficiency.
- **Complex Overt Response** - Complex movements are possible with a minimum of wasted effort and a high level of assurance they will be successful.
- **Adaptation** - Movements can be modified for special situations.
- **Origination** - New movements can be created for special situations.

Harrow (1972) developed this taxonomy [Harrow, A.(1972). *A Taxonomy of the Psychomotor Domain: A Guide for Developing Behavioral Objectives.* New York: McKay], as summarised in Barry, K. and King, L. (1993) *Beginning Teaching.* Wentworth Falls, NSW: Social Science Press. It is organized according to the degree of coordination including involuntary responses and learned capabilities. The levels of this domain are categorised as:

- **Reflex movements** - Automatic reactions.
- **Basic fundamental movements** - Simple movements that can build to more complex sets of movements. (crawl, run, jump, reach, change direction)
- **Perceptual abilities** - Environmental cues that allow one to adjust movements(catch, write, balance, distinguish, manipulate)
- **Physical abilities** - Things requiring endurance, strength, vigor, and agility (stop, increase, move quickly, change, react)
- **Skilled movements** - Activities where a level of efficiency is achieved.(play, hit, swim, dive, use)
- **Nondiscursive communication**- Objectives in this area refer to expressive movements through posture, gestures, facial expressions, and/or creative movements like those in mime or ballet. These movements refer to interpretative movements that communicate meaning without the aid of verbal commands or help.

Dave (1975) developed this taxonomy:

- **Imitation** - Observing and copying someone else.
- **Manipulation** - Guided via instruction to perform a skill.
- **Precision** - Accuracy, proportion and exactness exist in the skill performance without the presence of the original source.
- **Articulation** - Two or more skills combined, sequenced, and performed consistently.
- **Naturalization** - Two or more skills combined, sequenced, and performed consistently and with ease. The performance is automatic with little physical or mental exertion.

Level	Sample Verbs	Definition
Imitation	begin, assemble, attempt, carry out, copy, calibrate, construct, dissect, duplicate, follow, mimic, move, practice, proceed, repeat, reproduce, respond, organize, sketch, start	Includes repeating an act that has been demonstrated or explained, and it includes trial and error until an appropriate response is achieved.
Manipulation	(similar to imitation), acquire, assemble, complete, conduct, do, execute, improve, maintain, make, manipulate, operate, pace, perform, produce, progress, use	Includes repeating an act that has been demonstrated or explained, and it includes trial and error until an appropriate response is achieved.
Precision	achieve, accomplish, advance, exceed, excel, master, reach, refine, succeed, surpass, transcend	Response is complex and performed without hesitation.
Articulation	adapt, alter, change, excel, rearrange, reorganize, revise, surpass	Skills are so well developed that the individual can modify movement patterns to fit special requirements or to meet a problem situation.
Naturalization	arrange, combine, compose, construct, create, design, refine, originate, transcend	Response is automatic. One acts "without thinking."

The following list is a synthesis of the above taxonomies:

Psychomotor Domain Hierarchy		
Level	**Definition**	**Example**
Observing	Active mental attending of a physical event.	The learner watches a more experienced person. Other mental activity, such as reading may be a part of the observation process.
Imitating	Attempted copying of a physical behavior.	The first steps in learning a skill. The learner is observed and given direction and feedback on performance. Movement is not automatic or smooth.
Practicing	Trying a specific physical activity over and over.	The skill is repeated over and over. The entire sequence is performed repeatedly. Movement is moving towards becoming automatic and smooth.
Adapting	Fine tuning. Making minor adjustments in the physical activity in order to perfect it.	The skill is perfected. A mentor or a coach is often needed to provide an outside perspective on how to improve or adjust as needed for the situation.

Here are key verbs for each level you can use when writing psychomotor objectives:

Key Verbs for the Psychomotor Domain		
• bend • calibrates • constructs • differentiate (by touch) • dismantles • displays • fastens • fixes • grasp	• grinds • handle • heats • manipulates • measures • mends • mixes • operate	• organizes • perform (skillfully) • reach • relax • shorten • sketches • stretch • write

Reasons for Employing Bloom's Taxonomy

Bloom's framework provided one of the first systematic and easy-to-understand classifications of thinking and learning. Bloom's Taxonomy provides a clear and robust tool for guiding the development of teaching and learning.

Some of the reasons for employing Bloom's Taxonomy include:

- Accurately measuring students' abilities requires an understanding of the different levels of cognition that are critical for learning.
- It is important to establish intended learning outcomes in professor/student interactions so that both parties understand the purpose of the interactions.
- Developing intended student learning outcomes according to Bloom's Taxonomy helps students understand what is expected of them.
- Using Bloom's Taxonomy to develop intended student learning outcomes helps professors to plan and deliver appropriate instruction.
- Developing intended student learning outcomes using Bloom's Taxonomy helps faculty to design and implement appropriate assessment tasks, measures, and instruments.
- Having intended student learning outcomes based on Bloom's Taxonomy helps to ensure that instruction and assessment are appropriately aligned with the intended outcomes.

Criticisms and the need for Revision of Bloom's Taxonomy

The original taxonomy is still widely used by teachers, instructional designers, researchers, and assessment writers. However, a revised version of the taxonomy was published in 2001 to update the original and provide more guidance for classroom teachers. The editors also addressed some common criticisms of the original:

- The hierarchy lacks internal consistency; this is the most frequent criticism. Some categories overlap, and some skills—such as understanding—can be exercised at many cognitive levels.
- The taxonomy has not been validated by external evidence. Different raters often assign different cognitive levels to the same items, and the hierarchical relationship of the cognitive levels has not been proven.
- The taxonomy is too simplistic in the way it represents thinking and learning. Learning does not always follow a step-by-step progression. Also, the categories at the top level of the hierarchy do not adequately describe higher-order thinking processes.
- The taxonomy is a framework, or set of loosely organized principles, rather than a theory of instruction that can be used to predict how learners will behave.
- The term "lower-level thinking skills" has led educators to devalue the foundational knowledge required for higher-order thinking.

- The original taxonomy was based on the classroom practice and educational psychology of the 1950s.

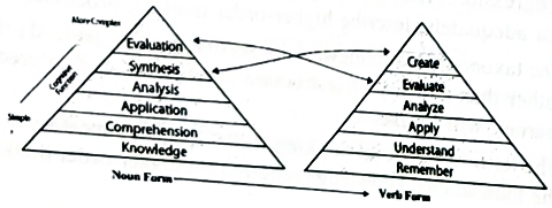
The Revised Bloom's Taxonomy

In the 1990's, Lorin Anderson, a former student of Bloom, along with David Krathwohl, one of Boom's original partners, a group of cognitive psychologists, curriculum theorists and instructional researchers, and testing and assessment specialists published a revision of Bloom's Taxonomy in 2001 entitled 'A Taxonomy for Teaching, Learning, and Assessment'. The revision updates the taxonomy for the 21st century, and includes significant changes in terminology and structure. In the revised framework, "action words" or verbs, instead of nouns, are used to label the six cognitive levels, three of the cognitive levels are renamed, and the top two higher-order cognitive levels are interchanged. The result is a more dynamic model for classifying the intellectual processes used by learners in acquiring and using knowledge.

The revised taxonomy identifies the following new levels of cognitive learning (arranged from lower-order to higher-order levels of learning):

- **Remembering** – Retrieving, recognizing, and recalling relevant knowledge from long-term memory
- **Understanding** – Constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining
- **Applying** – Using information in new ways; carrying out or using a procedure or process through executing or implementing
- **Analyzing** – Breaking material into constituent parts; determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing, and attributing
- **Evaluating** – Making judgments based on criteria and standards through checking and critiquing; defending concepts and ideas
- **Creating** – Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing

Here is a comparison of the original and revised taxonomies:



In the revised taxonomy, synthesis and evaluation are switched. Also, verbs are used in place of nouns to imply the action one takes in each level.

Revised Bloom's Taxonomy of the Cognitive Domain

Cognitive Level	Illustrative Verbs					Definitions
Remember	Define Duplicate	Identify List	Name Recall	Recognize Reproduce	Retrieve Tell	Using memory to recall facts and definitions
Understand	Calculate Categorize Clarify Classify Compare	Conclude Contrast Describe Discuss Exemplify	Expand Explain Identify Illustrate Infer	Interpret Locate Match Outline Paraphrase	Predict Report Restate Summarize Translate	Constructing meaning from information.
Apply	Carry out Classify	Demonstrate Execute	Illustrate Implement	Practice Solve	Use Utilize	Using procedures to carry out a task.
Analyze	Appraise Attribute Compare Contrast	Deconstruct Detect Differentiate Discriminate	Distinguish Examine Formulate Infer	Integrate Organize Parse Relate	Select Sequence Structure Test	Breaking materials into parts to determine structures and relationships.
Evaluate	Appraise Check Coordinate	Critique Defend Detect	Dispute Judge Monitor	Prioritize Rate Reconstruct	Select Support Verify	Making judgments based on checking against given criteria.
Create	Change Combine Compile	Compose Construct Create	Design Formulate Generate	Hypothesize Improve Invent	Plan Predict Produce	Putting materials together to form a unique product.

Whichever taxonomy you prefer, there are key verbs for each level you can use when writing cognitive objectives.

Writing Teaching Objectives in Behavioral Terms

The goal of education is learning. Most would also agree that education is likely to be more effective if educators are clear about what it is that they want the learners to learn. Finally, most would agree that if teachers have a clear idea about what learners are expected to learn, they can more easily and more accurately determine how well students have learned. It has been made clear that the teacher must have identified or determined the teaching objective after the content analysis. It is also essential to define them. Since, changes are brought in many aspects of pupil's behaviour, therefore, only then, any 'teaching objective' is said to be meaningful or attainable when it is defined completely which behavioural change in the pupils is to be brought and in what aspect. From this point of view, making clear the specifications of teaching objective in simple language is defining the objective. It will benefit in many ways. For example:

1. All the uncertainties and confusions will be removed.

2. It will help in advance study. For the convenience of the pupil-teach
3. A comparison between the class-room behaviours of teachers and pu
will be established.
4. Measurement of performance and other activities would be possible

Need for Writing Objectives in Behavioural Terms

In the modern teaching process, the following is the need or importance o
writing teaching objectives in behavioural terms:

1. Writing objectives in behavioural terms help in making certain and specif
the teaching activities.
2. The teacher gets help in selecting teaching strategy, because once ab
such objectives are fixed, we can find out the differences between the variou
types of behaviours of the pupils and teachers.
3. It helps in selecting the questions for testing.
4. With the help of these objectives, the characteristics of learning
experiences can be determined and measurement is also possible.
5. A balance between teaching and learning can be maintained.
6. It helps in selecting audio-visual aids.
7. The objectives written in behavioural terms help in managing an
examination for the achievement of objectives relating to all the aspects.

Writing Intended Student Learning Outcomes Statements Or / Writing Objectives in Behavioural Terms

Intended student learning outcomes / Instructional objectives (also known as *behavioral objectives* or *learning objectives*) are statements that focused on the outcome of learning rather than on the learning process. It describe the desired learning that students should have acquired and should be able to demonstrate at the end of a program of study. They identify what students should know and be able to do as a result of completing their learning that they might not have been able to do before the teaching and learning process began. Consequently, statements of intended learning outcomes should clearly articulate the intended knowledge, skills, abilities, competencies, attitudes, and values that characterize the essential learning required of a graduate of a program of study. The structure of the educational or instructional objectives mainly consists of two parts

(i) The modification part
(ii) The content part

The modification part- This part represents behavioral changes that are designated to the behavior of the learner through the related instruction or learning experience.

The content part- This part refers to the syllabus in particular and to the curriculum in general to be covered by the related instruction.

While writing and defining the learning objectives, the following points should be kept in mind—

1. Learning objective should indicate desired behaviour.
2. The level of the objective achievement should be described in clear terms.
3. The learning objective should be described with reference to pupil's achievement.
4. Mastery on the subject must be there in order to achieve the objective.
5. The description of the objective should be in accordance with the learning.
6. Achievement of a single learning experience should be possible from each objective.

A completely stated behavioral objective has four key components. Referred to as the ABCDs of writing behavioral objectives, the key components are:

1. The audience (the student for whom the objective is intended).
2. The terminal behavior (the anticipated measurable performance).
3. The observable conditions (the setting in which the behavior is to be demonstrated and observed).
4. The performance level (the degree of proficiency, primarily for the purpose of evaluation, and frequently omitted). For exercises that follow you may ignore this ingredient, as we assume a mastery (100 percent) performance level expectation.

Several Methods of Writing Objectives Terms

Various educationists have presented schemes / methods of writing or defining learning objectives in behavioural terms. The three main approaches are as follows :

- Robert Mager's Approach
- Robert Miler's Approach
- R.C.E.M. Approach (Regional College Of Education , Mysore)

Robert Mager's Approach (1962)

In 1962, Robert F. Mager has suggested by developing his scheme that all the cognitive and affective instructional objectives are best described in terms of the terminal behavior expected from the learners. He recommends the following things for the writing of the objectives;

1. Identification of the terminal behavior or performance and its naming

2. Description of the important conditions under which the behavior is expected to occur

3. Specification of the criteria of acceptable performance (desired terminal behavior) by describing how good a learner's performance must be for being acceptable.

Mager has made the Bloom's taxonomy as basis for writing the objectives in behavioural terms. In Mager's scheme of writing objectives in behavioural terms 'Action Verbs' are used, A list of action verbs is prepared for every objective suggested by Bloom. A teacher selects action verbs and then writes objectives in behavioural terms. Various action verbs have been suggested for each objective. A list of these action verbs is given below:

A List of Action Verbs Cognitive Objectives

OBJECTIVES	ACTION VERBS
1. Knowledge	Define, Select, State, Measure, Recall, List, Recognize, Write
2. Comprehension	Explain, Illustrate, Indicate, Present, Formulate, Classify, Judge, Select, Interpret, Translate
3. Application	Predict, Assess, Compute, Construct, Use, Find, Demonstrate, Explain
4. Analysis	Analysis, Divide, Conclude, Compare, Differentiate, Criticize, Separate, justify
5. Synthesis	Argue, Select, Discuss, Conclude, Organize, Predict, Generalize, Summarise
6. Evaluation	Judge, Identify, Evaluation, Avoid, Criticize Defend

Robert Mager has given a list of 'Action Verbs' for writing Bloom's Affective Objectives into behavioural terms. The list is given here under in the form of a table—

A List of Action Verbs Affective Objectives

OBJECTIVES	ACTION VERBS
1. Responding	Listen, Receive, Accept, Perceive, Prefer, Select
2. Receiving	Answer, Develop, State, Receive, List, Write
3. Valuing	Accept, Influence, Participate, Recognise, Increase, Indicate, Decide

4. Conceptualization	Differentiate, Relate, Analyse, Demonstrate, Indicate, Compare
5. Organization	Organise, Correlate, Judge, Select, Relate, Determine, Form, Revise, Develop
6. Characterization	Change, Demonstrate, Accept, Identify

Examples: Following are some examples of writing objectives in behavioural terms—

(a) Example of Cognitive Objectives

1. Knowledge—(i) The pupils can define networking. In this, the term 'define' is used as action verb.

(ii) The pupils can list types of networking. In this objectives, the action verb is 'List'.

2. Comprehension—(i) The pupils can explain the ' networking '. In this, 'interpret' is the action verb.

(ii) The pupils can classify networking. In this, 'classify' is the action verb.

3. Application—(i) The pupils can demonstrate the working of different networking . In this, 'demonstrate' is the action verb

(b) Examples of Affective Objectives

1. The pupils can select the type of networking in the lesson . In this, 'select' is the action verb. (Responding Objective)

2. The pupils can list types of networking. In this, 'list' is the action verb. (Receiving Objective)

3. The pupils can decide appropriate networking for specific distance. In this, 'decide' is the action verb. (Valuing Objective)

4. The pupils can relate teaching and learning. Here, 'relate' is the action verb. (Organization Objective)

Limitations of Robert Mager's Scheme

Robert Mager's scheme has many drawbacks too, which are as follows—

1. In this Mager's scheme, activities have been given more importance. Mental reactions have not been considered.

2. Mager has given the list of action verbs for writing cognitive and effective domains of objectives in the behavioural terms. Many verbs have been included in the tables of cognitive and affective objectives. Therefore, a clear differentiation cannot be made in writing cognitive and affective objectives in behavioural terms. The objectives in behavioural terms must be more specific and definite.

3. Many action verbs determined for objectives of cognitive domain by Mager have been included in many objectives which create confusion in the

minds of the teachers. Therefore, the use of one action-verbs in many objectives is not proper.

4. Mager's this scheme is more useful in programmed learning.

5. Mager's this scheme cannot be used for writing objectives of psychomotor domain in behavioural terms.

6. Mager has expressed learning through stimulus and response. But all human learning cannot be expressed through stimulus and response.

Mager's approach has adopted Bloom's taxonomy as starting base for the writing of objectives. He has sought the help of the associated action verbs for stating the different objectives. The verbs help in describing the outcomes of learning or the terminal behavior of the learner in a well-defined way (observable and testable)

Robert Miler's Approach

In 1962, Dr. Robert B. Miller suggested by developing his scheme that the psychomotor objectives should be written in the following way—

(i) The teacher should describe indicator at first. This indicates the essential activity.

(ii) After describing the indicator, the teacher should describe the stimulus so that the responding may occur.

(iii) Then, after this, the teacher should describe that controlling thing which is to be activated.

(iv) The teacher should write that activity which is to be performed.

(v) In the end, the teacher should give importance to the adequacy of indication of the response or reinforcement.

A List of Action Verbs Psychomotor Objectives

Psychomotor Domain	Action Verbs
Reflex movements	Relax, jerk, stretch, etc
Fundamental movements	walk, run, jump, push, pull etc.
Perceptual abilities	hearing, write, touch etc.
Physical abilities	start, stop, begin, bend etc.
Skilled movements	games, sports, dances, drive etc
Nondiscursive communication	Sit, smile, stand, pose, mimic etc

From the above description, it becomes clear that Dr. R.F. Mager has given clear schemes of writing cognitive and affective objectives, while Dr. R.B. Miller has given the scheme of writing psychomotor objectives and by describing this, it is explained how learning objectives should be written. The pupil-teachers should write the learning objectives in simple and clear language,

keeping in view, both the above schemes, which may lead them towards next phases of the teaching-learning management.

The R.C.E.M. Approach

As it has already been mentioned that Robert Mager's scheme of writing objectives in behavioural terms has some limitations. Keeping in view the limitations of Mager's scheme, Regional College of Education, Mysore (R.C.E.M)developed its own scheme which is known as R.C.E.M. System. In Mager's scheme, more emphasis is laid on the product, while process is more important in R.C.E.M. system. In this system, mental abilities are also considered more important. Mysore's this institute of Mysore adopted Bloom's Taxonomy as its base. Bloom has divided cognitive objectives into six objectives, but R.C.E.M. system has changed Bloom's six cognitive objectives into four objectives only. The later three objectives of Bloom, i.e. analysis, synthesis and evaluation have been named as 'creativity', in R.C.E.M. System. All the mental abilities, involved in these four objectives, have been placed into 17 categories. Hence, we see that all the activities of human learning have been divided into 17 mental abilities. These mental abilities are used in writing objectives in behavioural terms. The objectives and mental abilities used in this system are described in the table:

Objectives	Mental abilities
1. Knowledge	1.1 recognize 1.2 recall
2. Understanding	2.1 seeing relationship 2.2 cite example 2.3 discriminate 2.4 classify 2.5 interpret 2.6 verify 2.7 generalize
3. Application	3.1 reason out 3.2 formulate hypothesis 3.3 Establish hypothesis 3.4 infer 3.5 predict
4. Creativity (Skill)	4.1 analyze 4.2 synthesize 4.3 evaluate

The four categories of objectives (knowledge, understanding, application, creativity), have been divided into 17 mental processes or abilities. These processes or abilities are used for the necessary outline of the 17 frames or statements.

Classification of Objectives according to the R.C.E.M. System

Example: Following are some examples of writing objectives in behavioural terms according to R.C.E.M. System—

1. Cognitive Objective. The pupils have the ability to recall the definition of the term ' networking '.

2. Understanding Objective. The pupils have the ability to differentiate types of networking.

3. Application Objective. The pupils have an ability to communicate through networking.

4. Creativity Objectives. The pupils have an ability to analyse the characteristics of 'networking'.

Characteristics of R.C.EM. System

R.C.E.M. system has some characteristics which are as follows:

1. Writing or converting objectives into behavioural terms is easy.
2. The construction of test-items is convenient.
3. This system lays more stress on mental activities.
4. This system has been developed in and according to Indian conditions.
5. All the educational objectives can be written in behavioural terms in this system.
6. The objectives in behavioural terms are more specific and definite.
7. R.C.E.M. system gives more importance to the learning process than learning outcome.

Limitations of R.C.E.M. System

R.C.E.M. system has some limitations which are as follows:

1. If we see the table of objectives, it would be clear that there is no balance between the various mental activities for different objectives. In cognitive objectives there are two, in understanding objectives, there are seven, in application objective, there are five and in creativity objective there are three mental activities.

2. It is a difficult task to associate various elements of the content with the various mental activities.

3. Guilford has suggested 120 mental abilities, while this system has suggested only 17 mental abilities.

4. This system is more useful for cognitive objectives only because use of a single design for cognitive, affective and psychomotor objectives does not seem to be appropriate.

Conclusion Regarding Writing of Instructional Objectives

The discussion held so far may help the pupil teachers in the task of formulating the desired instructional objectives related to the topics or sub units of their daily lessons. The question, however, arises in actual practice and conditions available for teachers training what type of behavioral changes part really expected in the behavior of the students through the teaching of the lessons in a particular subject. These changes falling in different domains of their behavior may generally be summarized as follows:

1. Students may acquire the knowledge and understanding of the facts, principles and ideas related to the topics and units of different branches of a particular subject of the school curriculum.

2. They may learn about the various skils related to the process and products of the subject like drawing skill, surveying skill, computational skill, etc.

3. They may be able to utilize the knowledge, understanding and skills related to the subject in their daily life.

4. They may develop proper positive attitude for the learning.

5. They may develop proper interest and appreciation for the facts related to the study of that subject.



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Micro Teaching

The art of teaching does not merely involve a simple transfer of knowledge from one to other. Instead, it is a complex process that facilitates and influences the process of learning. Quality of a teacher is estimated on how much the students understand from his/her teaching. Teaching is considered to be made up of skills and each teaching skill is a set of related teaching behaviour which tends to facilitate Pupils' learning. Such skills can be defined, practiced, controlled, observed and evaluated. A particular lesson may involve any number of skills. The classrooms cannot be used as a learning platform for acquiring teaching skills. Training of teachers in specific teaching skills is a major challenge in education programs. The skill for teaching can be acquired only through more structured and cheaper faculty training techniques. With the introduction of microteaching about five decades ago, the lacunae of scientifically proven or effectlve methods to be followed in teacher training programs has been overcome.

Concept and Definition of Teaching

- Teaching is the stimulation, guidance, direction and encouragement of learning.
- Teaching is to cause the child to learn and acquire the desired knowledge, skills and also desired ways of living in the society.
- Teaching is the communication between two or more persons, who influence each other by their ideas and learn something in the process of interaction.
- Teaching is to fill the minds of the learner by information and knowledge of facts for future use.
- Teaching is the process in which learner, teacher and other variables are organized in a systematic way to attain some pre-determined goals.

- Teaching is the stimulation, guidance, direction and encouragement of learning.

Teaching : Definition

- "Teaching is an intimate contact between a more mature personality and less mature one which is designed to further the education of the latter." - *(H.C. Morrison, 1934)*
- "Teaching means many different things, that teaching act varies from person to person and from situation to situation." - *(Bar, 1961)*
- "The behaviour or activities of persons as they go about doing whatever is required of teachers, particularly those activities which are concerned with the guidance or direction of learning of others." - *(Ryan, 1965)*
- "Teaching is the arrangement of contingencies of reinforcement under which students learn. They learn without teaching in their natural environment, but teachers arrange special contingencies which expedite learning and hastening the appearance of behaviour which would otherwise be acquired slowly or making scene of the appearance of behaviour which might otherwise never occur." - *(B.F. Skinner. 1968)*
- "Teaching as an act of interpersonal influence aimed at changing the ways in which other persons can or will behave." - *(N.L. Gage, 1963)*

Concept and Definition of Micro Teaching

Micro-teaching is one of the most recent innovations in teacher education or training programme which aims at modifying teacher's behavior according to the specific objectives. It is a process of subjecting samples of human behavior to 5 R's of video tape- 'recording', 'reviewing', 'responding', 'refining', and 'redoing'. Micro-teaching is a controlled practice that makes it possible to concentrate on teaching behavior in the student-teacher training programme. It is a training concept that can be applied at the pre-service and in-service stages in the professional development of teachers. Micro-teaching provides teacher with a practice setting for instruction in which the normal complexities of class- room are reduced and in which the teacher receives a great deal of feedback on his performance. To minimize the complexities of the normal teaching encounter, several dimensions are limited. The length of the lesson is reduced. The scope of the lesson is narrowed, and the teacher teaches only a few students.

Basically in micro-teaching, the trainee is engaged in a scaled-down teaching situation. It is scaled down in terms of class size, since the trainee is

teaching a small group of 5-10 pupils. The lesson is scaled down in length of class-time and is reduced to 5-10 minutes. It is also scaled down in terms of teaching tasks. These tasks may include the practicing and mastering of a specific teaching skill such as lecturing or teaching explanation, questioning or leading a discussion; mastering of specific teaching strategies; flexibility, instructional decision making, alternative uses of specific curricula, instructional materials and class- room management. Only one skill or task is taken up at a time. If possible micro-lesson is video-taped or tape-recorded. The student teacher immediately views his lesson, evaluates it, amends his approach, reteaches the lesson to another group of pupils, reviews and evaluates.

Definitions of Micro-Teaching

- D. W. Allen (1966), "Micro-Teaching is a scaled down teaching encounter in class size and time."
- Buch (1968), "Micro-Teaching is a teacher education technique which allows teachers to apply clearly defined Caching skills to carefully prepared lessons in a planned series of five to ten minutes encounters with a small group of real students, often with an opportunity to observe the result on video tape."
- Allen and Eve (1968), "Micro-Teaching is defined as a system of controlled practice that makes it possible to concentrate on specific teaching behaviour and to practice teaching under controlled conditions."
- David B. Young defined Micro-Teaching as "a device which provides the novice and experienced teacher alike, new opportunities to improve teaching."
- Clift and Others (1976), "Micro-Teaching is a teacher training procedure which reduces the teaching situation ot simpler and more controlled encounter achieved by limiting the practice teaching to a specific skill and reducing teaching time and class size."
- MC Alleese and Unwin (1970), "The term Micro-Teaching is most often applied to the use of Closed Circuit Television (CCTV) to give immediate feedback of a trainee teacher's performance in a simplified environment."
- Passi, B.K. (1976) says, "It is a training technique which requires pupil-teachers to teach a single concept using specified teaching skills to a small number of pupils in a short duration of time."
- According to the Encyclopedia of Education (Ed. DeigHton), "Micro-Teaching is a real, constructed, scaled down teaching encounter which is used for teacher training, curriculum development and research."

Origin and Development of Micro-teaching

Micro teaching was first introduced at Stanford University, USA in 1963. The idea of micro-teaching originated when an Experimental Project on the identification of teaching skills was in progress under the guidance and supervision of the faculty members (Bush, Allen, McDonald Acheson and many others). This project was aided by Ford Foundation and Kettering Foundation. The team of experts was assigned the development of testing and evaluation tools to measure the attainment of teaching skills. At this juncture Keath Acheson, a research worker was investigating the utility of video tape recorder in the development of technical teaching skills. This instrument could be used for recording the class interaction and the behaviours of the trainee vividly and accurately. This lead to the development of a systematic and accurate method of giving feedback to the teacher trainee. All the steps of micro-teaching technique :

Teach → Feedback → Replan → Reteach → Refeedback were formulated. Thus the name of micro-teaching was coined for this method of developing teaching skills in 1963. Since then this technique of teacher training has been widely used in almost all Colleges and Universities of Europe and Asia. In India, it is being used with great emphasis in all the teacher training programmes of developing teaching skills and competencies among teacher trainees.

Micro-Teaching in India

Micro-Teaching was introduced in India in 1967, with the humble attempt made by D.D. Tiwari of Government Central Pedagogical Institute, Allahabad. In 1970, G.B. Shaw experimented with Micro-Teaching at M.S. University, Baroda. Then the Technical Teachers Training Institute, Madras introduced Micro-Teaching to train the technical teachers. Dr. N.L. Dosajh used Micro-Teaching as a teaching device in Teachers Training Institute, Chandigarh.

Rationale for Micro-Teaching in teacher education program

Microteaching is a teacher training technique for learning teaching skills. It employs real teaching situation for developing skills and helps to get deeper knowledge regarding the art of teaching. It is assumed that if a person is trained to acquire the sub-skills of teaching one by one, and then if all these sub-skills are integrated together he becomes an efficient teacher. The systematic training that a would-be-teacher or a practicing teacher, receives for each sub-skill of teaching is called micro-teaching. Microteaching is a unique model of practice teaching and a viable instrument for the desired change in the teaching behavior or the behavior potential which, in specified types of real classroom situations, tends to facilitate the achievement of specified types of objectives. The pupil-teachers trained using the microteaching instrument are expected to have a greater range of technical

teaching skills to choose from for overcoming day to day classroom teaching problems. Micro-Teaching is one of the most recent innovations in teacher education programmes which aim to modify teacher's behaviour according to the specified objectives. The teacher in the class room uses several techniques and procedures to bring about effective learning in his /her students, these activities include introducing, demonstrating, explaining or questioning. The teacher could make use of non-verbal behaviours such as smiling, gesturing and nodding these group of activities are called teaching skills. The teacher trainee is introduced to a wide range of teaching skills. Microteaching allows the teacher trainee to practice any one skill on his/her own, and then combine it with others when it has been mastered.

Objectives of Microteaching

- To enable teacher trainees to learn and assimilate new teaching skills under controlled conditions.
- To enable teacher trainees to master a number of teaching skills.
- To enable teacher trainees to gain confidence in teaching.

Features of Micro-teaching

1. Micro-teaching is relatively a new innovation in the field of teacher education
2. Real teaching: Micro-teaching is real teaching but focuses on developing teaching skills.
3. Scaled down teaching: Micro-teaching is a scaled down teaching:
   (i) To reduce the class size to 5-10 pupils.
   (ii) To reduce the duration of period to 5-10 minutes.
   (iii) To reduce the size of the lesson.
   (iv) To reduce the teaching skill.
4. Individualised device: Micro-teaching is a highly individualized training device.
5. Providing feed back: It provides the adequate feedback for trainee's performance.
6. Device for preparing teachers: Micro-teaching ia a device to prepare effective teachers.
7. Selection of one skill: It provides opportunity to select one skill at a time and practice it through scaled down encounter and then take others in a similar way.
8. Use of videotape and closed circuit television makes observation very effective.
9. Micro-teaching is an analytic approach to training.

Components of Micro-Teaching

The components of Micro-Teaching are:

(i) A teacher,
(ii) The pupils (usually 4 or 5),
(iii) A brief lesson,
(iv) The objectives of the specific Micro-Teaching occasion,
(v) Feedback by the supervisor, or by using audio tape recordings, video tape recordings and closed circuit television.

Assumptions of Micro-Teaching

The assumptions on which Micro-Teaching is based areas under:

1. Teaching behaviour of a teacher can be observed in class-room situations.
2. Drawbacks in the teaching competency can be traced out and then they can be improved upon.
3. Complexities of normal class-room situation can be reduced. The size of the class, the duration of teaching, teaching contents etc., can be reduced for giving training to the beginner teachers.
4. Training of specific skills can be given very well by taking up one skill at a time.
5. Practice of teaching can be controlled by providing regular feedback.
6. Teacher training programme can be highly individualised.
7. In-service teachers can also be better trained through Micro- Teaching technique.
8. Observation of teaching can be done objectively by using video-tape and Closed Circuit Television.
9. Feedback to the teacher trainee can be possible immediately. The earlier the feedback to the teacher trainee, the better is his learning the different skills of teaching.

Principles Underlying Micro-Teaching

Micro-Teaching is based on a few sound principles which are briefly explained below:

1. Principle of One Skill at a Time: In Micro-Teaching, training of one skill is given till the person has acquired mastery over it. Then the second skill is taken up and so on. Thus, we find that Micro-Teaching is based on the principle of giving training of one skill at a time.

2. Principle of Limited Contents: Micro-Teaching, limited contents are taken up and the teacher is required to use those contents only. It helps the beginner teacher teach that limited material easily and confidently.

3. Principle of Practice: Micro-Teaching is based on the sound principle of practice. Here lot of practice is given by taking up on is skill at a time. Practice makes a man perfect. It helps the pupil- teacher in becoming better and better.

4. Principle of Experimentation: A lot of Experimentation is involved in Micro-Teaching. The experiment consists of objective observation of actions perfumed under controlled conditions. The pupil-teacher and the supervisor conduct experiment on teaching skills under controlled conditions. Variables like time duration of the lesson, contents of the lesson to be taught, number of students sitting in the class etc., can be easily controlled.

5. Principle of Immediate Feedback: The micro lesson lasts for four or five minutes only. Thereafter, feedback is provided to the pupil-teacher. It helps the pupil-teacher to know his drawbacks and improve them effectively without any delay.

6. Principle of Evaluation: In Micro-Teaching, there is continuous assessment of the performance of the pupil-teacher. Evaluation helps the learner know his drawback and then he is able to improve it. In Micro-Teaching each micro lesson is supervised by the supervisor or the peers. Drawbacks in teaching are pointed out and suggestion for improvement is given. Self-evaluation is also possible. Thus, evaluation ensures good learning by the pupil-teacher.

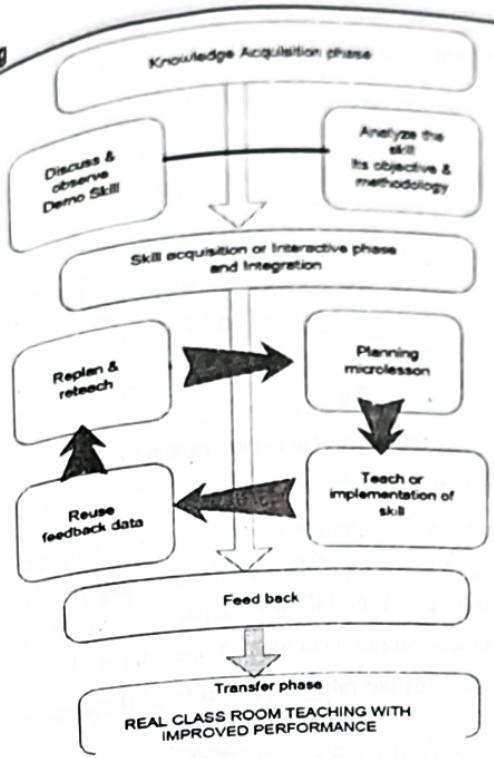
7. Principle of Continuity: Learning of different skills of teaching is a continuous process in Micro-Teaching programme. The pupil-teacher is learning one skill at a time and learning continues till he has mastered the skill. For each skill, the principle of continuity is implied. It makes the teacher good and effective.

8. Principle of Individualised Training: In Micro-Teaching, each trainee is given training very thoroughly. There is individual attention by the supervisor. The drawbacks in teaching are pointed out, suggestions given one by one and thus improvement is brought about.

Phases of Micro-teaching:

According to J.C. Clift and others, micro-teaching procedure has three phases:

(i) Knowledge acquisition phase **(Pre-Active Phase)**
(ii) Skill acquisition phase **(Inter-active Phase)**
(iii) Transfer phase **(Post –Active Phase)**



Phases of Micro Teaching

1. **Knowledge acquisition phase (Pre-Active Phase)** It includes the activities such as
   - Provide knowledge about teaching skills.
   - Observe the demonstration of teaching skill.
   - Analyze and discuss the demonstration of the teaching skill.
2. **Skill acquisition phase (Inter-active Phase)** It includes the activities such as
   - Planning and preparation of micro lesson for a skill.
   - Practicing the skill.
   - Evaluation of the practiced skill (Feedback).
   - Re-plan, Re-teach and re-feedback till the desired level of skill is achieved.
3. **Transfer phase (Post –Active Phase)** It includes the activities such as
   - Giving opportunity to use the mastered skill in normal class room teaching.
   - Integrate the different skill practiced

Micro-Teaching Procedures

A Micro-Teaching programme is organised to expose the trainees to an organised curriculum of miniature teaching encounters, moving from the less complex to the more complex. Micro-Teaching process includes the following steps:

1. **Orientation About Micro Teaching** : In the beginning, the student teachers should be given necessary theoretical background about micro teaching by having a free and fair discussion of aspects like these given below:

- Concept of micro teaching.
- Significance or rationale of using micro teaching.
- Procedure of micro teaching.
- Requirements and setting for adopting micro teaching technique.

2. **Discussion of teaching skills** : Under this step the knowledge and understanding about the following aspects is to be developed:

- Analysis of teaching into component teaching skills.
- The discussion of the rationale and role of these teaching skills in teaching.
- Discussion about the component teaching.

3. **Selection of a particular teaching skill** : The teaching skills are to be practised by taking them one at a time. Therefore the student teachers are persuaded to select a particular skill for practice. They are also provided with necessary orientation and processing material for the practice of that skill. The student, teachers may be given a necessary background for the observation of a model or demonstration lesson on the slected particular teaching skill.

4. **Presentation of a model demonstration lesson:**

Here a demonstration or model lesson for the use of selected teaching skill is presented before the trainees. This is also termed as modeling i.e. demonstration of the desired behaviours relating to a skill for limitation by the observers. Demonstration or model lesson can be given in a number of ways like these given below:

- By providing written material such as handbooks, guides, illustrations & video tapes.
- By exhibiting a film or video tape.
- By making the trainees listen an audiotape.
- By arranging a demonstration from a live model. i.e. a teacher educator or an expert demonstrating the use of the skill.

5. **Observation of the model lesson and criticism** : What is read, viewed, listened and observed through a modeling source is carefully analysed by the trainees in a demonstration given by an expert or teacher educator, student-teachers are expected to note down their observations. An observation schedule especially designed for the observation of specific skill is distributed among the trainees and they are also trained in its use before hand. Such observation of the model lesson and its relevant criticism provides desirable feedbacks to the person giving the model lesson.

6. **Preparation of micro lesson plan**: Under this step, student teachers are required to prepare micro lesson plans by selecting proper concept for the practice of demonstrated skill help may be taken from books on the subject of micro teaching.

7. **Creation of micro teaching setting**: Under this step. Consideration is made for creating proper conditions and providing appropriate facilities for the practice of teaching skill. The standard setting for a micro class is as below:

- No. of pupils : 5-10
- Type of pupils : real pupils or preferably peers.
- Type of supervisor : teacher-educators and peers.
- Time duration of a micro lesson : 6 mins.
- Time duration of a micro teaching cycle : 36 mins.

This duration is divided as under:-

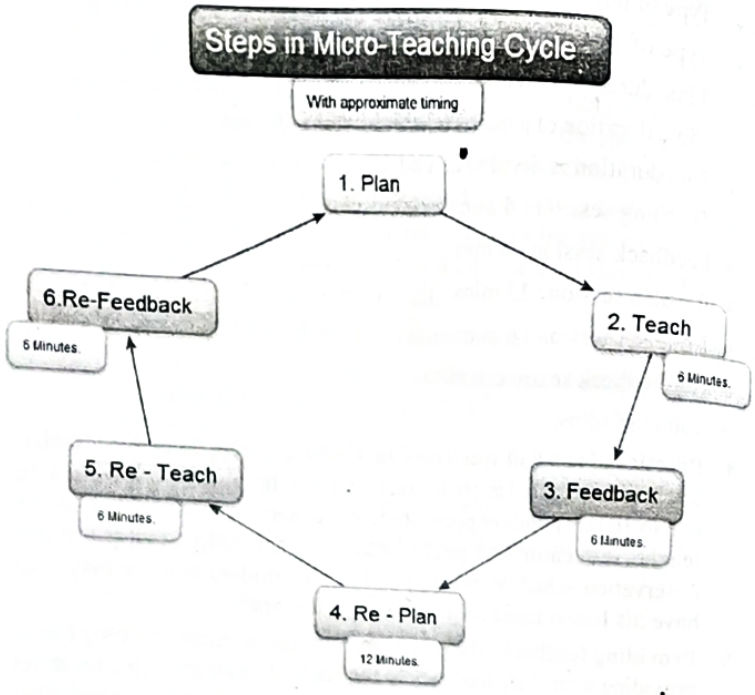
- Teaching session : 6 mins.
- Feedback session : 6 mins.
- Re-plan session : 12 mins.
- Re-teach session : 6 mins.
- Re-feedback session : 6 mins.
- Total : 36 mins.

8. **Practice of the skill-teach session**: Under this step, the student teacher teaches his prepared micro lesson for 6 mins. In a micro class consisting of 5 to 10 real pupils or peers(student-teachers). It is supervised by the teacher-educator and peers both with the help of appropriate observation schedule. where possible the student teacher may also have his lesson taped on a video or audio tape.

9. **Providing feedback**: The greatest advantage of micro teaching lies in providing immediate feedback to the student- teacher on his teaching performance demonstrated in his micro lesson.the feedback is provided

in terms of his use of the component teaching behaviours emphasizing the skill under practice so that he may be able to modify them in the desired direction.this feedback in Indian situation may be properly provided by the peers and teacher- educator observing the micro lesson.

10. **Re-Panning(Re-Plan Session):** In view of the feedback received from the different sources the student-teacher tries to re-plan his micro lesson.he is provided 12 mins. Time for this purpose.
11. **Re-Teaching(Re-Teach Session):** In this session of 6 mins. The student-teacher re-teaches his micro lesson on the basis of his re-prepared plan and re-arranged setting.
12. **Providing Re-Feedback (Re-Feedback Session):** On the basis of his performance in the re-taught micro lesson,the student-teacher is provided re-feedback in the way outlined earliar.
13. **Repetition of Micro Teaching Cycle :** A micro teaching cycle used to practice a teaching skill consists of planning, teaching, feedback, re-planning ,re-teaching and re-feedback operations as shown in the diagram below:



The above micro teaching cycle is repeated and the student-teacher is required to re-plan and re-teach his lesson till he attains mastry over the skill under practice.

14. **Integration Of Teaching Skills**: The last step is concerned with the task of integrating various teaching skills individually mastered by a student-teacher. This helps in bridging a gap between training in isolated teaching skills and the real teaching situation faced by a student-teacher.

Positive Aspects Of Microteaching

Participants in microteaching sessions will be able to hone their skills in the following areas:

- **oral presentation skills** (voice modulation and articulation, enthusiasm, gestures, non-verbal cues, clarity of explanations and examples)
- **organization skills** (structure of lesson, strong opening and closing, good transitions between sections, clear learning objectives, effective use of time, good pacing)
- **relating to the student** (speaker engages audience, material is audience-appropriate, effective questioning, use of relatable examples)
- **effective use of teaching aids** (handouts, blackboard, presentation software, overhead transparencies, props, charts, etc.)

Comparison Between Micro Teaching And Traditional Teaching

	Micro Teaching	Traditional Teaching
1	Objectives are specified in behavioural terms	Objectives are general and not specified in behavioural terms.
2	Class consists of small group of 5-10 students.	Class consists of 40-6- students.
3	The teacher takes up one skill at a time	The teacher practices several skills at a time.
4	Duration time for teaching is 5-10 minutes.	The duration is 40-50 minutes.
5	There is immediate feed-back.	Immediate feed-back is not available
6	Teaching is carried on under controlled situation.	There is no control over situation.
7	Teaching is relatively simple.	Teaching become complex.
8	The role of supervisor is specific and well defined to improve teaching.	The role of the supervisor is vague.
9	Patterns of class room interaction can be studied objectively.	Patterns of classroom interactions cannot be studied objectively.

Merits of Micro-Teaching

Micro-Teaching is an innovation which has sound basis of principles of learning and application of technology. The advantages of Micro-Teaching are as follows:-

1. It is an effective feedback device for the modification of teacher's behaviour.
2. It is highly individualized type to teacher training.
3. It is useful for developing teaching efficiency in pre-service and in-service teacher training programme.
4. It helps in systematic and objective observation by providing specific observation schedule.
5. It helps in acquiring various types of skills which ultimately form the basis of successful teaching.
6. It reduces the complexities of normal class-room teaching such as size of class, time and problem of discipline.
7. It is a training device for improving teaching practice and to prepare effective teachers.
8. Teaching is a complicated type of activity. Micro-Teaching simplifies it so as to make it suitable for the beginner teachers.
9. It develops the feeling of confidence among the teachers.
10. It provides economy in mastering the teaching skills. The use of video-tape enables the trainee to analyse his own teaching performance.
11. It can be done either in real class-room conditions or simulated conditions.
12. It focuses on training for the accomplishment of special tasks such as practice of instructional skills, mastery of certain curricular materials and practice of techniques of teaching.
13. It permits increased control and regulates teaching practice.
14. It enables the trainee to make progress in developing teaching skills at his own rating depending upon ability.
15. Trainees get satisfaction when they hear and see themselves through audio-video-tapes.

Demerits of Micro-Teaching

The drawbacks of Micro-Teaching are as follows:

1. Through Micro-Teaching one trainee is trained at a time.
2. It is more time consuming as a trainee will take 35 minutes to practice one skill only.
3. It presents fragmented view of teaching.

4. It may enable a trainee to seek mastery over the isolated teaching skills but hardly trains him to meet the needs of the real teaching encounter.
5. The immediate feedback which is a must may not be feasible in all conditions.
6. Due to short lesson of 6 minutes, a trainee cannot get training in evaluation, diagnostic and remedial skills.
7. It cannot fit in Indian conditions and situations due to its short practice period which may create academic and administrative problems in the schools.
8. It depresses the creativity of teachers. During teaching a teacher evolves something new but he has to stop as the micro lesson ends.
9. Micro-Teaching can be carried on successfully only in controlled environment but generally it is found class-room situations are flexible.
10. It wastes a lot of time of students. Each micro lesson goes on for 5 to 10 minutes where the main emphasis is on teaching technique, learning by students is almost ignored.
11. Micro-Teaching alone may not be sufficient. There is need of integrating it with other teaching techniques.



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Micro Teaching Skills

Meaning of Teaching Skill

Teaching Skill can be defined as :

- A teaching skill is that behaviour of the teacher which facilitates pupils' learning directly or indirectly.
- A teaching skill includes all arts and behaviour of the teacher which maximizes Pupils' learning.
- A teaching skill is that art of the teacher which makes communication between the teacher and pupils sufficiently.

Acc. to B.K.PASSI: "Teaching skills are a set of related teaching acts or behaviours performed with the intension to facilitate pupil's learning."

Acc. to N.L.GAGE(1968): " Teaching skills are specific instructional activities and procedures that a teacher may use in his classroom.these are related to the various stages of teaching or in the continuous flow of teacher performance."

Attempts have been made to list teaching skills. **Allen and Ryan** listed the following teaching skills at Stanford University in the U.S.A.

1. Stimulus Variation
2. Set induction
3. Closure
4. Teacher silence and non-verbal cues
5. Reinforcing pupil participation
6. Fluency in questioning
7. Probing questioning

8. Use of higher questions
9. Divergent questions
10. Recognizing and attending behaviour
11. Illustrating and use of examples
12. Lecturing
13. Planned repetition
14. Completeness of communication

B.K. Passi has given the following list of Teaching Skills in his book **"Becoming Better Teacher;** Micro-teaching Approach":

1. Writing instructional objectives
2. Introducing a lesson
3. Fluency in questioning
4. Probing questioning
5. Explaining
6. Illustrating with examples
7. Stimulus variation
8. Silence and non-verbal cues
9. Reinforcement
10. Increasing pupil participation
11. Using black board
12. Achieving Closure
13. Recognizing attending behavior

NCERT (National Council of Educational Research and Training) in its publication ***Core Teaching Skills*** (1982) has laid stress on the following teaching skills...

- writing instructional objectives
- Organizing the content
- Creating set for introducing the lesson
- introducing a lesson
- Structuring classroom questions
- Question delivery and its distribution
- Response management
- explaining
- illustrating with examples
- Using teaching aids
- Stimulus variation

- Pacing of the lesson
- Promoting pupil participation
- Use of blackboard
- Achieving closure of the lesson
- Giving assignments
- Evaluating the pupil's progress
- Diagnosing pupil learning difficulties and taking remedial measures
- Management of the class

Core Teaching Skills

It is not possible to train all the pupil teachers in all these skills in any training programme because of the constraints of time and funds. Therefore a set of teaching skills which cuts across the subject areas has been identified. They have been found very useful for every teacher. The set of these skills are known as CORE TEACHING SKILLS

Core Teaching Skills are:

1. Skill of Probing Questions
2. Skill of Explaining
3. Skill of Illustrating With Examples
4. Skill of Stimulus Variation
5. Skill of Reinforcement
6. Skill of Classroom Management
7. Skill of Using Blackboard .
8. Skill of Introducing a lesson

SKILL OF EXPLAINING

Explaining can be defined as an activity to bring about a concept, principle, etc. It is an activity to fill up a gap in someone's understanding. The skill of explaining aims at making sure that the explanation is understood. The teacher has to give proper explanation and reasons to bring clarity and proper understanding of what is being taught. In order to make the pupils understand many ideas, concepts or principles which need explanation a teacher has to learn the skill of explaining. Explanation is nothing but a few interrelated appropriate statements. Thus the skill of explaining may be defined as the art of learning the use of interrelated appropriate statements by the teacher for making the pupils understand the desired concept phenomenon or principle.

It is by all means a verbal skill and has two main aspects:

a. The selection of appropriate statements relevant to the ge, maturity, previous knowledge and content of the concept or phenomenon.

b. The skill of interrelating and using the selected statements for the proper understanding of the concept or phenomenon. The statements are generally of three types:

- Descriptive (meant for how)
- Interpretive (meant for what)
- Reason giving statement (meant for why)

COMPONENTS OF SKILL OF EXPLAINING

a) **DESIRABLE BEHAVIOUR:**

1. **Using appropriate beginning and concluding statements:** Beginning statement is an opening statement announcing what is going to be explained by the teacher. It prepares the pupils mentally to receive the explanation. On the other hand, concluding statements are made after the end of the explanation in order to summarise or conclude the whole explanation.
2. **Using explaining links:** Explaining links in the form of words and phrases are meant for establishing links or continuity in the statements used for explaining a concept phenomenon or principle. Some of these linking words and phrases generally used for explaining are listed as since, because, so that, that is why, that's is how etc..
3. **Covering essential points:** The explanation given for the understanding of a given concept or principle should be as complete as possible. The completeness is determined by the scope of the concept or principle as specified in the instructional objectives. It should aim for covering all the essential points leading to clear understanding of the desired concept or principle.
4. **Testing pupil understanding:** This component behavior involves asking of appropriate questions from the pupils to as certain whether the purpose of explaining the concept or principle has been achieved or not.

b) **UNDESIRABLE BEHAVIOUR**

1. **Using irrelevant statements:** This behaviour covers the statement not related to the concept or principle being explained. These statements, instead of helping the pupils to understand the concept , create confusion and distract the attention of the pupils.
2. **Lacking continuity in statements:** this behaviour involves a missing link or break in the logical sequence of interrelated statements by the teacher for explaining a concept or phenomenon.
3. **Lacking fluency:** fluency relates to the flow of uninterrupted statements for explaining a concept or principle. If a teacher lacks in fluency he

may be seen to show the following types of behaviours:

- Does not speak clearly.
- Utters incomplete or half sentences.
- Tries to reformulate or correct his statements in the midway of a sentence or a statement and,
- Uses fumbling ideas or inappropriate words or statements.

4. Using inappropriate vocabulary , vague words and phrases:

- Use of vocabulary not known to pupils or inappropriate to their age grade and maturity level.
- Use of certain vague words and phrases (like infect, somewhat, you see, you know etc.).

Micro Lesson Plan

SKILL OF EXPLAINING

Date- Pupil teacher's roll no-

Subject:-Computer Science Class-

Topic- Computer Memory Duration- 5-8 min.

Pupil Teacher Activity	Students' Activity		Behavioral Components
Students, all of you can memorize the things, facts in your brain in the form of memory like that computer can store information in its brain that is C.P.U in the form of computer memory.	Listen attentively		Appropriate beginning statement
Computer Memory is the storage space in the brain of computer. There are two types of memory :- 1. Primary memory 2. Secondary memory	Listen attentively and note down in notebooks		Using explaining link
1. Primary Memory : The memory inside the CPU is called Primary Memory. It is also known as Internal memory, Which is of two types i.e. RAM: Random Access memory ROM: Read only memory **2. Secondary Memory :** The memory which is outside the CPU called Secondary Memory. It is also known as External memory. Eg. Harddisk, Pendrive, Cd-Rom etc.	Listen carefully and note down in notebooks		Covering essential points
Now tell me what is computer memory?	A memory is just like a human brain. It is used to store data and instructions. Computer memory is the storage space in computer		Testing pupils' understanding
What is the Difference b/w Primary and Secondary Memory?	Primary • This is internal memory • In the form of RAM & ROM	Secondary • This is external memory • In the form of Hard disk, Pendrive, Cd-Rom etc.	
Yes, like human brain computer also has its memory called computer memory.			Appropriate concluding statement

Observation Schedule Cum Rating Scale

The observation schedule cum rating scale for the skill of explaining comprises of three columns. The first column indicates the components of the skill. (desirable or undesirable behavior) The second column specifies the tallies against all the components. The third one indicates rating from one to seven against each of the components. The rating indicates the adequacy of the acquisition of the component of the skill. The rating may be indicated by encircling O the number which represents the observer's assessment.

Sr. No.	Components Desirable Behaviour	Tallies (Frequency occurrence)	Rating scale From Extremely poor to Excellent
1	Using Appropriate Beginning & Concluding Statement		1 2 3 4 5 6 7
	Using explaining links		1 2 3 4 5 6 7
2	Covering essential point		1 2 3 4 5 6 7
3	Testing pupil understanding		1 2 3 4 5 6 7
4			

Sr. No.	Components Undesirable Behaviour	Tallies (Frequency occurrence)	Rating scale not at all very much
1	Using irrelevant statements		1 2 3 4 5 6 7
2	Lacking continuity in statements		1 2 3 4 5 6 7
3	Lacking fluency		1 2 3 4 5 6 7
4	Using inappropriate vocabulary , vague words and phrases		1 2 3 4 5 6 7

1 Extremely Weak
2 Very Weak
3 Weak
4 Average
5 Good
6 Very Good
7 Excellent

SKILL OF ILLUSTRATION

Some times some abstract ideas or concepts are very difficult to teach. In spite of their best efforts of explaining the concepts, the teachers are unable to convey the true sense and meaning of the concepts. To clarify the understanding, the selection of the eg. Relevant to the concept or generalization to be taught to pupils, so that the content under study may be clear and understandable to the pupils. Examples contribute significantly in teaching learning since these pupils take from known to unknown. The other important properties attached to eg. are their sustaining the attention of pupils and thus are helpful in creating motivation and interest in their lesson.

Skill of illustration with examples involves describing an idea, concept, principle or generalization by using various examples. Thus functions of this skill can be broadly divided into two broad steps:

i. Clarifying the ideas, concepts, principles or generalization to the pupils and

ii. To test their understanding about the taught content. The illustrative eg. Which is the central theme of the skill have the following properties so that they may significantly affect the understanding of the pupils.

COMPONENTS OF THE SKILL

I. **Examples should be simple:-** Simple is a relative word example which is simple for class (x) may be difficult for class (viii), an example which is simple for the same grade simple for the pupils in city school, may be simple for the pupils in rural areas. Hence, while formulating simple examples for the students, we must keep in mind the age level, grade level, previous experiences, their family background etc.

II. **Examples should be relevant to the topic:-** Sometimes the teacher sets such eg which are not directly related to the topic being discussed or the eg itself need explanation. Such examples do not produce any significant on pupils learning.

III. **Examples should be interesting:-** An interesting eg. is one which is helpful in sustaining student attention and disabled to arouse curiosity among students. The term interesting is the relative word. An eg. which is interesting to class VI students may not have any meaning to class XII students. Hence a teacher while formulating an eg. must also consider the age level, grade level, maturity level etc of the pupils for whom he/he is formulating examples pupils attentive behavior, enthusiasm, eagerness etc are the clear tests that the eg. is interesting to them.

IV. **Using Appropriate Media for Example:-** Appropriateness of media refers to its suitability to age level, grade level, maturity and to the unit taught. The decision about the nature of media, whether verbal or non verbal depends on the nature of concept.

➢ **Different medium for presenting examples:-** Illustrative eg may be classified according to the manner of their presentation which are as follows:-

- **Visual examples:-** This includes presenting such objects as egs which are visible eg presenting models, charts, diagrams etc are included under this category.
- **Auditory examples:-** Telling of stories, explaining of events etc are included under this category.

- **Tactual examples:-** Actual objects are presenting as eg are included under this category. Examples may also be classified according to their media of presentation which are non verbal and verbal media.

a) **Non-verbal medium of presentation:-** Without using words presentation of eg fall in this category which according to their nature may further be classified as:-

- **Use of objects:-** Real objects like flower, branching of trees, leaves etc in botany lesson may be used as illustrative eg to classify some of the concepts, principles or ideas.
- **Use of models:-** Models are the replica of reality and hence can be used to serve the purpose of real objects for clarifying concepts, ideas, and principles. These are used when real objects are not possible to use in the classroom setting. When the models are specially prepared o illustrate the concept and be detached into its component parts for clear examination. In explaining a principle, law. Concepts can be explained well with its help.

b) **Verbal medium of presentation of examples:-** Illustration through verbal medium includes telling a story or analog by the teacher in the classroom situation.

V. **Use of Appropriate approaches:-** The basic approaches which help the teacher in clarifying an idea, principle or fact in a systematic way, are inductive and deductive approaches respectively.

a) **Inductive approach:-** In this approach we start with eg based on the concept, idea or rule and then try to draw inferences on the basis of these example. In this approach the function of the teacher starts with the relevant eg and draws conclusion on the basis of these examples. It encourages divergent and creative thinking.

b) **Deductive approach:-** It states the generalization first, and applies it to a number of examples. The initial statement, even if not fully understood by students, helps to focus their attention on those aspects of examples on which teacher wishes them to concentrate. Classroom observation suggests that effective explanation often occurs when first statement of a rule is followed by examples and then by a second statement of the rule, for example, clarity in establishing relationship between general rule and specific examples. In all cases, it is essential for the teacher to use examples which are relevant to student's experience and interests, and their present level of understanding.

Micro Lesson Plan

SKILL OF ILLUSTRATION

Date- Pupil teacher's roll no-

Subject:-Computer Science Class-

Topic- Input Device Duration-5-7 min.

Pupil teacher activity	Students activity	Components
Good Morning Students Do you recognize this Picture? (By showing the picture of keyboard)  Good Keyboard is used to input the data into the computer and we can see data onto the monitor. (Now show the Picture of mouse.)  Have you seen this picture before?	This is Keyboard. Yes, This is Mouse. Listen attentively	Visual Media is used Visual media is used Use of Inductive approach
Yes, Very Good Mouse is used like a pointer. Both Keyboard & mouse are used to enter the data into the computer and are known as input devices . So we can define the input devices as: The devices through which we input some data into the computer is called input devices. More example of Input Devices are: (By showing the chart of more input devices.) Joystick is also a input device. Light pen is also a input device. It also work as a pointer. Scanner is also a input device. We can scan our images & pictures and can use them. So all these are the input devices.	Students write down in their notebook. Students looks towards the chart & listen attentively.	Relevant Example Simple & interesting examples.

Observation Schedule Cum Rating Scale

The observation schedule cum rating scale for the skill of illustration comprises of three columns. The first column indicates the components of the skill. The second column specifies the tallies against all the components. The third one indicates rating from one to seven against each of the components. The rating indicates the adequacy of the acquisition of the component of the skill. The rating may be indicated by encircling O the number which represents the observer's assessment.

Sr. No.	Components	Tallies (Frequency occurrence)	Rating scale From Extremely poor to Excellent
1	Examples should be simple		1 2 3 4 5 6 7
2	Examples should be relevant to the topic		1 2 3 4 5 6 7
3	Examples should be interesting		1 2 3 4 5 6 7
4	Using Appropriate Media for Example		1 2 3 4 5 6 7
5	Use of Appropriate approaches		1 2 3 4 5 6 7

SKILL OF STIMULUS VARIATION

For the success of any lesson it is essential to secure and sustain the attention of the pupils-learning is optimum when the pupils are fully attentive to the teaching-learning process. To attract and sustain student's attention. The skill of stimulus variation implies attracting and focusing pupil's attention by changing stimuli in the environment for securing and sustaining pupil's attention and to lead to greater pupil interest and achievement. This skill is also known as "teacher liveliness".

Components of Skill

1. Teacher's Movements.
2. Teacher's Gestures.
3. Change in Speech Pattern.
4. Change in Sensory focus.
5. Change in Interactions Style.
6. Focusing.
7. Pausing.
8. Pupil physical participation.

1. **Teacher's Movement**: Making movements from one place to another with some purpose. The teacher moves from one place to another

during the course of lesson like moving towards blackboard or moving towards pupil purposefully. The purpose may be either to write certain important points on the blackboard to draw pupils attention or to check their activities and to help them in solving certain problems. These purposeful teacher movements capture the attention of the pupils and keep them at their toes. In order to secure and sustain the attention of the pupils, the teacher should avoid aimless and habitual wandering and pacing up and down the class. These movements can be monotonous and sometime distracting.

2. **Teacher's Gesture**: Gestures are movements of the part of body to direct attention to express emotion, to emphasize importance or to indicate shape, size and movements etc. proper gestures reinforce the verbal exposition and also catch the attention of the pupils. The oral message is less effective in conveying meaning than the oral message combined with gestural ones. All these acts are performed to become more expressive.

3. **Change In Speech Pattern**: When the teacher wants show emotions or to put emphasis on a particular point, sudden or radical changes in tone, volume or speed of the verbal presentation are brought out. The change in the speech pattern makes the pupils attentive and creates interest in the lesson. When we go on teaching in a monotonous tone without using inflections gradually pupils attention is distracted and at that time they either indulge in day dreaming or dozing in the class. It may however be noted that teacher should be able to change his/her speech pattern at proper points and in appropriate situations.

4. **Change In Sensory Focus**: The teacher gives information to the class verbally about something. This is called oral medium. When the teacher is showing maps, charts and object without saying something. This is called visual medium. If the teacher is giving information to the pupils through any one medium(oral, visual, oral visual) for a long time., it is possible that the students may lose attention to what the teacher is conveying to them. Therefore it is essential for the teacher to change medium rapidly in order to secure and sustain pupils' attention to what he says. There are three types media :

   a. Oral-visual

   b. Oral/ oral-visual and

   c. Visual/oral-visual

   a. **Oral/Visual**: when the focus of attention is changed from verbal stimulus to visual stimulus eg. While speaking, the teacher shows a photograph or a chart this switching of sensory focus Is from oral to visual. Now, if the teacher shifts again to lecturing, then the switching is from visual to oral.

   b. **Oral/ Oral-Visual**: Here the shift is from verbal stimulus to verbal and visual stimuli and vice-versa. If the teacher while lecturing, shows chart or model and explains its various parts, this type of switching is an example of oral to oral-visual switching.

   c. **Visual/ Oral-Visual**: This shift is from visual stimulus to verbal and visual stimuli and vice-versa. When a teacher demonstrates an experiment silently and then explains the phenomenon with the help of diagram on the black board, this type of change is from visual to oral-visual.

5. **Change In Interaction Styles**: When two or more persons communicate their views with each other, they are said to be interacting. In the classroom the following three styles of interaction are possible :

   a. Teacher $\Longleftrightarrow$ class

   b. Teacher $\Longleftrightarrow$ pupil

   c. Pupil $\Longleftrightarrow$ pupil interaction

   a. **Teacher $\Longleftrightarrow$ Class**: A teacher communicates to the whole class and whole or part of the class responds.

   b. **Teacher $\Longleftrightarrow$ Pupil**: In this style of interaction occurs when communication is directed towards a particular pupil who is supposed to respond.

   c. **Pupil $\Longleftrightarrow$ Pupil**: when the discussion takes place among pupils in the absence of teacher participation, the interaction is known as pupil to pupil interaction.

   All types of interaction should go side by side to secure and sustain pupils' attention.

6. **Focusing**: The teacher draws the attention of the pupils to a particular point which they are required to observe. The focusing can be obtained, either through verbal behavior or using gesture or both.

   a. **Verbal focusing**:- statements like look at the board, listen carefully watch the experiment etc. illustrate verbal focusing.

   b. **Gesture focusing**:- this can be obtained by pointing toward the specific object through gesture.eg:- pointing with finger or underlying the important words on the blackboard.

   c. **Verbal-cum-gesture focusing**:- they may be achieved by pointing to an object under reference and also saying verbally. Look at this. It has been found that this type of focusing is more effective in capturing the attention of the pupils.

7. **Pausing**: - This means "stop talking" by the teacher for a moment. When the teacher becomes silent during teaching, it at once draws the attention of the pupils with curiosity towards the teacher. The message given at this point is easily received by the pupils.

   The purposes of pause are :

   a) to secure the attention of the pupils.

   b) to give time for structuring an answer to teacher's question.

   c) to give time for assimilation of ideas and concepts.

   The pause should not be two short or two long. Pause should be at appropriate place in the utterance. A pause can be given at an appropriate place provided the aim is to capture the attention of the non attending pupils.

8. **Pupil-Physical Participation**:- This refers to pupil's physical participation asked for or intended by the teacher.eg:- handling apparatus , dramatization etc. pupil movement gives a pupil the chance to break the monotony to increase his/her interest in the lesson.

Micro Lesson Plan

SKILL OF STIMULUS VARIATION

Date- Pupil teacher's roll no-

Subject:-Computer Science Class-

Topic- Computer Memory Duration-5-7 min.

Teacher's Activity	Students' Activity	Components
Where All of you store the things which you want to memorize?	In our brain	Teacher's Interaction & use of gestures
Where computer stores its data?	No response	Pausing
Computer stores its data in computer memory.	Listen Attentively	Change in speech pattern
Computer memory is the storage space in the brain of computer i.e. CPU	Listen Attentively	Verbal focusing
Ram, can you tell In which form computer stores data in its memory?	No response	Change in interaction style

Data stores its memory in the form of bytes. Form of bytes like KB, MB, GB etc. (Tells & writes it on the blackboard) And, 1 Byte = 8 Bits 1 KB = 1024 Bytes 1 MB = 1024 KB 1 GB = 1024 MB	Listen Attentively & Note down in their Notebook.	Teacher's movement Oral/ Oral-Visual switching & Focusing
And all of you must know that maximum capacity of a computer to store data is more than gigabytes i.e Terabytes, Petabytes and more.	Listen with full attention and interest	Verbal focusing
Now, anybody tell me what is the purpose of computer memory?	To store more and more data which we never remember in our brain	Teacher's Interaction
Good, so students now I expect all of you know about computer memory. Now each of you may write about the computer memory in your exercise work book .		Pupil physical participation

Observation Schedule Cum Rating Scale

The observation schedule cum rating scale for the skill of stimulus variation comprises of three columns. The first column indicates the components of the skill. The second column specifies the tallies against all the components. The third one indicates rating from one to seven against each of the components. The rating indicates the adequacy of the acquisition of the component of the skill. The rating may be indicated by encircling O the number which represents the observer's assessment.

Sr. No.	Components	Tallies (Frequency occurrence)	Rating scale From Extremely poor to Excellent
1	Teacher's Movement		1 2 3 4 5 6 7
2	Teacher's Gesture		1 2 3 4 5 6 7
3	Change In Speech Pattern		1 2 3 4 5 6 7
4	Change In Sensory Focus		1 2 3 4 5 6 7
5	Change In Interaction Styles		1 2 3 4 5 6 7
6	Focusing		1 2 3 4 5 6 7
7	Pausing		1 2 3 4 5 6 7
8	Pupil-Physical Participation		1 2 3 4 5 6 7

SKILL OF INTRODUCING THE LESSON

The skill of introducing a lesson involves the proficiency in the use of verbal and non-verbal behavior's, teaching aids and appropriate devices for making the pupils realize the need of studying the lesson by establishing cognition and affective support with them.

The skill involves the following component behaviors:-

1. Maximum utilization of previous knowledge of pupil.
2. Using appropriate device.
3. Maintenance of continuity.
4. Relevancy of verbal or non-verbal behaviour.

1. **Maximum utilization of previous knowledge of pupil**:- Introducing of a new lesson has to be based on previous knowledge and experience of pupil. The teacher has to learn the art of utilizing previous knowledge and experience of pupil. The teacher should keeps in mind the following:-
   1. Previous knowledge of the subject of the pupil.
   2. General awareness of the pupil with the physical and social environment.
   3. Device technique of exploring the previous knowledge.
   4. Technique of establishing link between previous and new knowledge.
2. **Using appropriate device**:- here device refers to a technique that the teacher uses in introducing a lesson such device can be:
   1. Use of example, analogies, similarities.
   2. Questioning.
   3. Story telling.
   4. Audio-visual aids.

   The appropriateness of the use of each of such device depend upon the unit to be taught and also on its suitability to the maturity level, age level, interest, culture and experience of the pupil.
3. **Maintenance of continuity**:-Continuity refers to the sequence of ideal or information being presented. Proper introducing require the continuity in sequence of ideal or information logical sequence is to be maintained between the main part of the introducing.
4. **Relevancy of verbal or non-verbal behaviour**:-The teacher should maintain relevancy in his verbal and non-verbal behaviour. Statement question, demonstration and illustration used by the teacher should contribute maximum towards the introduction of the lesson in the various ways like:
   1. testing the previous knowledge.
   2. utilizing these post experience.
   3. making the pupil feel the need and importance of studying the lesson.

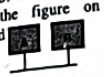
Micro Lesson Plan

SKILL OF INTRODUCING THE LESSON

Date- Pupil teacher's roll no- Class-

Subject:-Computer Science Duration-5-7 min.

Topic- Networking

Teacher's Activity	Students' Activity	Components
Students do you recognize this picture. (Shows a chart having the picture of computer on it)	Yes, This is computer	Utilization of previous knowledge
What is computer ?	Computer is an electronic machine which accept data from the user, process the data and then display the result on the monitor according to the user's needs.	Maintenance of continuity
What are the functions a computer can perform?	One can save the data, process the data, share the data , Retrieve the data etc. at any time .	Relevancy of Verbal behavior
If it is possible that you save your data on system  and retrieve your saved data from system  without connecting system A& system B.	No, it is not possible	Using appropriate device
Yes, without connecting it is not possible but it is possible when we connect system A & system B. look this figure(drawing the figure on the blackboard 	Looking at the board and listen attentively.	Maintenance of continuity Using appropriate device
Like that number of computers can be connected together by communication channels and each computer can share the same data.	Listen Attentively	Maintenance of continuity
What do you call this type of data sharing?	No response	Relevancy of non-verbal behavior.
When a group of computers connected together to share data and resources is called Networking	Listen Attentively	Relevancy of verbal behavior.
well, students now you will know more about the Networking.		

Observation Schedule Cum Rating Scale

The observation schedule cum rating scale for the skill of introducing the lesson comprises of three columns. The first column indicates the components of the skill. The second column specifies the tallies against all the components. The third one indicates rating from one to seven against each of the components. The rating indicates the adequacy of the acquisition of the component of the skill. The rating may be indicated by encircling O the number which represents the observer's assessment.

Sr. No.	Components	Tallies (Frequency occurrence)	Rating scale From Extremely poor to Excellent
1	Maximum utilization of previous knowledge of pupil		1234567
2	Using appropriate device		1234567
3	Maintenance of continuity		1234567
4	Relevancy of verbal or non-verbal behaviour		1234567

SKILL OF QUESTIONING

Questioning skill can be defined as a teaching skill helpful in putting the desired, meaningful, clear, relevant, precise, specific, grammatically correct, simple and straight forward question to the students in a classroom teaching-learning situation for the purpose of testing their knowledge & understanding.

Components of the skill:-

1. Relevant Question
2. Specific Question
3. Grammatically Correctness
4. Conciseness
5. Speed in asking Question

1. **Relevant Question:-** Questions should be relevant to the topic.
2. **Specific Question:-** Questions should be specific to the topic.
3. **Grammatically Correctness:-** Questions should be framed correctly.
4. **Conciseness:-** Questions should be concise & clear.
5. **Speed in asking Question :-** Students should be given time to response before asking the other question.

Micro Lesson Plan

SKILL OF QUESTIONING

Date- Pupil teacher's roll no-
Subject:-Computer Science Class-
Topic- Computer and its Components Duration-5-7 min.

Pupil Teacher's Activity	Student Activity	Components
What is a computer?	Computer is an electronic machine which accept input ,process input input and display the result on the monitor according to the user's need.	Clarity
How many components of a computer does have?	A computer have three components .	Relevant
Give the names of three components of a computer?	The three components are: The Input Unit The Processing Unit	Specification
	The Output Unit	
Which unit is used to enter the data in the computer?	Input unit	Conciseness
What is known as the brain of the computer?	The Central Processing Unit	Specification
What is the output unit?	The Output unit contain the devices which are used to display the result.	Relevant
Give some examples of input unit.	Keyboard, Mouse.	Grammatically Correct.
What are the various output devices?	The output devices are Monitor and Printer.	Clarity
Is printer an example of output device?	Yes	Specification
Why CPU is called the Brain of the computer?	As it does all processing, also store data and control all parts of the computer.	Conciseness

Observation Schedule Cum Rating Scale

The observation schedule cum rating scale for the skill of Questioning comprises of three columns. The first column indicates the components of the skill. The second column specifies the tallies against all the components. The third one indicates rating from one to seven against each of the components. The rating indicates the adequacy of the acquisition of the component of the skill. The rating may be indicated by encircling O the number which represents the observer's assessment.

Sr. No.	Components	Tallies (Frequency occurrence)	Rating scale From Extremely poor to Excellent
1	Relevant Question		1234567
2	Specific Question		1234567
3	Grammatically Correctness		1234567
4	Conciseness		1234567
5	Speed in asking Question		1234567

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14

Methods of Teaching

"The aim of teaching is simple: it is to make student learning possible...To teach is to make an assumption about what and how the student learns; therefore, to teach well implies learning about students' learning" (Ramsden, 1992).

Teaching does not mean simply going into the class and coming back. Its actual meaning is to bring about socially desirable behavior and necessary changes in the students through a systematic and effective procedure. The teacher must adopt such a method with which the hidden knowledge in the mind of the pupil and the knowledge of the world are correlated and integrated. This organized systematic scheme of interpreting the world of knowledge to the child's mind is called the Method of Teaching. So we can define teaching method as It is a systematic way of doing something which implies an orderly logical arrangement of steps with more procedural.

Purposes of Methods

The following are the reasons why we use teaching methods during teaching process.

1. It makes learning more efficient
2. It enables the learner to think logically
3. It facilitates smooth transition from one activity to another
4. It serves as guide in preparing all the needed materials, tasks and equipments.
5. It defines the approximate time to be allotted for each activity to avoid waste of time and lapses.
6. It makes planning clear and precise, to prevent confusion, unnecessary delays and time wastage.

7. It helps in planning for assessment and evaluation of the lesson.
8. It add a feeling of confidence and security for the teacher and students.

Principles of Selecting Methods

The following principles should be considered during the selection of method.

- It must be based on sound principles, laws and theories of learning.
- It must be consistent with the requirements of objectives.
- It must be appropriate with the content.
- It must give to way to varied students' participation.
- It must consider to be undertaken to ensure gainful learning.
- It must assist the learners to define their purposes and motive.
- It must originate from the learners' past experiences.
- It must suit individual differences, needs, interests and developmental maturity.
- It must the learners to the world of diverse learning experiences.
- It must stimulate the learners to think critically, analytically and creatively.
- It must Must be challenging
- It must be flexible.

Factors to Consider in Choosing a Method

While selecting the method for teaching the content the teacher should consider the following.

- **Learner's ability**: The first and foremost consideration based on the nature/characteristics, age, maturity, abilities, etc.
- **Teacher's ability**: Teacher must be personally and professionally qualified to teach
- **Objective** : The expected outcome of the lesson in terms of knowledge/ skills and attitudes.
- **Subject Matter** : The content to be taken so that the desired outcome will be achieved.
- **Pre requisite learning** : That is students' experiences which can help to facilitate acquisition of new knowledge, skills and attitudes.
- **Time allotment**: specified target frame for chosen activities properly distributed to the entire period.
- **Safety precautions**: students should feel that they are safe and out of danger in the school.

- **School climate**: The learner should feel the warmth of the teachers and classmate.
- **Classroom set up**: It must be inviting to students and conducive to learning.
- **School facilities/equipments/technologies**: The availability of the needed equipments, technologies, tools for learning found in the right places.

It is in fact, not a well planned syllabus but methods of teaching which makes the teaching impressive. It is true that teaching is an inborn act but by practice teacher can train himself. A method good for one class at one time for certain topic may be a complete failure at another time in another class and for another topic. There are few methods which are described here:

- Lecture-cum-Demonstration Method
- Laboratory Method
- Project Method
- Inductive-Deductive Method
- Problem Solving Method
- Advanced Methods of Teaching : CML,CAI, Mobile Learning and Online Learning.

Lecture-cum-Demonstration Method

Lecture-cum-demonstration includes two methods i.e. lecture as well as demonstration method. In Lecture method teacher just tells but in demonstration method teacher shows and illustrates certain fundamental phenomena. Let we know firstly about the both methods separately.

Lecture Method

Lecture method is not a new method, but it is a traditional autocratic method. Books were not available then and manuscripts were rare and hence lecture method was used for instruction. Lecture means teaching a lesson in the form of speech or talk. The teacher delivers a lecture on a particular topic and the students keep listening in an idle manner. The lecture method has been the earliest known methods of instruction.

Features of Lecture Method

Following are the features of this method

- It is a convenient method for the teacher.
- It is useful for higher classes.

- It is easy, brief and attractive for teacher.
- It provides more information in a short time period.
- More number of students can listen and prepare notes.
- The argumentative flow of the subject is restricted.
- The flow of thought is maintained and the teacher tells about many new things.
- The teacher is always alert.

Merits

- This method presents the proper orientation of the subject and can be used to cover a lengthy syllabus in a short interval of time in an impressive way.
- It makes possible to stimulate interest in the subject.
- This method is economical and usually followed in colleges or in high classes of the schools with big classes. A single teacher can teach a large number of students while adopting this method.
- This method can be successful for rapid revision.
- This is an attractive and concise method and the teacher always feels secure and satisfied with his progress.
- Factual information about historical incidents etc, can be easily imparted to the students by this method.
- It facilitates inter-disciplinary approach to topics
- This method proceeds logically and the logical sequence of ideas in not interrupted.
- Spoken word has greater weight than books

Demerits

- This method neglects the experimental work and therefore the students do not get any opportunity to develop their intellectual power, and capability of discovering new things for themselves.
- This method is against the principle of learning by doing and does not encourage the habit of independent thinking, self-reliance and self-confidence among the pupils.
- Only the teacher plans the actual part and students always remain dormant. This is unpsychological.
- The teachers can get only his self-satisfaction and there is no assurance whether the students have followed or not what he had

taught in the classes. If the lecturer is very fast, the pupils cannot easily take notes and follow the lecture

- The rate of imparting knowledge to the students may not be according to the capabilities of the learners. They do not get necessary connections of thought.
- Too much stress is laid on the memory work which is just a burden on the minds of students. It decrease the initiative of pupils and their problem solving attitude.
- It is waste of time to repeat the matter already present in books.

Demonstration method

Demonstration method involves "showing what or showing how". The dictionary meaning of the word "demonstration" is the outward showing of a feeling etc., a description and explanation by experiment i.e. logically prove the truth; or a practical display of a piece of equipment to show its display and its capabilities .

In this method, the spoken word is supplemented with demonstration using varied aids resulting in auditory and visual learning. It involves getting answers from pupils as the demonstration proceeds gradually in stages. By the help of this method, the student himself makes observation and acquires permanent and true knowledge. The student makes observations and acquires firsthand knowledge. The teacher only encourages to make observations and students act accordingly.

In short it is a proof provided by logic, argument etc. To define "it is a physical display of the form, outline or a substance of object or Events for the purpose of increasing knowledge of such objects or events.

Features of Demonstration method: Following are the features of this method

- The knowledge is acquired from natural resources and thus permanent.
- This method helps students to seek, think, give logic and to convey their thoughts independently.
- The students are able to learn the similarities and dissimilarities of objects clearly and easily.
- The work of the teacher is made easy.
- Develops the interest of the students in the subjects.
- The students learn in a systematic procedure.

Merits

- Much matter can be covered in a short time

- Only one set of apparatus is required , so it is economical
- Demonstration will stimulate the thoughts of pupil
- By the expression of the pupils, the method of delivery of lecture could be varied to suit the needs of the learner
- Possible wastage of time, effort and resources will be avoided since the demonstration is supposed to be well- planned in advance.
- The findings are reliable and accurate since the procedure has been tried before.

Demerits

- Students are devoid of doing practical work
- It seems that all students see same facts but it does not mean they follow it

Lecture-cum-Demonstration Method

Students cannot learn the subject either by lecture or by demonstration used in isolation. This method includes the merits of lecture method and Demonstration method. The teacher performs the experiment in the class and goes on explaining What he/she does. It takes into account the active participation of the student and is thus not a lopsided process like the lecture method. The students see the actual apparatus and operations and help the teacher in demonstrating experiments and thereby they feel interested in learning. So also this method follows maxims from concrete to abstract Wherein the students observe the demonstration critically and try to draw inferences. Thus with help of lecture cum demonstration method their power of observation and reasoning are also exercised. So the important principle on which this method works is "Truth is that works." For eg. Suppose the teacher wants to teach the topic ' operations of a computer' then he/she demonstrate this by operation of a computer associated with lecture method in order to sustain the attention of the students and also making the students to participate in this activity.

Purpose of Lecture-cum-Demonstration Method

Following are the purposes of this method:

- It helps in gaining learning.
- It helps in Problem solving.
- It Verify the facts
- It Develop scientific skill

A Good Demonstration Should Have

For the success of any demonstration following points should be kept in mind.

- It should be planned and rehearsed by the teacher before hand.
- The apparatus used for demonstration should be big enough to be seen by the whole class. If the class may be disciplined she may allow them to sit on the benches to enable them a better view.
- Adequate lighting arrangements be made on demonstration table and a proper background table need to be provided.
- All the pieces of apparatus be placed in order before starting the demonstration. The apparatus likely to be used should be placed in the left hand side of the table and it should be arranged in the same order in which it is likely to be used
- Before actually starting the demonstration a clear statement about the purpose of demonstration be made to the students.
- The teacher makes sure that the demonstration lecture method leads to active participation of the students in the process of teaching.
- The demonstration should be quick and slick and should not appear to linger on unnecessarily.
- The demonstration should be interesting so that it captures the attention of the students.
- It would be better if the teacher demonstrates with materials or things the children handles in everyday life.
- For active participation of students the teacher may call individual student in turn to help him in demonstration.
- The teacher should write the summary of the principles arrived at because of demonstration on the blackboard. The black board can be also used for drawing the necessary diagrams. These are some of the requirements of a good demonstrations.
- The teacher should ask objective questions to make students alert during demonstration.

Steps in Lecture-cum-demonstration

1) **Planning and Preparation**: A great care be taken by the teacher while planning and preparing his demonstration. While planning a demonstration the following points should be kept in mind.

- Subject matter
- Lesson planning

- Rehearsal of experiment
- Collection and arrangement of apparatus
- Identify the concepts to be explained
- Formulate objectives

2) **Introduction of lesson:** It is always considered more useful to introduce the lesson in a problematic way which would make the student's realise the importance of the topic. The lesson may be introduced by motivating students on the following basis

- Student's personal experience
- Student's environment
- Telling story
- A simple and interesting experiment

3) **Presentation of the subject matter:** The method presenting the subject matter is very important. A good teacher should present his lesson in an interesting manner so the following points should be kept in mind.

- The teacher must study the subject matter on broad basis taking into consideration the interest and experience of students
- While demonstration is going on, question should also be asked which help the students to understand the principles
- The teacher should try to illustrate the facts and principles
- Language used by teacher should be simple and clear.
- All the matter should not be displayed at once

4) **Performance of experiment:** Through this method we want children to observe what happens in a experiment and to state it carefully. We also want them to make generalization without violating scientific spirit. The following steps are generally accepted as valuable in conducting experiment.

- Demonstration should be properly spaced and striking, clear and convincing
- The demonstration table should have only apparatus
- The experiment should be simple and speedy
- All the apparatus should not be displayed at once

5) **Blackboard work & Summary**

There should be a blackboard behind the demonstration table in order to summarize the principles and other matters of demonstration and also to draw necessary diagrams and sketches.

6) **Supervision:** Students are asked to take the complete notes of the black board summary including the sketches and diagrams drawn. Such a record will be quite helpful to the student while learning the lessons .Such a summary will prove beneficial only if it has been copied correctly from the black boards and to make sure that it is done so the teacher must check it frequently during this stage.

Common Errors In Demonstration Lesson

A summary of the common errors committed while delivering a demonstration lesson is given below:

- Apparatus may not be ready for use
- There may not be an apparent relation between the demonstration experiment and the topic under discussion.
- Black board summary not up to the mark
- Teacher may be in a hurry to arrive at a generalisation without allowing students to arrive at a generalisation from facts.
- Teacher may take to talking too much which will mar the enthusiasm of the students.
- Teacher may not have allowed sufficient time for recording of data.
- Teacher may fail to ask the right type of questions

Merits of Lecture cum Demonstration Method

- It is an economical method as compared to a purely student centered method
- It is a psychological method and students take active interest in the teaching learning process
- It leads the students from concrete to abstract situations
- It is suitable method if the apparatus to be handled is costly and sensitive. Such apparatus is likely to be handled and damaged by the students.
- This method is safe if the experiment is dangerous.
- In comparison to Heuristic, Project method it is time saving but purely Lecture method is too lengthy
- It can be successfully used for all types of students
- It improves the observational and reasoning skills of the students

Limitations of Lecture cum Demonstration Method

- It provides no scope for "Learning by Doing" for the Students as students are only observing the Teacher performing.

- Since Teacher performs the experiment at his/ her own pace many students may not be able to comprehend the concept being clarified.
- Since this method is not child centered it makes no provision for individual differences, all types of students including slow learners and genius have to proceed with the same speed.
- It fails to develop laboratory skills in the students.
- It fails to impart training in scientific attitude. In this method students many a times fail to observe many finer details of the apparatus used because they observe it from a distance.

Laboratory Method and Research Method

This method deals with first hand experiences regarding materials or facts obtained from investigation or experimentation. Laboratories are wonderful settings for teaching and learning . They provide students with opportunities to think about, discuss, and solve real problems.

Types of Laboratory Method

Two types of Laboratory Method are:

1. **Experimental**: It aims to train students in problem solving with incidental acquisition of information and motor skills, emphasis is on discovery, original procedure, and solution of problems.
2. **Observational Type** : It is based on the acquisition of facts. Activities would include visits to museums, exhibits or galleries, watching documentaries, going on filed trips.

Features of Laboratory Method :

1. To promote information acquisition through observation, experimental solutions to problems guided by reflective thinking and acquisition of skill in manipulation.
2. Provides students opportunities to conduct or participate in original research.
3. Develops skill in using laboratory equipment and instruments.
4. Enhances higher order thinking skills.

Steps of Laboratory Method

1. **Orientation/Motivation**: This includes motivating and informing students about the work to be done, why should it be done and giving precise and explicit directions.
2. **Work Period** : In this students are allowed to work on their own either individually or in groups with the teacher supervising.
3. **Culminating Activities**: It is the organizing, presenting and exhibiting of the completed work.

Advantages of Laboratory Method :

1. Students learn by doing and come in contact with raw data or materials object in teaching learning process.
2. Develops the power of observation and reasoning.
3. Develops the scientific attitudes
4. Gives an understanding of what research is and how to apply the scientific method of research
5. Gives training in organizing data gathered from real materials object and how these objects are manipulated to attain the objectives.
6. Since students come in contact with real life situations, it can be a preparation for solving real life problems.

Disadvantages of Laboratory Method

1. Uneconomical way of learning in time and material.
2. Does not give much training in verbal expression.

Project Method

This method is a purposeful, natural, significant constructive activity needing both intellectual and physical solutions. This method is entirely based on the fact that children can learn a lot through associated and mutual co-operation. The essence of the method is to carry out a purposeful activity in a group in which all the children work co-operatively. As the name indicates, all the students work together in the form of a small group and participate according to their interests and capabilities. Learning by doing and learning by living are the central themes of this method.

Definition of project

"A project is a problematic act carried to completion in its natural setting" – Stevenson

"A project is a whole-hearted purposeful activity proceeding in social environment" – Kilpatrick

"It is a unit of activity in which pupils are made responsible for planning and purposing" - Parker

Features of Project method

Following are the features of this method

- This method is based on the principle of learning by doing, and learning by living.
- In this method, school curriculum and contents of studies are considered from pupil's point of view.

- It also illustrates problem solving method.
- It is a pupil centered method.
- The students work out problems selected by themselves, investigate them and solve them in groups or individually.
- The teacher act as a guide and instructor.

Types of Project

Projects are of the following two types—

1. **Individual Project:** Individual projects are such projects which every pupil completes in his own way. By completing them, social qualities do not develop in the pupils.
2. **Social Projects:** Social projects are those projects which are completed by the students of a class collectively. Such projects develop feelings of citizenship and sociability in the pupils.

According to W.H. Kilpatrick, projects are of following four types-

1. **Constructive Projects**: In constructive projects, the nature of the work is physical, such as- letter writing, digging of a well, making models and playing a drama etc.
2. **Aesthetic Projects**: In aesthetic projects, some artistic or aesthetic feeling is aroused, such as- presenting a music programme, recitation of poems etc.
3. **Problematic Projects**: In problematic projects, some intellectual problem is solved, such as-why tide occurs in a sea?, why it rains? etc.
4. **Drill Projects:** In drill projects, the working efficiency and capacity of the pupils are increased such as-drawing a map and a sketch.

Principle Underlying Project Strategy:

Project strategy is based on the following principles:

1. **Principle of Purposiveness:** According to this principle, there must be some objective of the project. Its reason is that the pupils do that work with more enthusiasm which have definite and clear objectives.
2. **Principle of Utility**: According to this principle, the project must possess the quality of utility. It is because the pupils do the work with more interest which are useful for them.
3. **Principle of Reality:** According to this principle, the project should be real. Only then, the pupils would be able to complete it naturally and in real conditions.
4. **Principle of Activity**: According to this principle, the project should be activity-centered. Its reason is that the knowledge gained as a result of activity is stable and useful.

5. **Principle of Freedom:** According to this principle, the pupils are free to select the project. They select the project according to their will and they execute it with the advice of the teachers.
6. **Principle of Social Development**: According to this principle, the project should be such that the social development of the pupils may occur by social attributes and social contacts.

Steps involved in a Project method:

1. **Providing a situation to propose a project :** Many opportunities should be given to students to express their ideas and to have discussions among themselves. While choosing a problem the teacher should know that it is real need of students. No project or activity should be forced on them.
2. **Choosing and proposing the topic :** The topic should be chosen or proposed by the students. The teacher should stimulate discussion by suggestions. The teacher should see that the project is the real need of the students and is acceptable to all. Its purpose should be clearly defined and well understood by the students.
3. **Planning :**The whole project should be planned with common discussions between students and teacher. Every student should be encouraged to take part in discussion and to make suggestions. Any type of inferiority complex or shyness in the mind of a student must be removed by proper techniques.
4. **Executing :** The whole work and duties are assigned to the students according to their interest and capability. The role of the teacher is just to have proper control over the work, which is being done by the pupils. He should encourage, guide and watch the progress of the students and give them instructions wherever they need. Execution is the longest step in the project and it requires patience to completer it.
5. **Evaluating the project :** When the project is complete, students should have a discussion over it with the help of teacher. Deficiencies and weak points should be discussed.
6. **Recording :** At the end, the student should frame a complete record of their work, their planning, discussions on important aspects, duties and achievement etc. and finally criticism of their own work and guidance for future work.

Merits of Project Method

- It is based on three laws of learning i.e. law of readiness, law of exercise, law of effect
- It develops among students self confidence

- Correlation of various subjects is achieved
- Problem solving method is stressed
- Learning travels from hand to head and is therefore retained for a longer time.
- Co-operative activity is encourages, as a result of which power of tolerance and socially desirable habits are flourished.
- Being a democratic way of learning, open mindedness and thinking power are developed because the students choose their topics and complete the project themselves.
- Dignity of labor is developed. Pupils have respect and taste for all type of work.
- It is a wholehearted activity.

Demerits of Project Method

- A lot of time is required. Hence the course cannot be covered within a specific period. So the quantity of knowledge suffers in this method.
- The teacher has to work hard and only expert teachers can be successful.
- It requires a well-equipped library and laboratories to organize any activity.
- The whole syllabus cannot be included and interpreted in the form of projects.
- Selection of good projects is not possible for all pupils.
- There is no provision for drill and practice.
- It is expensive.

Criteria of selecting a project

The project should have:

- It should have definite educational value
- It should have according to need and ability of students
- It should be selected by students
- It should provide purposeful activity
- It should be challenging

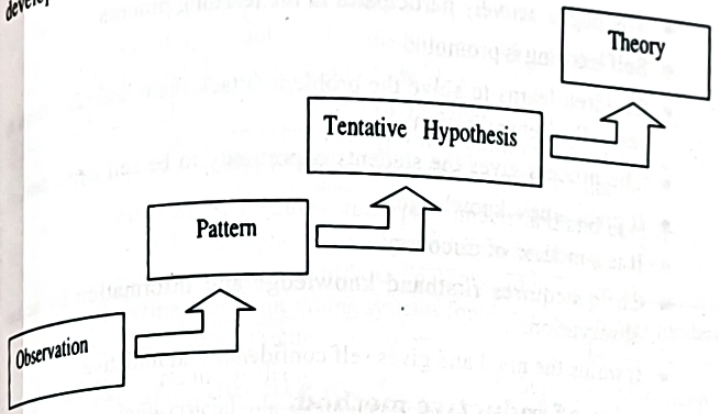
INDUCTIVE-DEDUCTIVE METHOD

The inductive approach

Inductive method of teaching is based on the claim that knowledge is built primarily from a learner's experiences and interactions with phenomena. It is

also called Discovery teaching or Inquiry teaching. A teacher using an inductive approach begins by exposing students to a concrete instance, or instances of a concept. Then learners are encouraged to observe patterns, raise questions, or make generalizations from their observations. The teacher's role is to create opportunities and the context in which students can successfully make the appropriate generalizations, and to guide students as necessary.

Inductive reasoning works in a different way. It leads from specific observations to broader generalizations and theories. We can say it is **a "bottom up" approach.** In inductive reasoning, we start with specific observations and then patterns. We can explore a tentative hypothesis, and finally end up developing some general conclusions or theories.



Features of inductive method

Following are the features of this method

- This method requires the study and careful examination of particular facts to deduce a general principle.
- Pupils are actively engaged in thinking for themselves and discovered new rule, generalization etc.
- The students draw generalization from particular principles, from observed rules and from instances.
- It is more open-ended and exploratory.
- It is very natural method of learning.

Steps involved in inductive method

1. **Sensing the problem:** The pupils define the problem.
2. **Analysing the situation:** The situation is analysed and relevant information is sought. It may require book study, references, making field trips etc.

3. **Organising information:** Under the guidance of the teacher the pupils organise the collected information
4. **Framing solution :** The children frame possible solutions. The teacher acts as guide.
5. **Eliminating:** Only the Possible solutions are kept and others are eliminated
6. **Verification:** The solutions are applied to the situation and results are checked. The procedure is related until a correct solution is discovered.

Merits of inductive method

- It promotes mental ability
- The pupils actively participates in the learning process
- Self learning is promoted
- Children learns to solve the problem, attack them and plan them to reach the generalisation.
- The process gives the students opportunity to be self dependent.
- It gives a new knowledge.
- It is a method of discovery.
- Child acquires firsthand knowledge and information by actual observation.
- It trains the mind and gives self confidence and initiative

Demerits of inductive method

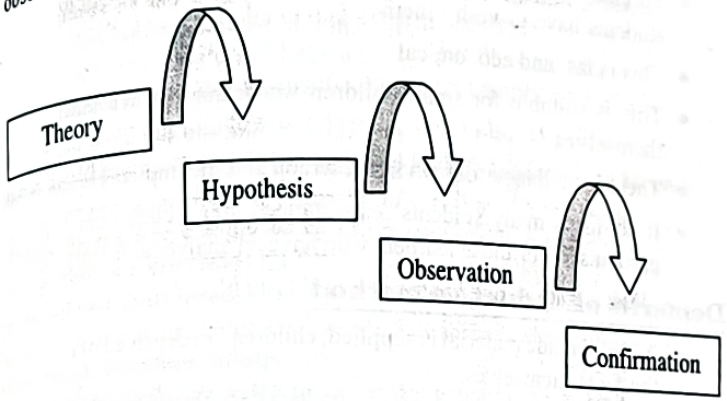
- The time taken to work out a rule may be at the expense of time spent in putting the rule to some sort of productive practice.
- Students may hypothesise the wrong rule, or their version of the rule may be either too broad or too narrow in its application: this is especially a danger where there is no overt testing of their hypotheses, either through practice examples, or by eliciting an explicit statement of the rule.
- It can place heavy demands on teachers in planning a lesson. They need to select and organise the data carefully so as to guide learners to an accurate formulation of the rule, while also ensuring the data is intelligible.
- It is an incomplete method

The deductive approach

Deductive method of teaching is much less constructivist and is based on the idea that a highly structured presentation of content creates optimal

learning of students. It is also called direct instruction. The teacher using a deductive approach typically presents a general concept by first defining it and then providing examples or illustrations that demonstrates the idea. Examples that do not fit the idea are helpful in confirming the idea. Students are given opportunities to practice, with constructor guidance and feedback, applying and finding examples of the concept at hand, until they achieve concept mastery.

Deductive reasoning works from the general to the specific. We can also call it a **"top-down" approach.** We will begin by thinking up a theory of interest and then placing it into more specific hypotheses, which can be tested and observations collected to prove or disprove the hypotheses.



Features of deductive method

Following are the features of this method

- It suggests the verification of general principles, rules, definitions already learnt.
- It move from a more general level to a more specific one.
- It is associate with scientific investigation.

It should be noted that this method has two functions to perform:

- Drawing inferences from general principles studied.
- Explaining particular facts with the help of general principles, laws etc.

Steps involved in deductive method

The following steps are used in it

1. **Understanding the problem:** The pupils understand the problem. They define and formulate it
2. **Collecting information:** The pupils gather information about the problem

3. **Reviewing:** The Principles, generalizations are reviewed to find facts which may be applied to find a suitable solution, conclusion or result.
4. **Drawing inferences:** The principle, rule or generalization is applied to the case and inferences are drawn that the problem falls under such and such principle.
5. **Verification:** The principle is applied to the case. If it solves the problem, it is accepted otherwise the procedure is repeated to find the correct one.

Merits of deductive method

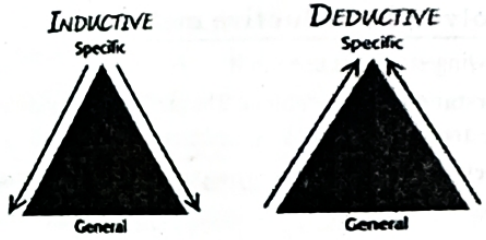
- Teacher's work is simplified. He gives general principles and the students have to verify them
- This is fast and economical
- This is suitable for small children who cannot prove the facts by themselves
- There is no danger of arriving at wrong and incomplete results
- It confirms many students' expectations about classroom learning, particularly for those learners who have an analytical learning style.

Demerits of deductive method

- As readymade material is supplied, children are deprived of exploring the facts themselves.
- It encourages memorization.
- Self confidence is not encouraged.
- It does not motivate the students as facts are not found by them.
- Lack of students' involvement and struggle for understanding.

Inductive versus Deductive

Both **Inductive** and **Deductive** sequences are valuable for teaching concepts, generalizations, processes, and skills but there is difference between the two approaches. The table given below shows the differences between them.



Inductive Method	Deductive Method
1. It gives new knowledge	1. It does not give any new knowledge.
2. It is a method of discovery.	2. It is a method of verification.
3. It is a method of teaching.	3. It is the method of instruction.
4.Child acquires first hand knowledge and information by actual observation.	4. Child gets ready made information and makes use of it.
5. It is a slow process.	5. It is quick process.
6. It trains the mind and gives self confidence and initiative.	6. It encourages dependence on other sources.
7. It is full of activity.	7. There is less scope of activity in it.
8. It is an upward process of thought and leads to principles.	8. It is a downward process of thought and leads to useful results.

Problem Solving Method

Problem-solving is the ability to identify and solve problems by applying appropriate skills systematically. It is a purposeful activity aimed at removing difficulty or perplexity through a process of reasoning. Problem-solving is a process—an ongoing activity in which we take what we know to discover what we don't know. It involves overcoming obstacles by generating hypotheses, testing those predictions, and arriving at satisfactory solutions. Problem-solving is the ability to identify and solve problems by applying appropriate skills systematically.

Problem-based learning is a method of educating the learners that combines theoretical knowledge with practical application. The process engages participants in considering complex and challenging issues and encourages them to work collaboratively towards finding an appropriate solution.

Features of Problem Solving Method

1. Allows for students' active involvement resulting in meaningful experiences.
2. Develops independence and higher level thinking skills.
3. Promotes open – mindedness and wise judgment

Problem-solving involves three basic functions

1. Seeking information
2. Generating new knowledge
3. Making decisions

Steps in Problem solving method

1. **Ability 'to sense the problem and emergence of problem:-** As odd as it sounds, identifying a situation as problematic is sometimes a difficult step.

- This arises due to students reading of lessons, their interest during teacher's discussions in the class, through field trips or by seeing film.
- At this stage the teacher can raise a problem by providing situation.
- It should be however, confirmed by the teacher.
- That problem is purposeful and is, according to the need and requirements of students; availability of material relevant to the problem should also be considered.
- It should be from majority of students' side and better if it fits into curriculum.

2. **Defining the problem:** We may fail to recognize that we have a goal, that our path to a goal is obstructed, or that the solution we had in our mind does not work. If our problem is the need to write a term paper, we must first identify a question that our paper will address.
   - Here the students need much of teacher's help, as children may find it difficult to define the problem themselves.
   - Different statements can be given about it.
   - The most essential feature of the defining of problem is that students should understand the problem and grasp it.
3. **Collecting & organizing the data**: Now students are ready to collect and organize the available information. Of course, throughout the problem-solving cycle, they are constantly organizing and reorganizing the available information. At this step, however, they organize the information strategically, finding a representation that best enables them to implement their strategy.
   - When the students have defined the problem they know the possible solution.
   - Now the teacher should help the students to collect the relevant data.
   - They may have to read extra books, draw charts, prepare models, make field trips.
   - They can discuss it with experts.
   - It should be by observation, study and experiment.
4. **Interpreting the data**: This is an important and bit difficult step and it is possible only if the students do not divert their attention from the main problem.
   - When the students have collected the data, they have now to eliminate unnecessary material.
   - This step involves thinking and reasoning

- Judgment should not be given till sufficient data are collected and organized in a systematic way.
- The teacher should prepare the students in such a way that they do not quickly jump to conclusion.

5. **Consideration of evidence leading to formation of conclusions**: On the basis of Recorded or collected data
   - After the data are collected and organized, the students should move towards final solutions.
   - The teacher should see that students should complete this step by their essential thinking.
   - Now individual differences will appear as some bright students will find solution easily whereas others may take longer time.
6. **Testing Conclusions or verification of solution :**
   The results are to be verified to prove their correctness. This can be done by applying the results to other situations or some demonstration can be done by the teacher.

Advantages of the problem solving method

- The students discover new knowledge
- They learn how to act in a new situation
- They learn how to make certain things
- They learn how to get out of a difficult situation
- They learn to verify opinion
- It provides opportunity to satisfy their curiosity
- They become able to limit and define problems
- They learn to invent new devices
- They learn to create new ideas
- It develops the habit of extra study
- It takes into account the individual difference

Disadvantages of problem solving method

- Time consuming
- Unsuitable for small children
- Dull and monotonous
- Neglecting physical activity
- No satisfactory results

Advanced Methods of Teaching : CML,CAI, Mobile Learning and Online Learning

Computer managed learning (CML)

Meaning

Computer-managed instruction is an instructional strategy whereby the computer is used to provide learning objectives, learning resources, and assessment of learner performance. It refers to the use of a computer system to manage information about learner performance and learning resources options.

The Computer Managed Learning is an electronic management information system of a student learning. It is a significant application of computer technology for accountability and documentation of student progress by electronic filing, sorting, and reporting of his learning outcomes. Computer-managed instruction (CMI) aids the instructor in instructional management without actually doing the teaching.

Definitions

CML is an electronic learning management system that allows data from tests to be analysed, providing information which can be the basis of educational decisions"

Acc to Hofmeister : "The systematic control of instruction by the computer, characterized by testing, diagnosis, learning prescriptions, and thorough record-keeping"

Acc to Hartmann (1989) CML as a record keeping system or information management system is a significant improvement over manually based operations.

Features & functions of Computer managed learning (CML)

CMI in its most sophisticated levels provides the following instructional functions.

- It assesses the learner's present level of knowledge.
- It diagnoses weakness or gaps in the student's learning.
- It prescribes learning activities to remediate the identified weaknesses.
- It continuously monitors progress of the learner.
- It is an improvement over Manual Performance Record system.
- It is the use of computer technology to collect, analyze , and report information concerning the performance of students in an educational program.

- It is a system to monitor student progress and the effectiveness of their instruction.

Merits of Computer managed learning (CML) system:

- It treats every student as an individual and helps teachers to follow suit.
- It allows students to be extended or remediated as required.
- It makes computer software accessible and relevant.
- It provides accurate measurement and analysis for decision making.
- It provides accountability and control .
- It traps, retains and shares valuable resources developed by teachers over time.
- It facilitates quality control of the teaching process.
- It allows for new goal setting in measurable education outcomes.
- It gives back huge amounts of time from testing and marking that is better spent on creative student learning.
- It provides previously unknown data on which to constantly refine and improve the teaching method.

Demerits of Computer managed learning (CML) system:

Electronic data bases manage information poses the possible dangers of:

- The volume of information can present problems for teachers, providing too much material to use in reasonable ways.
- What kinds of controls exist to assure the accuracy of the information?
- Increased impersonalization.
- Not enough well trained educators computer literate to assure proper use or systems.

Computer Assisted Instruction (CAI)

Computer-assisted instruction (CAI) represents a teaching tool that involves the use of a computer program or programs to facilitate the education of a group of students. Its major goal is to provide practical instruction through interactive programs that teach effectively. The method was first introduced in the 1960s. Since then it has evolved so that in the twenty-first century computers are an integral part of the education process in the developed countries.

CAI is an interactive instructional technique where a computer is used to present the instructional material and also to monitor the learning of the learners. It provides individualized and self paced instructions to the learners.

Definitions

Jurich, 2001 and Cotton, 2001; 'Computer Assisted Instruction (CAI) is a program of instructional material presented by means of a computer or computer systems. Drill and practice software is generally called Computer-Assisted Instruction'.

Kara et al2007, Jurich, 2001, Barot, 2009 and Yusuf, 2010; 'Computer-assisted instruction (CAI) is that in which teacher use computers at different times and spaces according to the characteristics of the subject matter, the students and the available software and hardware. Most recent CAI software integrates features that encourage activities beyond the simple drill-and-practice, such as simulations, graphing and even modelling'.

Features of Computer Assisted Instructional (CAI)

Computer-assisted instruction (CAI) is an interactive instructional technique whereby a computer is used to present the instructional material and monitor the learning that takes place.

- CAI uses a combination of text, graphics, sound and video in enhancing the learning process.
- It has many purposes in the classroom, and can be utilized to help a student in all areas of the curriculum.
- It refers to the use of the computer as a tool to facilitate and improve instruction. CAI programs use tutorials, drill and practice, simulation, and problem solving approaches to present topics, and they test the student's understanding.
- It is a self-learning technique, usually offline/online, involving interaction of the student with programmed instructional materials.

Functions of Computer Assisted Instructional (CAI)

It provides to the students:

- text or multimedia content
- multiple-choice questions
- immediate feedback
- notes on incorrect responses
- summarizes students' performance
- exercises for practice
- Worksheets and tests.

Types of Computer Assisted Instruction

- **Drill-and-practice :** Drill and practice provide opportunities for students to repeatedly practice the skills that have previously been presented and that further practice is necessary for mastery.
- **Tutorial :** Tutorial activity includes both the presentation of information and its extension into different forms of work, including drill and practice, games and simulation.
- **Games:** Game software often creates a contest to achieve the highest score and either beat others or beat the computer.
- **Simulation:** Simulation software can provide an approximation of reality that does not require the expense of real life or its risks.
- **Discovery:** Discovery approach provides a large database of information specific to a course or content area and challenges the learner to analyze, compare, infer and evaluate based on their explorations of the data.
- **Problem Solving :** This approach helps children develop specific problem solving skills and strategies.

Advantages of CAI :

- It is one-to-one interaction.
- It act as a great motivator.
- It provides freedom to experiment with different options.
- It gives instantaneous response/immediate feedback to the answers elicited.
- It is Self pacing - allow students to proceed at their own pace.
- It Helps teacher to devote more time to individual students.
- By maintaining the privacy it helps the shy and slow learner to learns.
- It pays Individual attention .
- It helps to learn more and more rapidly
- With multimedia it helps to understand difficult concepts through multi sensory approach.
- It is self directed learning – students can decide when, where, and what to learn

Limitations of CAI

- Sometimes it may feel overwhelmed by the information and resources available.
- Over use of multimedia may divert the attention from the content.
- Learning becomes too mechanical.
- Good CAI packages are not available.
- Lack of infrastructure in institutions.

Mobile Learning

Mobile learning is emerging as one of the solutions to the challenges faced by education. With a variety of tools and resources always available, mobile learning provides increased options for the personalization of learning. Mobile learning in classrooms often has students working interdependently, in groups, or individually to solve problems, to work on projects, to meet individual needs, and to allow for student voice and choice. With access to so much content anytime and anywhere, there are plenty of opportunities for formal and informal learning, both inside and outside the classroom. Notebooks, mobile Tablets, iPod touch, and iPods are very popular devices for mobile learning because of their cost and availability of apps. They are used for collecting students' responses (clickers), reading electronic books and websites, recording reflections, documenting field trips, collecting and analyzing data, and much more.

Mobile learning can happen anywhere, in a classroom, at the dining room table, on a bus, in front of a science exhibit, and anywhere. Portability is not as important as the ability of the learner to connect, communicate, collaborate, and create using tools that are readily at hand.

Definitions

MOBIlearn., 2003; "Any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies".

Crescente and Lee, 2011; With the use of mobile devices, learners can learn anywhere and at any time. Mobile learning is considered to be the ability to use mobile devices to support teaching and learning.

Features of Mobile Learning

- M-learning or mobile learning is defined as "learning across multiple contexts, through social and content interactions, using personal electronic devices." A form of distance education, m-learners use mobile device educational technology at their time convenience.
- M-learning technologies include handheld computers, MP3 players, notebooks, mobile phones and tablets. M-learning focuses on the mobility of the learner, interacting with portable technologies. Using mobile tools for creating learning aids and materials becomes an important part of informal learning.
- M-learning is convenient in that it is accessible from virtually anywhere. Sharing is almost instantaneous among everyone using the same content, which leads to the reception of instant feedback and tips.

Importance Of Mobile Learning

(Savill, 2010) have made the following value statements in favor of M-Learning.

- It is important to bring new technology into the classroom.
- Devices used are more lightweight than books and PCs.
- Mobile learning can be used to diversify the types of learning activities students partake in.
- Mobile learning supports the learning process rather than being integral to it.
- Mobile learning can be a useful add-on tool for students with special needs. However, for SMS and MMS this might be dependent on the students' specific disabilities or difficulties involved.
- Mobile learning can be used as a 'hook' to re-engage disaffected youth.

Benefits Of Mobile Learning

(Elias, 2011; Crescente and Lee, 2011) defined the benefits of mobile learning as:

- Relatively inexpensive opportunities, as the cost of mobile devices are significantly less than PCs and laptops.
- Multimedia content delivery and creation options .
- Continuous and situated learning support.
- Decrease in training costs.
- Potentially a more rewarding learning experience
- Improving levels of literacy, numeracy and participation in education amongst young adults.
- Using the communication features of a mobile phone as part of a larger learning activity, e.g.: sending media or texts into a central portfolio, or exporting audio files from a learning platform to your phone.

Challenges Of Mobile Learning

Technical challenges for M-Learning include:

- Connectivity and battery life
- Screen size and key size
- Meeting required bandwidth for nonstop/fast streaming
- Number of file/asset formats supported by a specific device
- Content security or copyright issue from authoring group

- Multiple standards, multiple screen sizes, multiple operating systems
- Reworking existing E-Learning materials for mobile platforms
- Limited memory
- Risk of sudden obsolescence

Social and educational challenges for M-Learning include

- How to assess learning outside the classroom.
- How to support learning across many contexts .
- Content's security or pirating issues .
- Frequent changes in device models/technologies/functionality etc.
- Developing an appropriate theory of learning for the mobile age.
- Conceptual differences between E-Learning and M-Learning .
- Design of technology to support a lifetime of learning .
- Tracking of results and proper use of this information .
- No restriction on learning timetable .
- Personal and private information and content .
- No demographic boundary .
- Disruption of students' personal and academic lives.

Online Learning

Online learning includes learning with the assistance of the Internet and a personal computer. Online learning can consist of both real-time interactions, such as in Collaborate, as well as interactions, which occur over extended periods of time, such as email or an online discussion board. Courses will be broken up into modules that contain the learning content and activities which the learner will have to complete. Each module usually begins with text readings, PowerPoint, and lectures that provide the information learner will need to complete the assignments. The learning activities will vary each module and might include discussions, scenarios, simulations, projects, or papers.

The important benefit of online learning is that it can span time and distance. learner do not have to be in the same place as teacher to obtain course related information. Even if learner are attending a traditional course, when the instructor uses Blackboard, learner can have anywhere, anytime access to the course documents along with consistent interaction with other classmates and teacher.

Definitions

'Online learning as a more recent version of distance learning which improves access to educational opportunities for learners described as both

nontraditional and disenfranchised'.

'A structured learning activity that utilizes technology with intranet/ internet-based tools and resources as the delivery method for instruction, research, assessment, and communication'.

Features of Online Learning

Online learning has become popular because of its perceived potential to provide more flexible access to content and instruction :

- It increases the availability of learning experiences for those who cannot or choose not to attend traditional schools,
- It assembles and disseminate instructional content more efficiently.
- It increases student-instructor ratios while achieving learning outcomes equal to those of traditional classroom instruction.
- It is organized in a coherent, sequential manner .
- It has instructional goals, objectives, strategies, and assessments that are aligned with state standards, benchmarks and expectations.
- It is comparable in rigor, depth, and breadth to traditionally delivered courses

Advantages of online learning

a) **Convenience and flexibility**

1. **Schedule Flexibility**: Students can access their course at any time, from anywhere they can log on, in most cases. This means that parents, working students, and professionals on the move have the option of attending classes no matter their work schedule. Students only need a computer and Internet access to take online classes.
2. **Ease of accessibility**: Courseware can be accessible for students when they need it. Students can review lectures, discussions, explanations, and comments. Individuals can also share notes with each other to help facilitate community learning.
3. **Range of options**: Students may be able to choose from a wider breadth of degree programs. Some online colleges develop and offer degree programs that might not yet be available through nearby public or private institutions.
4. **Students control study time**: On-campus courses are typically scheduled in a more rigid format, with shorter classes running 50 minutes, and others running longer. Night classes may last for nearly three hours. One of the benefits of online education is that students may not have to sit for long periods of time. Lessons can be paused when needed, and notes read at will.

b) **Student enrichment**

1. **Chance for interaction**: Online courses may be less intimidating than the brick-and-mortar classroom setting, and could help to increase student interaction. By allowing everyone to have a voice, shared ideas grow diverse as well. Students can also think longer about what they want to say and add their comments when ready. In a traditional classroom, the conversation could have moved past the point where the student may be willing to comment.
2. **Online communications**: Instructors can be more approachable in the online setting. Students may feel more comfortable talking openly with their teachers through online chats, emails, and newsgroup discussions rather than face-to-face. Online correspondence also cuts out having to wait for office hours that may not be convenient for either party.
3. **Time to absorb material**: Positive results are reported for students enrolled in online classes, according to a study by the U.S. Department of Education: "on average, students in online learning conditions performed modestly better than those receiving face-to-face instruction." Using over 1,000 empirical studies, the DOE found that time was the additive that helped students perform better. The report noted benefits in studies in which online learners spent more time on task than students in the face-to-face condition.

c) **Cost-effective choices**

1. **Money saving option**: Students may be able to save money by not having to physically attend classes. Online courses may help individuals cut down or eliminate costs of transportation, babysitting, and other expenses incurred by attending classes in a traditional setting.
2. **No more expensive textbooks**: Some web-based classes may not require physical textbooks, as reading materials may be available either through the school's own library or their partnerships with e-libraries and other digital publishers. E-textbooks might offer substantial savings for students.

Disadvantages of online learning:

- **No face to face meetings** – Clearly this entails a wide range of disadvantages. Hand gestures, voice intonation, and facial expression, can all be very important in efficiently making things clear and conveying valuable nuance. But how important will depend on the material. For students who aren't self-starters, or whose self-discipline or motivation are not sufficient, a lecture can force them to pay attention to and learn the material, because if they do not, and/or do not take

good notes the material will be lost come exam time. This illustrates a disadvantage of Power Point. Students are not forced to pay attention and take notes (which can do much to internalize and force concentration) because they may think that they can always just look at the slides later.

- **No Traditional Group Projects** – In an internet course students cannot work on group projects in the traditional face to face way. They can however work together over the internet and by phone, or through teleconferencing, which we can expect to become increasingly accessible and sophisticated. This kind of electronic group work may provide valuable experience, with the world's increasing globalization and outsourcing.
- **Academic Dishonesty** – Typical internet courses do not have proctored exams and are thus substantially more susceptible to cheating.
- **Speed and Mediation of Discussion** – With an online discussion board students have much more time to formulate and post their responses; this gives important advantages, but it also has disadvantages. The flow of the discussion is slower, and sometimes a lot of quick back and forth, question and answer, can be valuable, as it can get a lot out at once, and gives a logical flow that's all seen in a short time, where all the parts are fresh in the memory. Chat can sometimes get a fast flow going, but is harder to keep well ordered.



15

Unit Planning

'A teacher who is attempting to teach without inspiring the pupil with a desire to learn is hammering on a cold iron'

Teaching is a complex activity. It needs proper preparation and planning. Every teacher tries to plan the content in his own style so that he can teach systematically and effectively at the right moment. A unit plan is a mapping process that began with long-term plan. Unit Plan provides the overall strategy in terms of identifying the methods of teaching the specific topic and the resource required. Of the various ways of organizing materials, the unit approach clearly predominates in popular usage.

The "unit" as defined in the dictionary of education, "is an organization of various activities, experiences and types of learning around a central problem or purpose, developed co-operatively by a group of pupils under teacher leadership; involves planning, execution of plans and evaluation of results".

According to Bossing, "A unit consists of a comprehensive series of related and meaningful activities so as to achieve pupil's purposes, provide significant educational experiences and results in appropriate behavioural changes."

According to Wesley, "The unit is an organized body of information and experience designed to effect significant outcomes of the learner.'

The following are the major characteristics of the unit:

- It involves pupils in learning activities through active participation intellectually and physically.
- It develops certain information, understanding, attitude, interest and skills to enable the pupils to cope with new problems and situations more competently.

- It is a purposeful learning experience. It has significant content. It is comprehensive enough to have scope and unity.

According to Gestalt Psychology, when we perceive a figure, our attention goes first to its 'whole' form. Then, we analyse its different parts. In other words, learning is considered as 'unit'. Hence, to understand 'whole' pupils seek the help of 'unit' and the 'whole' is communicated by the 'unit'. Remember that in an unit, the meaningful activities are established in which a way that the desired behavioural changes may take place by creating appropriate learning experiences in the pupils. In this way, Gestalt Psychology gave to the concept of unit plan.

A unit plan usually consists of the vision/unit goals, unit content in detail, time allocated for the completion of each stage, how lessons/stages are designed to realize these goals collectively, pre and post-tests and cross-curricular connections, etc.

Prof. H.C. Morrison. In his book, The Practice of Teaching in Secondary Schools, advocate Morrison's Unit Approach has explained while describing unit method that the unit method is an important method from psychological point of view. It is a student-centered method. It is prepared by pupils and the teachers. In this approach, the interests, attitudes and needs of the pupils are considered. Also, the learning objectives are made clear to them. Morrison in his unit approach, emphasized more on assimilation.

Structure of a Teaching Unit

The structure of a unit is based on the nature of the subject-matter and the teaching objectives. Every teaching unit has its own structure. The teaching unit has the following characteristics:

1. Division of Content. While using unit approach, the entire subject-matter which is to be taught throughout the session or semester, is divided into smaller units. Pupils understand these smaller units easily by concentrating on them.

2. Giving Practical Shape of Teaching Process. After understanding the smaller units ie the subject-matter, giving practical shape to the teaching process.

The teaching unit is administered in the following three phases—

a. **Introductory Phase.** In this phase, the pupils are made clear about the teaching objectives. This makes them curious to gain new knowledge.

b. **Presentation Phase.** In this phase, the learning experiences are provided to the pupils while presenting the contents.

c. **Evaluation Phase.** In this phase, pupils repeat the acquired experiences while interpreting them. In other words, in this phase, the acquired knowledge of the pupils is evaluated.

Elements of Teaching Unit

In a good teaching unit the following elements are used in a sequence:

1. Overview. The teacher should determine the objectives of the teaching unit in such a way that the needs of the pupils are fulfilled. They should be so much motivated so that they may acquire new knowledge with interest. In order to accomplish this task, the teacher gives the statement of aim after introduction so that the pupils get awareness of the scope of teaching unit.

2. Previous Knowledge. The second important phase of teaching unit is to get awareness of the previous knowledge of the pupils for their new knowledge. For this, the teacher asks questions from the pupils so that he may decide the point to start with after relating the previous knowledge to the new knowledge.

3. Presentation of New Experiences. In the third phase of teaching unit, the new experiences and the elements of the contents are presented in a logical order and the lesson is developed with the cooperation of the pupils. For this, the question-answer method is also used. If the pupils fail to answer the questions for some reasons, the teacher interprets the elements himself.

4. Motivation. Every activity of the teaching unit is performed for learning. Hence, the teacher should motivate the pupils at intervals of time so that they may show interest continuously in the teaching and get ready to learn.

5. Summarization. In a teaching unit, this phase is considered important. It enables the pupils to give the summarized form of the lesson.

6. Drill and Recapitulation. To minimize forgetting in learning, drill and recapitulation techniques are important. Hence, the pupils must get the opportunity of drill and recapitulation after presentation so that they may retain the learning experiences for longer duration.

7. Organization. The teaching unit has a proper provision for organizing the acquired experiences. For this, the teacher assigns home work to the pupils with time to time instructions which helps them in organizing the acquired knowledge.

8. Evaluation. In the teaching unit, there is a provision of evaluating the knowledge acquired by the pupils which makes them aware of the limit of acquisition of the objectives. For this task, oral questions or oral and written tests are used.

Fundamental Principles of Unit Planning

The fundamental principles of unit-planning are as follows—

1. Principle of Unit. In the unit planning, the 'whole' is considered important according to Gestalt Psychology. For this the pupil, in the process of acquiring knowledge, the teacher presents the content of a unit before the pupils giving

supremacy to the unity or 'Wholeness'.

2. Principle of Interest and Purpose. the teacher creates interest in pupils in order to achieve the objectives of the unit. This brings the desired changes in their behaviour.

3. Principle of Child's Supremacy. In the unit planning, the child's supremacy is important. According to this principle, the activities of the pupils are emphasized in the entire teaching while assigning the special importance to the needs and basic instincts of the pupils.

4. Principle of Dynamism. According to the principles of dynamism, all the teaching units should be dynamic. This makes the scope of each unit more wider and pupils acquire it easily. Dynamism is the key to teaching. Hence, the teacher should apply the principle of dynamism according to the need.

5. Principle of Recitation. From psychological point of view, in order to mark the new knowledge in the minds of the pupils, recitation is important. Hence, in unit-method, the recitation by the pupils is encouraged more and more and they assimilate the knowledge conveniently.

6. Principle of Organization. According to this principle, the organization of the content is important in the unit method. Hence, in order to provide complete knowledge to the pupils, various teaching materials should be used.

Essential Steps In Unit Planning

While planning the unit, the teacher should bear in mind the aims and the methodology of teaching. The teacher has to select the instructional objectives analyze the contents, identify the appropriate teaching methods, and teaching aids and evaluate the learning out comes.

The various steps involved in the unit planning are:

- **Preparation or Motivation:** Students should be provided with a purpose to achieve and should be motivated to accomplish the task.

  Introduction to topic and correlating life situations or giving examples for the topic could motivate students.

  The motivation as far as possible should be natural and self-directed.

  The process of motivation should not be restricted to the beginning of the lesson but should continue throughout lesson.

- **Testing of previous knowledge:** The second step that should follow motivation is testing the previous knowledge of the students.

  It gives insight into the abilities of the students.

  Through this unit, the teacher may avoid repetition of the content and also comes to know about the comprehension capacity of the students.

- **Presentation:** This step provides new experiences to the students. Hence the teacher needs to present the content in a clear, precise and interesting manner by including teaching material, aids and other class room activities.
- **Organization of learning:** The organization could be done in the written or oral form.

  The student must be provided with the opportunity to organize the content that they learnt. So that they could establish the relationship between the new experiences and be able to assimilate them properly in their minds.
- **Summarization:** At the end of the unit, the entire unit is summarized in a systematic order to bring all the learning together.

  Summarization could also be done at intervals during the progress of the unit.

  Usually organization and summarization go together.
- **Recapitulation:** The teacher should revise the new experiences taught during the presentation. The unit is revised by asking simple questions to the students regarding the topic. It is not necessary to do recapitulation only at the end of the unit. One can also do at a number or places during the progress of the lesson.
- **Evaluation:** This steps helps to check the achievement levels of the students. This test may be oral or written. It could be conducted in between the lessons. They may be given tests in the form of performance tests, interviews, self-check test, puzzles etc.

  The final evaluation test is given at the end of the unit to give grades to the students as well as to check the effectiveness of one's teaching methodology.

  Based on the evaluation results further remedial measures should be planned.

Merits of Unit planning

The following are the merits of a unit method—

1. Psychological. Unit planning is based on Gestalt Psychology. Hence, in this method, the importance is given to the 'whole' instead of 'part'.

2. Interesting. In Unit planning, the interest of the pupils is emphasized. Also, the easy acquisition of teaching objectives is preferred.

3. Organized Learning. By Unit planning learning occurs in an organized form. Consequently, it becomes the permanent part of the brain.

4. Child-centered. The Unit planning is the child-centered. In this, the capacities and needs of the pupils are considered supreme.

5. Habit of Healthy Study. The Unit planning helps in the habit of healthy study. This makes them self-learners.

6. Encouragement to Expression of Ideas. The Unit planning is a child-centered this encourages the development of their social values as well as the capacity to express ideas.

7. Use of Appropriate Teaching Aids. In unit planning, the knowledge is imparted with the help of appropriate teaching aid. This enables them to learn how to apply properly the teaching aid.

Demerits of Unit Planning

There are some limitations noticed while planning for the unit. They are

- It requires committed and hard working teachers
- Confusion sets in when the topics are unrelated and unsystematically arranged
- Evaluation is difficult to do at lower stages.
- The freedom of the teacher is delimited so much that he fails to present his thoughts before the pupils. In such a situation, the learning becomes lifeless, boring and mechanical.
- Due to the detailed knowledge provided to the pupils, it has very limited scope.
- it is possible that the pupils acquire sufficient knowledge in some subjects and insufficient knowledge in others.
- pupils are to restrict. This finishes the originality of the teaching and learning.

Unit Plan

Proforma 'A'

Subject: Computer Science Class: IX

Name of the Unit: Input-Output and Storage Devices

Major objectives of the Unit: The pupils are expected to-

1. Understand the concept of Input-output and Storage devices.
2. Identify the differences between Input-Output and storage devices.
3. Identify various devices of computer system.

S. No.	Concepts	Number of Lesson required	Time required (periods)	Scope of Subject Content	Procedure to be adopted	Teaching Aids
1.	Introduction of Input devices	One	40-45 minutes(one period)	Definition of input devices, its uses	Lecture-cum-demonstration method	Chalk board
2.	Types of Input devices	One	Two	Detailed Explanation of each input device with example	Lecture and Chalk board method using diagram and charts	Chalk board and charts to display functions
3.	Introduction of Output devices	One	One	Definition of output devices, its uses	Lecture and chalk board method	Chalk board
4.	Types of Output devices	One	Two	Detailed Explanation of each input device with example	Lecture and chalk board method using charts and original display	Devices like- mouse, keyboard etc.
5.	Introduction of Storage Devices	One	One	Definition of storage devices, its uses	Lecture cum demonstration method	Chalk board and chart
6.	Types of Storage devices	One	Two	Detailed Explanation of each input device with example	Lecture method with display of various storage devices	Devices like- CD's, DVD's, Floppies etc

After completing proforma 'A', detailed unit plan should be prepared according to proforma 'B'.

Proforma 'B'

Sub concepts	Behavioural Objectives	Procedure (Pupil- Teacher activity)	Pupil's Assignments	Evaluation
Concept of input-devices	The pupils are expected to: • Recall the definition of input devices	Explain concept of Input devices	Define Input devices	Define input devices
Various input devices	Differentiate between various input devices	Define various input devices & explain them by showing diagram	Draw & explain input devices	Describe input devices with diagram
Concept of output-devices	The pupils are expected to: Recall the definition of output devices	Explain concept of output devices	Define output devices	Define output devices
Various output devices	Differentiate between various output devices	Define various output devices & explain them by showing diagram	Draw & explain output devices Difference between input & output devices	Describe output devices with diagram
Concept of storage devices	Recall the definition of input and output devices	Explain concept of storage devices	a) Define storage devices b) Explain difference between input and output devices & storage devices	Define storage devices & differentiate between storage & input-output devices by giving examples
Types of storage devices	Differentiate between various storage devices	Define various storage devices & explain them by showing diagram	Draw & explain storage devices	Describe storage devices with diagram



16

Lesson Planning

Introduction

Teaching is a process which involves those teaching activities which a teacher performs in the class-room. It is based on planning and specifically lesson planning. Thus, a lesson plan is a detailed plan prepared by the teacher in advance for the daily teaching. It helps the teacher in systematic and effective teaching. Lesson plan is a teaching outline of the important point of a lesson arranged in order in which they are to be presented; It may include objectives, points to be made, questions to be asked, reference to materials, assignments etc..A lesson plan is the systematic preparation done in a scientific manner. Effective and successful teaching mainly depends on perfect lesson planning. A lesson plan represents a single teaching unit meant for a class period. Generally a lesson plan is teacher's mental and emotional visualization of classroom activities.

Definition

"Lesson plan is the title given to a statement of the achievement to be realized and the specific means by which these are to be attained as a result of the activities engaged in during the period".

According to Bossing, "Daily lesson planning involves defining the objectives, selecting and arranging the subject matter and determining the method and procedure".

According to tester B. Stands, "A lesson plan is actually a plan of action". It therefore includes the working philosophy of the teacher, his knowledge of philosophy, his information about and understanding of his pupils, his comprehension of the objectives of education, his knowledge of the material to be taught and his difficulty to utilize effective methods.

Bining and Bining, have explained the structure and purpose of lesson-plan in their definition as follows. "daily lesson planning involves defining

the objectives, selecting and arranging the subject matter and determining the method and procedure".

Need of Lesson Planning

Lesson planning is a vital component of the teaching-learning process. Proper classroom planning will keep teachers organized and on track while teaching, thus allowing them to teach more, help students reach objectives more easily and manage less. The better prepared the teacher is, the more likely she/he will be able to handle whatever unexpectedly happens in the lesson. The lesson plan does not allow the teacher to deviate and its keep him on the way. In the process of teaching, lesson plan is needed due to the following reasons.

- Through lesson plan, the teacher regularly achieves the teaching objectives and process in the form of complex objectives and processes.
- A lesson plan develops the possibilities of adjustment in the classroom situation which makes the teaching effective.
- A lesson plan helps in calling every step of curriculum unit.
- A lesson plan helps in planning the process of teaching on the basis of class control, motivation and individual differences.
- A lesson plan provides a coherent framework for smooth efficient teaching.
- A lesson plan helps the teacher to be more organized.
- A lesson plan gives a sense of direction in relation to the syllabus.
- A lesson plan helps the teacher to be more confident when delivering the lesson.
- A lesson plan provides a useful basis for future planning.
- A lesson plan helps the teacher to plan lessons which cater for different students.
- A lesson plan is a proof that the teacher has taken a considerable amount of effort in his/her teaching.

Importance of Lesson Planning

Planning is essential for every aspect of human activities, but for a planned teaching more planning is required.

1. **Suitable Environment**

   In a lesson plan objectives are fixed and the teaching strategies, techniques and material aid etc. are decided beforehand. When a

proper teaching environment is created, the teaching task goes in a much planned way.

2. **Based on previous knowledge**

In preparing lesson plans, the teacher presents new knowledge as the basis of previous knowledge of the pupils. This enables the pupils to gain the knowledge very conveniently on one side, the teacher succeeds in acquiring his objective on the other side.

3. **Psychological teaching**

The teacher uses proper teaching strategies, techniques and instruments keeping in mind the interests, aptitudes, needs, capacities and abilities of the pupils for teaching them when the lesson plans are prepared. This makes the teaching more psychological.

4. **Limitation of subject matter**

In a lesson plan, the subject matter becomes limited. This enables the teacher to give up irrelevant things. He only remembers definite and limited matter and its presentation before the pupils become easy. The pupils also receive the knowledge in a systematic and organized way.

5. **Determination of activities**

In a lesson plan, the teachers and pupils activities are pre-decided according to the class level. This makes the teaching activities meaningful and purposeful.

6. **Preparation of material aids**

At the time of preparing a lesson plan, the teacher decides what facts are to be clarified by what strategies, techniques and instruments and what aid is to be used at what time. This prepares the necessary and effective aids before starting the teaching task.

7. **Developing of teaching skill**

The lesson plan acts as an important means for developing teaching skills in the pupil-teacher.

8. **Use of Theoretical knowledge**

Whatever the pupil-teachers get theoretical knowledge during their training period, that knowledge.

9. **Teaching with confidence**

The preparation of a lesson plan makes the subject and other allied subjects more clearly to the teachers. This arouses self confidence among them. When a teacher gets developed the feeling of self-confidence, then he presents the new knowledge to the pupils with more enthusiasm and pleasure.

10. **Discipline in class**

By preparing lesson plan, the teacher becomes aware of what, when and how much is to be done in the class. This absorbs all the pupils in their respective tasks. Hence, it results in appreciable classroom discipline.

11. **Time sense**

Lesson plan is prepared allotting to the duration of the periods.

12. **Teaching from memory level to reflective level**

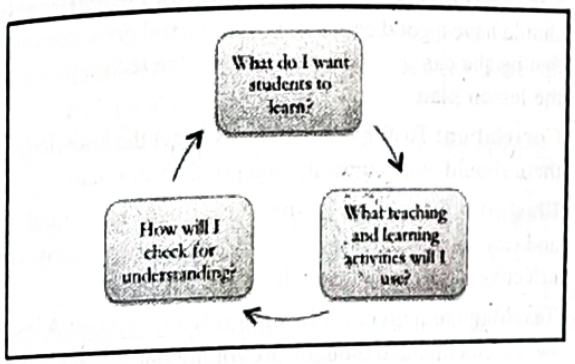
In an ideal lesson plan, development and thought provoking questions should be asked. Also there should be an effort to stretch the teaching from memory level to reflective level.

Components of Lesson Plan

A successful lesson plan addresses and integrates these three key components:

- Objectives for student learning
- Teaching/learning activities
- Strategies to check student understanding

Specifying concrete objectives for student learning will help a teacher to determine the kinds of teaching and learning activities he/ she will use in the class, while those activities will define and check whether the learning objectives have been accomplished (see Fig. 1).



Characteristics Of Lesson Plan

The following are the important characteristics of a good lesson plan.

- **Objective based:** The objectives of the lessons should be clearly defined and the plan of the lesson should be based on these

objectives. It should be mentioned about instructional objectives. Objectives should be in the written form.

- **Relevant teaching aids:** A good lesson plan should include teaching aids how and when to be used. Teaching of any lesson should be supported by a set of appropriate teaching aids like charts, graphs, pictures, diagram, maps etc. Therefore, it is essential to make preparation of a ideal lesson plan.
- **Primary knowledge:** The previous knowledge of the students will decide the course of new knowledge. Therefore an ideal lesson plan should be based on the previous knowledge of the student so that the student may not force problem in acquiring the new knowledge.
- **Division of lesson plan into units:** An ideal lesson plan should incorporate all the essential steps of all the three types of lesson plans. They are knowledge lesson, skill lesson, and appreciation lesson. Each lesson should be divided into units so that the students can understand if easily.
- **Use of simple language:** An ideal lesson plan should emphasize on the simplicity and clarity of the subject and the mental capacity of the students. The lesson plan should be subject – oriented rather than stressing on the language.
- **Determination of activities:** If the activities to be performed by the teachers and the students are determined in advance, the planning of the lesson will be easy and effective.
- **Use of strategies, tactics, techniques and teaching aids:** A teacher should have a good command over general principles of teaching, so that he/she can use the strategies and the techniques accordingly in the lesson plan.
- **Correlation:** To allow the students to get the knowledge as a whole, there should exist correlate in a good lesson plan.
- **Illustration:** An ideal lesson plan should incorporate illustrations and examples related to the daily life of the students and also have effective illustration throughout the period.
- **Teaching from memory level to reflective level:** A lesson plan with developmental and thought-provoking questions can lift the student from memory level to reflective level.
- **Time sense:** A lesson plan prepared according to the mental level of the student and duration of the period can prove to be an ideal one. The time assigned to each teaching step should be mentioned clearly in the lesson plan.

- **Use of Black Board:** The black board summary of each and every unit that is taught should be written on the black board in short but complete sentences.
- **Evaluation:** A good lesson plan should also mention the method of evaluation to assess the performance of the students and obtain the feedback them on the lessons.
- **Home work:** To check the level of acquired knowledge through class room learning, the students should be provided with the home work. A good lesson plan should include relevant home assignment.

Principles Of A Good Lesson Plan

The following are the important principles for a good lesson plan:

- A good lesson plan should proceed from simple to complex, known to unknown, concrete to abstract, whole to part and back to the whole.
- It should follow the instructional objectives and specifications
- The teaching aid should be generally and appropriately used
- The activities should be relevant and properly selected
- The evaluation procedures should be suitable to the lesson
- It should induce the power of reasoning, analysis and critical thinking among the students.
- It should indicate definite assignments for the students.
- There should be extra information about the topic and a note another available reference materials.

Lesson Plan's Need And Importance For Teacher-Education Programme

The lesson plan has significant role in planning and organizing teaching with the following reasons:

1. In teacher-education programme, the lesson planning provides the guideline to pupil-teachers during their teaching practices.
2. It provides awareness of teaching objectives and structure of content and teacher has to perform his activities in the direction to achieve the objectives.
3. The sequence of content is to be presented and finalized by task analysis in lesson planning
4. The perceptive mass of the learner is developed or encouraged by linking the new knowledge with the previous knowledge of the students

5. The use of teaching aids, techniques, strategies and tactics is pre- determined in the presentation of the content
6. It maintains the sequence of content presentation and prevents the teacher to deviate from the topic
7. The teaching activities are related to learning structures with the help of scientific lesson plan
8. It determines the suitable places of reinforcing and controlling the student behaviour during teaching
9. The classroom teaching activities are organized by considering the students individual differences.
10. The effectiveness of a teacher depends on a good lesson plan. It develops the reasoning decision making ability and imagination and pupil teachers.
11. The micro-lessons are helpful in developing specific teaching skills.
12. The pupil-teacher gains confidence in performing classroom teaching activities

Types of Lessons

The psychological researches have proved that the basis of learning is mental activity which is a complete unit in itself but it has three aspects—(i) Cognitive, (ii) Affective, and (iii) Conative. The lessons can be classified into the following three categories on the basis of above three aspects of mental activity—

1. Knowledge Lessons. In the knowledge lessons, the learner's cognitive aspect of his mental activity is more active which results an increase in his knowledge. In short, the pupils acquire the knowledge of various facts and events through the knowledge lessons. The lessons of History, Geography, Economics, Civics, Mathematics, Science and Grammar are knowledge lessons.

2. Appreciation Lessons. Appreciation lessons keep active the affective aspect of learner's mental activity. Since these lessons develop the appreciation of the pupils, they take interest in studying these lessons. The lessons of music and arts are said to be appreciation lessons.

3. Skill Lessons. In skill lessons, the conative aspect of the learner's mental activity is more active. In such lessons, the teacher provides some guidance to the pupils in the beginning-All the pupils get involved in accomplishing the task following the teacher's instructions or guidelines. In short, in skill lessons, the creative power of the pupils is more active. This benefits pupils and the society to its maximum. Painting, handicraft, gardening and agriculture etc. come under the skill lessons.

Classification of Lesson-Plans

Lesson plans are of following four classes:

1. Macro Approach. The macro approach to lesson-planning is used in the traditional teaching practice. In this, the basis of the lesson's unit is larger. Hence, in the lesson plan of macro-approach, the activities of forty to fifty pupils in 30 to 45 minutes are asked to develop. The preparation of lesson plans are taught to the student-teachers before beginning the teaching task in the teachers training colleges or departments so that they may accomplish the task of teaching practice under the guidance of some supervisor or a guide.

2. Micro Approach. The lesson plans of micro approach are not used for teaching practice but these are used to develop various skills and to bring about the modifications in their behavior. The lesson-plans under this approach are prepared to teach 5 or 7 pupils in 5 to 10 minutes. When the pupil-teachers teach according to the lesson plan of micro-approach in order to develop a skill in them, their supervisor allows him or some other pupil-teacher to teach the same lesson after imparting proper and urgent instructions. Hence, micro-approach includes teaching, guidance, re-teaching, re-guidance or instructions, reinforcement, feedback etc. and by using these techniques, behaviour of the pupils is modified. This micro approach has proved very useful in the qualitative improvement of the teachers.

3. Written Form. In the training colleges or departments, preparing the written form of lesson plan is taught to the pupil teachers in the training colleges or training departments. When the pupil-teachers get learnt to prepare the written form of the lesson plan and start their teaching practice, then their supervisors provide them with proper suggestions by comparing the lesson plan and the teaching activities so that they may acquire the objectives of teaching.

4. Unwritten Form. Under rules, every in-service teacher has to teach daily 5 to 6 classes. In such a situation, to teach every class, preparation of written forms of lesson-plans is very difficult. Hence, before entering the class, they prepare unwritten form of the lesson-plan in their minds so that the teaching objective may be achieved by an interaction between a teacher and the pupils.

Decisions involved in planning lessons

Planning is imagining the lesson before it happens. This involves prediction, anticipation, sequencing, organising and simplifying. When teachers plan a lesson, they have to make different types of decisions which are related to the following items:

- the aims to be achieved;
- the content to be taught;

- the group to be taught: their background, previous knowledge, age, interests, etc.
- the lessons in the book to be included or skipped;
- the tasks to be presented;
- the resources needed, etc.

The decisions and final results depend on the teaching situation, the learners' level, needs, interests and the teacher's understanding of how learners learn best, the time and resources available. The duration of a period may be smaller or longer, but in all the lesson-plans, all the teachers have to give similar description of the things. These are-

1. General aims
2. Specific aims
3. Previous knowledge of students
4. Appropriate strategies of teaching
5. Tactics of teaching
6. Techniques of Teaching
7. Teaching aids
8. The correlation between the new knowledge of the pupils and other subjects
9. What are the various teacher's activities
10. While helping personally the students what activities to be performed
11. How the evaluation of the knowledge acquired by the pupils to be done?

Advantages of Lesson plan

1. A good lesson plan helps the teacher to act orderly and proceed systematically while delivering the lessons. He / she will have a good control over the lesson delivery and haphazard teaching can therefore be avoided.
2. Through proper lesson planning the teacher can get clear aims for the students according to their interests, attitudes etc.
3. As a good lesson plan is present and appropriate. It provides a lot of confidence and self-confidence to the teachers, which again helps the teachers in effective teaching.
4. Lesson planning helps the teacher in deciding the definite objectives and in achieving the teaching goals.
5. It makes classroom teaching interesting, systematic and organized.
6. It guides the teacher in sustaining the interest of the students and organizing some activities.

7. A good lesson plan helps the teacher to give good assignments to the students
8. Lesson planning saves time and the students will be able to understand the subject content effectively. In this way, they also form certain desirable attitudes and behaviour patterns.
9. Lesson plan inculcated in the teaching process and discourages repetitions
10. It enables the teacher to understand and use the most relevant method of teaching the lesson
11. A good lesson plan correlate with social and physical environment and also considers the needs and interest of the student.
12. The micro lessons are useful in the development of specific teaching skills.
13. Lesson planning assures a proper connection of the new lesson with the previous lesson
14. Lesson planning ensures a proper consideration of the learning process and definite choice of appropriate learning procedures.
15. The effectiveness of a teacher depends on a good lesson plan. It develops reasoning, decision-making ability and imagination.
16. Lesson planning provides for an adequate evaluation of learning outcomes.
17. It eliminates the chance of trial and error in teaching
18. It helps to visualize the needs of the mixed ability of the pupils.

Demerits of lesson planning

1. Lesson planning makes the teaching process more difficult because of complicated lesson planning process.
2. More time is always needed by teacher to plan a lesson.
3. Sometimes, simple subject-matter becomes more complicated.
4. It has no flexibility and puts the fresh teacher in new helpless situations.
5. Teacher cannot teach a lesson independently.

Herbartian Approach of Lesson-Planning

According to their assumptions and principles' of education various educators have stressed different points to prepare a lesson-plan but the following approach is in common use:

This approach generally known as Herbartian five steps approach in the procedure of the Herbartian School of propagated by ***J.F.Herbart*** (1776-1841) and his followers.

The formal steps involved in the approach as below

i. Introduction / Motivation
ii. Presentation
iii. Comparison and association
iv. Generalization
v. Application
vi. Recapitulation

➢ **Preparation / Introduction/ Motivation**

The student should be in a position to acquire the new knowledge that is imparted to him/her. For this purpose, the teacher should acquaint himself or herself with the previous knowledge of the student. So that they can correlate the new knowledge with the earlier knowledge. This helps in bridging to gap and leaders a student towards the aim of the lesson of teacher can do this.

- By analyzing the previous knowledge of the student of the student and introducing the new lesson by explaining aims and objectives.
- By asking relevant questions that exposes their ignorance and arouse interest and curiosity to learn more and something new.
- By using different types of teaching aids such as charts, maps or pictcures.
- The teacher should keep in mind that this step should be short and concise and the duration of this step should not exceed five minutes.

How can a teacher start the lesson?

- By asking two or three interesting questions with the help of aids that is pictures, charts or models.
- By asking questions from the content – matter previously taught.
- By discussing a situation and illustration it with the help of a relevant story.

➢ **Presentation:**

Presentation of content-matter should be preceded with the mention of the aim of lesson. Once the aim of lesson is made clear to the students of the classroom, both the students and the teacher have a common focal point to concentrate, that is to reach the objective of the lesson. This is the step where there is equal participation of students and the teacher in the teaching-learning process.

A sort of heruristic attitude prevails during the whole teaching process. Questioning becomes one of the most important devices

that is used in this method. Use of other teaching aids can enhance the interest of the students towards the lesson and it can be made comprehensive. Development of black board summary is also necessary.

➢ **Comparison or Association:**

Some illustration are given to the students and they are asked to compare them from other illustrations or facts. This is one of the important steps, which compels a student to draw a generalization or a definition based on the result of the comparison and association.

➢ **Generalization or Definition:**

This step is as a result of the reflective thinking of the students. This knowledge gained in the earlier steps is used in this step to draw generalizations, formulations and rules with the help of comparison or abstraction. The aim of the lesson is achieved in this step, which is completed by answering the questions raised in the earlier steps. Now, the students are ready to use the knowledge they have gained by applying them in real life situation

➢ **Application:**

This is the step where students use the acquired knowledge in favourable and unfavourable situations. The validity of the generalization is determined, whether it is temporary or permanent. The generalization stays in the minds of the students and do not leave their consciousness soon.

Forms of application

- Solving problems
- Writing on essay or an article
- Drawing maps or charts
- Preparing some models
- Doing some practical work
- Getting of new type tests.

➢ **Recapitulation:**

This is last step. Putting some suitable questions on the topic to the students can test the understanding and comprehension of the subject matter by the teacher. This will also help the teacher to find out whether his method of teaching is effective and successful or not.

Merits of Herbartian lesson planning

The following are the advantages of the Herbartian lesson planning approach.

- It follows logical and psychological aspects and therefore incorporate the basic principles of learning
- It is an easy and simple approach of lesson planning
- Content matter is given utmost importance
- It employs deductive thinking in learning
- It is the method that can be used to teach any subject of the school. science subjects, social studies and languages.
- It uses previous knowledge of the students to impart the new knowledge
- This approach can be used to any size of the class or organization

Demerits of Herbartian lesson planning

Although the Herbartian lesson plan is the most widely used approach in lesson planning, it has some demerits. They are as follows.

- It mainly emphasizes on the content matter
- It confines teaching only to memory level
- It ignores the attitudes and requirements of the students
- It helps in achieving only cognitive objectives where as it cannot be employed to achieve the effective and psychomotor objectives
- This approach is highly dominated by the teacher
- It does not provide for the opportunities of the students creativity and originality as it is highly structured.
- Emphasis is given presentation.

Conclusion

To be effective, the lesson plan does not have to be an exhaustive document that describes each and every possible classroom scenario. Nor does it have to anticipate each and every student's response or question. Instead, it should provide you with a general outline of your teaching goals, Learning objectives, and means to accomplish them. It is a reminder of what you want to do and how you want to do it. A productive lesson is not one in which everything goes exactly as planned, but one in which both students and instructor learn from each other.

Difference between Unit Plan and Lesson Plan

Lesson plan and unit plan both enhance the standards of specially secondary and tertiary education by pre-planning to meet lesson and unit objectives.

Difference between Lesson Plan and Unit Plan

Unit Plan	Lesson Plan
1. A unit plan includes goals broken down in terms of lessons, the outline of the content intended to cover and cross-curricular references, etc.	1. A lesson plan elaborates, basically, objectives of a particular lesson and how teaching is planned in a way to achieve those objectives.
2. A unit plan is applicable to many teachers and those who play administrative roles in a school and is effective for a semester.	2. A lesson plan is implemented in one class undertaken by a teacher
3. A unit plan is for a whole unit and it is often a collective effort led by sectional heads.	3. A lesson plans is related to a particular lesson and prepare by a teacher.
4. A unit plan covers a wider area and a unit consists of many lessons.	4. A lesson plan covers a narrower area. It is a daily action plan.
5. Its duration is of several days.	5. It has fixed duration of a particular period of 35-40 minutes.
6. It contains a brief mentioning of methods, techniques and evaluation devices to be used.	6. The specific method, technique or evaluation devices to be used are mentioned.

LESSON PLAN

Roll no - Class -6th

Subject - Computer science Date -

Topic - Introduction to Computer Duration- 30min

Instructional Objective: After studying the lesson the students will is able to

A) **Knowledge:**

1. Recall the concept of Computer

2. Recognize the use of Computer

B) Understanding:

1. explain the applications of Computer.

C) Application:

1. use computer in their daily routine work.

D) Skill:

1. The students are able to develop the skill of creativity. They are able to edit, modify and make their work creative.

Instructional Aids:

1. General teaching aids: - Duster, blackboard, chalks etc.
2. Specific teaching aids:- A chart showing the figure of computer.

Previous knowledge assumed:- The students are aware about calculator etc.

Previous Knowledge Testing:

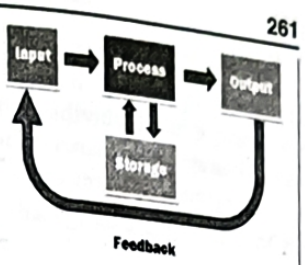
Pupil-Teacher Activity	Student's Activity
1. Do you know what can make our calculations easy?	Calculator
2. Can a calculator store large amount of data?	No
3. Can you tell a device that can make our work easy and can store data?	No Answer

Announcement Of The Topic:

Well Students, today we will study about a machine which solves the problem instantly and can store large amount of data and that machine is known as COMPUTER.

Presentation:

Teaching Point	Pupil-Teacher's Activity	Student's Activity	Use Of Blackboard/Aids
Concept Of Computer	A computer is an electronic machine, capable of performing basic operations like addition, subtraction, multiplication, division, etc. It is also capable of storing information, which can be used later.	Students see the picture & listen attentively.	

Definition of Computer	A Computer is an electronic machine which accepts data in its raw form along with the instructions, processes it electronically and gives back useful information.	Students see the picture & listen attentively	
Full Form Of Computer	**Common Operating Machine Particularly Used for Trade Education Research** A Computer is a common machine which can be used by any person for trade, education and research.	Students listen carefully and note down in their notebook	Use of Blackboard
Application Of A Computer	1.**Education**-It is used in schools for teaching and doing mathematical calculations. 2.**Banks**-It is used in banks for storing information about different account holders, keeping records of cash etc. 3.**Railway Stations And Airport**- It provides information about seat availability , booking tickets and keeping records of passengers.	Students listen attentively Students note down in their notebook	**Applications** 1. Education 2. Banks 3. Railway Stations And Airport

Recapitulation:-

1. What is computer?
2. What are the applications of computer?

Home Work:-

a) Long Answer Type:-

1. Define the definition of computer?

b) Short Answer Type:-

1. Which type of device computer is?



17

Meaning, Importance, Classification of Instructional Material used for Teaching of Computer Science

Meaning of Instructional Material

Instructional materials include all terms of information carriers that can be used to promote and encourage effective teaching and learning activities. These are some of the most important devices which both teachers and learners can use to enhance the quality of instruction. They are good sources of acquiring factual information and help to make learning permanent. They could be in form of text book, reference books, journals, posters, chart, programmed text, non-print materials, such as films, tapes, models, picture, recorders etc. furthermore instructional materials are anything the teacher turns for help in his goal-seeking activities. The help may be in form of information, idea, formulae, generalization or experiences. Instructional material plays a very important role in the teaching-learning process and enhances the memory level of the students. At present, education has spread wide and the entirely oral teaching cannot be the key to successful pedagogy. Therefore, the teacher has to use instructional materials to make the teaching-learning process interesting. The use of instructional material can enhance the learning achievement. (Nicholls, 2000 and Raw, 2003).

The Psychology of Using Teaching Aids

There is an old saying which reads

1. I hear, I forget;
2. I see, I remember;
3. I do, I understand.

I Hear, I Forget

The traditional teacher depended too much on verbal exposition. The pupil hears and forgets. Further, unless the individual has a pragmatic imagination it will be difficult for the individual to visualize objects and events, however the verbal description is. It is highly possible that concepts formed will depend upon the nature of background experience of the individual.

I See, I Remember

As a sensory organ, the eye is very highly developed when compared to the other sensory organs. It is quite natural that the knowledge gained through the sense of sight is more accurate and permanent. Hence, what one sees, one remembers. More than 80 per cent of our knowledge is gained through our eyes.

I Do, I Understand

When one is engaged in any practical activity, involving physical work (doing practical work in the laboratory, workshop or in the field) all the senses are used to perceive. Knowledge is through all the senses. This is learning by direct experience. The outcome is pragmatic. A lot of self activity is involved. It is an ideal method of making the pupil acquires complete knowledge. (Kumar, 2000).

Instructional materials helps teacher to meet individual differences of the learners in the class by using aids that appeal to different senses. Instructional materials are used to supplement verbal explanation of concepts or any description so that the lesson could be real to the students. These instructional materials are categorized into audio visual, audio and visual. These are materials that when teacher used them can appeal to student both sight and hearing. These can be electronically operated materials like Film, Slide motion; Computer and non electronic ones such as Chalk board, Charts, Models and many more. The absence of these materials in teaching could make the class very uninteresting to student and discourage learning thereby lead to low or poor achievement.

Definitions of Instructional Material

Instructional materials have been defined by various authors.

Bruner (1973) says that the teacher's work as communicator, model and identification figure can be supported by a wise use of variety of devices that expand experience, clarify it and give it personal significance.

According to Abdullahi (1982) instructional materials are materials or tools locally made or imported that could make tremendous enhancement of lesson impact if intelligently used.

Agun (1988) refers to them as learning materials, the proper use of which helps learners to learn faster and better.

Obanya (1989) view them as didactic materials-things which are supposed to make learning and teaching possible.

According to Johnson (1989) instructional materials are the collections and selection of resources (mechanical, otherwise) from available resources which are applied and integrated into a systematic process of teaching and learning to make learning effective.

Agina-Obu, 2005 Instructional materials are concrete or physical objects which provide sound, visual or both to the sense organs during teaching.

Importance of Instructional Materials

Instructional materials are said to be part of the instructional procedure. Inyang-Abia and Esu (1990) cited in Esu et al (2004:103) assert that "instructional materials are the pivot on which the wheel of the teaching-learning process rotates". The importance of instructional materials in the teaching-learning process is defined below:

- Facilitate the learning of abstract concepts and ideas as these are effective substitutes for direct contact of Students with the environment.
- Keep the learners busy and active thus, increasing their participation in the lesson.
- Save teachers' energy of talking too much.
- Illustrate the concepts clearer and better than the teachers' words only.
- Help overcome the limitations of the classroom, by making the inaccessible accessible.
- Help to broaden students' knowledge, increase their level of understanding as well as Discourage rote-learning (if used judiciously)
- Help to stimulate and motivate learners.
- Inaccessible processes, materials, events, objects, etc. could be easily brought to the class.
- Longer retention of information.
- It is a multi-sensory approach in teaching.
- It is suitable for any age group and of any size.

Importance of instructional material in computer science

- It develops computer scientific attitude.

- It develops or helps the child to acquire a scientific method of solving problems.
- It develops interest in an appreciation of the plan of life through the computer.
- It helps the child to acquire a useful knowledge of computer science.
- It helps the child to acquire a useful knowledge of computer scientific principles.

Principles and requirements for the selection of instructional materials

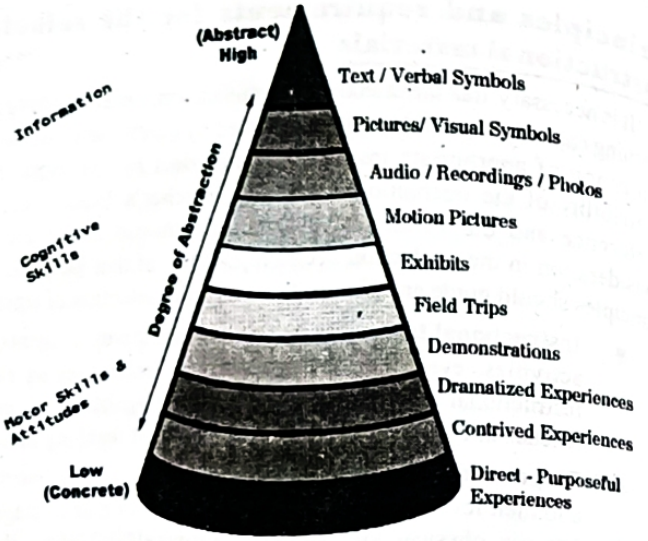
It is necessary, that the effective communication, better teaching and faster learning can only be facilitated or guaranteed by careful selection and skillful utilization of appropriate instructional materials by the users. However, availability of the instructional materials, teacher's experience, terms of preference and the volume of instructions should constitute intrinsic consideration in their selection decision. Despite of that fact, the following principles should guide an effective teacher in the selection of teaching aids:

- **Instructional tasks:** The behavioral objectives, contents, learning activities, evaluation instruments and techniques as element of instructional tasks, should be taking into cognizance by an effective teacher in the selection and development of teaching aids.
- **Target audience attributes:** These consists the learners' features and their level of understanding, their developmental stages such as age, sex, physical skills, attitude towards self and others, the learners experiences, social economic background should be considered.
- **The economy:** The available resources, financial factors technological advancement, economic climate of society where the materials should be operated, the socio-cultural level of the materials users, degree of urbanization, feasibility and acceptability of the selected teaching aids or instructional materials are equally considered in the selection and development decision.
- **Dynamic variables:** These variables constitute the concentration and size of the target audience, the desired level of learners response and participation, the classroom social climate, sitting, viewing and listening arrangement, available time, space, teacher competence among others are to be seriously considered in the selection decision and development.
- **The environmental factors:** These consists the educational community and the available educational infrastructure. Such as people, facilities, equipped library, workshops, laboratories, electricity,

water supply and personnel should equally be considered in the selection and development.

Edgar Dales "The Cone of Experience"

The core of experience developed by Edgar Dale asserts that the pattern of arrangement of the bands of experience is not difficulty but degree of abstraction - the amount of immediate sensory participation that is involved.



Graphic courtesy of Edward L. Counts, Jr.

- **Direct purposeful experience** - These are firsthand experience which serves as the foundation of our learning. We build our reservoir of meaningful information and ideas through seeing, hearing, touching, tasting and smelling. In the context of teaching-learning process, it is learning by doing.
- **Contrived experience** – This make use of representative models or mock-ups of reality for practical reasons and so that we can make the real-life accessible to the students' participation and understanding.
- **Dramatized experience** - A student can participate in reconstructed experiences even though the original event is far removed
- **Demonstrations** - is a visualized explanation of important fact, idea or process by use of photographs, drawings, films, displays or guided motions.
- **Study trips** - These are excursions and visits conducted to observe an event that is available within the classroom.

- **Exhibits** - These are displays to be seen by spectators. They may consist of working models arranged meaningfully or photographs with models, charts and posters.
- **Television and motion pictures** - These can reconstruct the reality of the past so effectively that we are made to feel we are there.
- **Still pictures, recordings, radio** - These are visual and auditory devices maybe used by an individual or group.
- **Visual symbols** - These are no longer realistic reproduction of physical things for these are highly abstract representations.
- **Verbal symbols** - They are not the objects or ideas to which they stand. They usually do not contain visual clues to their meaning. Written words fall under this category. It may be a word for a concrete object (book), and idea (freedom of speech), a scientific principle (the principle of balance), or a formula (e=mc2).

The 'cone of experience' as a model has ten bands. The model suggests a comparative approach to effective teaching-learning process. The model shows a progression of learning experience from "direct purposeful experience to abstract verbal expression". The progression suggests that the effectiveness of teaching decreases from base to pinnacle. The verbal symbol provides the lowest amount of learning and so it is put as the smallest band on the top. Direct purposeful experience provides better learning and hence is indicated by the largest band at the base. Starting from the pinnacle the Dale's cone consists of verbal symbol (lecture) visual symbol (poster, pamphlet), recording, radio, still pictures, motion pictures (film) educational television, exhibition, study trip, demonstration, role play, model and project, finally ending at learning by doing in the base.

Classification of Instructional Materials

Instructional materials are in various classes. They are audio or aural, visual and audio-visual. Thus audio instructional materials refer to those devices that make use of the sense of hearing only, like the television, radio, audio tape recording, etc. Visual instructional materials are those devices that appeal to the sense of sight only such as the chalkboard, chart, slide, filmstrip, etc. An audio-visual instructional material therefore is a combination of devices which appeal to the senses of both hearing and seeing such as television, motion picture and the computer.

In the classification of the visuals, two distinct groups emerge and they are iconic and the digital. The iconic visuals look like the objects they stand for as in drawing, painting, sculpturing, etc. for example, when we draw a computer; the image gives the impression of what a computer look like. On the other hand, a visuals is digital when the representation does not resemble

what the object stands for. Thus, when we write the word COMPUTER instead of drawing it we are making use of digital visuals. The inexperience is at a loss when digital rather than iconic visual is used.

Apart from classifying instructional materials based on sensory modes, there are other ways of classification and they are printed and non-printed Hardware/Equipment and software/materials. As stated earlier, the sensory mode comprises of three subgroups of (a) audio, (b) visual and (c) audio-visual.

1. Sensory modes

Audio	Visual		Audio –visual
	Projected	Non-Projected	
Radio, record, Disc, audio, Tape, recordings (reel to reel, cassette)	Projectors Slides Transparencies, etc.	Books Journal Magazines, map, graphs, newspapers, charts, diagrams, photographs, posters, drawings, paintings, chalkboards, etc.	Television Computer Motion picture, video language, laboratory, etc,

2. Printed and Non-printed instructional materials

Audio	Visual		Audio –visual
	Projected	Non-Projected	
Radio, record, Disc, audio, Tape, recordings (reel to reel, cassette)	Projectors Slides Transparencies, etc.	Books Journal Magazines, map, graphs, newspapers, charts, diagrams, photographs, posters, drawings, paintings, chalkboards, etc.	Television Computer Motion picture, video language, laboratory, etc,

3 Hardware/Equipment and Software/materials

Hardware/Equipment	Software/materials
Computer, television, radio, record player, slide projector, overhead projector, chalkboard, video play track, machine, etc.	Slide, filmstrip, transparency, maps, graphs, posters, cassette (audio and video chalk, etc.)

First, Second and Third generation of instructional materials

First	Second	Third
Chalkboard, book, journal, magazines, charts, maps, drawing, painting, posters, photographs, etc.	Television, filmstrips system, video system, radio, projector, etc.	Computer, satellite, etc.

The list of instructional materials that a teacher can use to improve the quality of instruction is inexhaustible. The teacher's level of resourcefulness, creativity and imagination is in fact, unlimited. Instructional materials will, therefore, include all forms of information carriers that can be used to promote and encourage effective teaching and learning activities.

PROJECTED AND NON-PROJECTED AIDS

Projected Aids

Projected aids are those aids through which on passing light, using a lens through a transparent picture, an enlarged picture is thrown up onto a screen.

Filmstrips and Slides

Filmstrips: A filmstrip is a related sequence of transparent still picture of images on a strip of 35 mm film. A filmstrip is made of cellulose acetate (non-inflammable) jilm 35 mm, slightly over an inch wide and varying in length from 2 to 5 feet. The most commonly used frame size is generally one inch across and 3/4 inch high. A projector is essential to project the filmstrip on to a screen.

Advantages of Filmstrips

- Filmstrips are light in weight and easy to transport.
- A large variety of information can be presented.
- Since it is a visual medium, it helps to stimulate and reinforce learning.
- It helps to motivate and sustain interest of learner.

Disadvantage of Film Strips

- This is a visual medium only.
- It requires an enterprising teacher to provide the auditory background as a commentator.

Slide

A slide is piece of transparent surface like cellulose acetate film, translucent paper, glass etc. of specific dimension with drawings or pictures made on it which can be mounted individually for use in a projector.

Advantages of Slides

- Slides are easy to prepare, handle and store.
- Slides are inexpensive and easy to operate.
- It is easy to revise and update slides.

Disadvantages of Slides

- They are easily clamped.
- They are bulky to store when number becomes more.
- Slides are comparatively more expensive than a filmstrip.

Educational Films

An educational film is one, which contributes to the achievement of desirable educational goals by making an effective use of motion picture as a medium of communication. They have helped in revolutionizing the teaching techniques. Films presents the concepts clearly and realistically and hence leave a long lasting impression on the viewer.

Advantages of using and Educational Films

- Films stimulate imagination and sustain interest.
- films provide vicarious visual experiences, which heighten interest and motivation.
- Films are not only informative but also recreative.
- Films are a means of mass communication.
- Film help recreate past, present events that happen outside the class inside the four walls of the classroom.

Disadvantages of using Educational Films

- The equipment is expensive.
- Difficult to operate and requires technicians.
- Difficult to procure educational films.
- Language barriers, since it is difficult to get films in local language.
- Usually films tend to be a one way interaction with no intervention of teacher; hence subtle details can be missed.

Overhead Projector

Overhead projector is a device that can project a chart, a diagram, a map, a table or for that matter anything written on a transparent sheet, unto a screen or even a wall.

Advantages of using OHP

- OHP's are usually light weight and easy to carry.
- Teacher can always face the class.
- OHP permits the use of colour and teacher can draw diagrams. pictures neatly.
- Lots of time is saved as writing on blackboard can be avoided.
- They are very useful with large groups since the visibility is more.

Disadvantages of using OHP

- They are expensive.
- Requires specific pens and sheets.
- Storage of transparencies is a problem.

Educational Television (ETV)

The television is called as the 'queen of audiovisual aids'. It is tipped to be the electronic blackboard of the future. Television is a means of mass communication that appeals to both the eye and the ear. There are three types of educational television programmes. They are:

- Direct teaching programmes.
- Supplementary enrichment programmes.
- Demonstration type programmes

Advantages of Educational Television

- It is a means of providing mass education.
- Television brings about more involvement and a greater variety in dissemination of ideas and knowledge.
- T.V. leads to increased motivation to learn and increased retention of information.
- It brings the world of reality into classroom.
- It save time, effort and labour of teacher.
- It helps overcome some classroom barriers like time. place. distance, abstractness. verbalism, etc.

Limitations/Disadvantages of educational Television

- It is a one - way communication with learner usually being a passive recipient.
- Individual differences cannot be catered to.
- Does not provide opportunities for learning by doing.
- Costly affair.

Episcope or opaque projector

This device is used for projecting small sized opaque material onto a screen (maps, diagrams). It is essentially used for producing enlargements of diagrams, maps and illustrations firm books-either for live presentation, as an aid to classroom teaching or for copying onto self-made charts or posters etc. For effective visibility general blackout is necessary/ The episcope is bulky and difficult to carry around. The focal kept if the snack at gas it okayed at least 10 -15 feet av ay from the screen i.e. in between students and hence tends to obstruct students view.

Non-projected aids

A Chinese saying "a thousand hearings are not so effective as one seeing" is highly relevant to the cause of using visual aids. Visual aids which do not require any projection for their presentation are called non-projected aids

Graphics Aids

Graphic aids are that form of visual aids that are two-dimensional and represented on a plane surface. They convey information as a combination of visual and pictorial message with suitable meaningful captions.

Pictures: Pictures help in crystallizing ideas and form a basis for teaching. In teaching they are useful to:

- motivate students and kindle their interests.
- introduce new concepts and evaluate students knowledge.
- provide basic imagery for concepts and hence broaden child's vision.
- break the monotony of lecture and draw attention of children.
- cultivate powers of observation, judgment and right attitudes.

The advantages of pictures are that they are inexpensive, easy to procure, simple to use. The probable disadvantage is that they are two-dimensional and require enterprising teachers to blend these visual media into their classrooms.

Photographs: A photograph is an exact replica or copy of a particular place, thing or person. A picture will always have an element of subjective

interpretation of painter. While talking about the historical background it will enhance the presentation if photographs are used.

Poster: A poster is a display material especially prepared to convey a message or an idea and to create a strong lasting impression. The effectiveness of a poster is based on the design, effects and cohesion of ideas. For example; A poster on ORS should convey the necessity of ORS, when it has to be used and how it has to be used.

The purpose of a poster is to:

- Motivate class interest.
- To present a contemporary relevant issue.
- To convey message accurately and carefully.
- to arrest attention by using attractive features.

Charts: Charts are defined as a combination of graphic and pictorial media for the orderly and logical visualizing of relationships between important facts, ideas or concepts. Edgar Dale defines a chart as a systematic arrangement of facts in a graphic or pictorial form, presenting for convenient reference comparisons of quantity, distribution, trends, summaries etc.

The charts serve the following purposes

- Showing relationship by means of facts, figures, Presenting matter or statistics symbolically, graphically
- Presenting abstract ideas in a visual form showing continuity in teaching - learning process and summarizing information presented,
- Motivating and arousing students interest.

Graphs: A graph is a visual representation of quantitative data. A graph is essentially a tool for expressing relationships between numerical data which makes visualisation easier than when expressed in words or figures. Graphs are a way of making data to speak for themselves. There are many types of graphs like bar graph, pie - graphs, line graphs etc.

Maps: A map is an accurate representation in a diagrammatic form of the surface of the earth or some part of it, showing the physical or political features. Maps help the students to visualise and localise important world realities and reveal an enormous amount of information such as sizes, shapes and location of areas, distribution of people and water, animal and vegetable life, economic and industrial resources and other natural phenomena and the association of these elements. Maps are called as "Encyclopedia's of man's existence". There are many types of maps like physical map, political map, navigation map, picture map, historical map, weather map etc.

Cartoons: A cartoon is a drawing executed in an exaggerated style for humorous or satirical effect. It is a symbolic line sketch, usually a drawing

with a small caption, intended to convey a message or point of view about things, events or situation. The effectiveness of a cartoon depends on its compactness, its simplicity and clarity. A cartoon thus tries to portray the message metaphorically through pictures.

Comics: A comic is a sequence of drawings in boxes that tell an amusing story and are generally meant to cause laughter. Comics depict a story in a sequence in an attractive pictorial form which are g generally appealing to the younger children.

Flash Cards: Flash cards are small compact cards made out of cardboard or any other thick material. They are used to present an idea in the form of posters, pictures, words and sentences. They develop in students the power of observation, identification, quick comprehension and retention.

Display Boards

Blackboard or Chalkboard: Even in this modern era of television and computer the blackboard is the extensively used, most trusted and powerful companion of the teacher. The traditional blackboard was black in colour but present day chalkboards are made in different materials and different colours.

Bulletin Boards: The bulletin board is used for displaying bulletins, news items, announcements, and visual displays that are interesting to the students. Bulletin boards are usually made of wood with thick flannel cloth on them and a wooden frame running around it with a glass covering on the front side.

Flannel Boards: The flannel board consists of a piece of flannel, stretched tightly over a strong backing of plywood. Pictures, cards and other similar material can be stuck on the flannel board if sand paper, felt paper or blotting paper are glued to their back.

3D Aids

3 - D aids are powerful interest arousing devices that can bring into play all the sense organs. They present the feel of the object as close to reality as possible.

Models: They are recognizable 3D representations of real things. Models also attempt to provide interior views of objects which are normally covered or otherwise invisible. Eg : Model of Eye / Ear etc.

Mock up: A mock up is a simplified version of reality. A representation of real thing so constructed as to highlights the essential part or function and to eliminate unnecessary details.

Dioramas: Dioramas are three dimensional scenes incorporating miniature objects and backgrounds in actual perspective. They have a real depth with larger objects placed in the foreground and smaller objects behind them.

Exhibit: According to Edgar Dale an exhibit is a collection of objects or

materials arranged in a setting so as to convey a unified idea. An exhibit is an arrangement of realistic materials primarily three dimensional, which is designed to inform the observer a specific topic. An exhibit is made by the exhibitor deliberately with a purpose.

Specimen: A Specimen is a segment, a small piece or part of the real sample. Objects which are representative of a group or class or similar objects are called specimens.

Actual Objects: An actual object is the real thing that has been brought to the class after displacing it from its natural setting.

Globe: A globe is the most basic equipment of a geography class. It helps in explaining the shape of earth, the position of different places, time lag etc.

Audio Aids

Audio aids appeal only to the sense of hearing such as Radio and Tape Recorder.

Radio: Radio is the transmission and reception of signals by means of electro magnetic waves. Radio listening helps in adding to students knowledge bank. It exerts an influence on students attitudes. appreciations, social thinking.

Tape Recorder: A tape recorder is one extremely versatile aid which can be used as a means of reproducing - pre recorded material. A tape recorder can be used as a means to provide commentary for slide shows. They can be used to record lectures of eminent speakers. They can be used by teachers to self-evaluate their lessons. Recordings eliminate the scheduling of the radio.

Activity Aids

Activity aids are those aids that keep students active both inside and outside the classroom. These aids enhance learning and interest of students.

Experimentation: 'Learning by doing' is the best maxim and experimentation aims at fulfilling it. Experiments provide direct, purposeful experiences. The student gains experience by using all his senses.

Demonstration: A demonstration is a visual presentation followed by discussion. A demonstration is a means wherein students observe how certain things (experiments) are done. Demonstrations are very helpful in developing observation skills. Children learn things not only by doing but also by imitating and demonstrations serve this purpose.

Field Trips: Learning experiences which are real, life and subject to scrutiny and verification are provided for in field trips. Field trips are a means of providing direct experiences, breaking down the monotony of being within the four walls of a classroom, for recreation, for developing keen observation, for collecting concrete experiences / evidences, for bridging the gap between theory and practice.

Dramatisation: The word drama is derived from the Greek word meaning 'to act' or 'to do'. Dramatisation involves two things one so actual participation and the other is just observing. It is a substitute for real experience. Humanized education through dramatisation attempts to build the child's instincts, impulses, interests and enriches his experience through interpretation of emotions.

Puppetry: Puppetry is another activity with as much significance as dramatisation which is seldom used in classrooms because of the technicalities involved in preparation and presentation. But they could be a powerful means of mass communication if properly utilised.

Individuals differ in so many aspects and they learn at different levels, so providing alternative resource materials is very necessary. The purpose of instruction therefore, is to help people learn. Instruction may include events that are generated by a page of prints, by a picture, by television program or by a combination of physical objects among other things. Furthermore, instructional materials can then be described as a systematic arrangement of instruction in such a way that, learning is facilitated.

Functions of teaching aids

Audio Visual teaching occupies an important place in managing teaching.

1. **Motivation:** Audio visual aids present the knowledge in the concrete form by attracting the attention of the students. This provides motivation and curiosity is aroused in the learning activity. The pupils listen with attention.
2. **Principle of activity:** When audio visual aids are used while teaching a lesson, the pupils talk, ask questions and discuss. This stimulates their various sense organs.
3. **Clarification:** The use of audio visual aids clarifies the most difficult contents because whatever the pupils hear, they also see it with their own eyes. So, the confusions are eliminated and they acquire the knowledge with precision.
4. **Meaningful experience:** The use of audio visual aids makes the experiences of the pupils meaningful by seeing, and touching an object. The symbolic representation of direct experience is possible by means of audio visual aids.
5. **Discouragement to cramming:** By using audio visual aids, the pupils take interest in the development of the lesson and they acquire the knowledge by doing themselves. This makes the learnt knowledge definite and stabilized. There is no need of cramming anything.

6. **Increase in vocabulary:** The use of audio visual aids increases vocabulary of the pupils because while using radio, telephone, television and cinema, new terms are used and they acquire them.
7. **Efficiency in teaching:** The use of audio visual aids causes efficiency in teaching. Teaching becomes more effective. Those minute things and difficult ideas which a pupil is unable to understand with chalk and talk, are followed easily by using audio visual aids.

Thus, dry and disinteresting subjects and topics can be made easy, interesting and precise by using audio visual aids. Audio visual aids make teaching and learning effective.



18

Text Book

In the teaching-learning process, the text-book occupies an important place. Textbooks are as universal as formal schooling and almost as old. They have been used to aid teaching, and in some cases, to be the teacher for centuries. Textbooks are not just teaching and learning objects but are political documents that hold content that reflects the vision of a specific group (Encyclopedia of Education, 2008a). There is a saying "As is the text-book, so is the teaching and learning". A good text-book can even replace class-room teaching. The text-book should aim at aiding the pupils in the development of their personalities, in developing open mindedness, developing appreciation and understanding of concepts and not merely stuffing their minds with facts.

Definitions of Textbook

The text book is one of the important aids in the teaching learning process. The Oxford English Dictionary defines textbook as "A tool used as a standard work for the study of a particular object."

The text book should contain the following tools,

- Study Q tions
- Scenarios
- Skill Guides

The definitions for Textbooks are wide and varied. One common definition is that a textbook is a printed and bound arte fact for each year or course of study (Encyclopedia of Education, 2008b). They contain facts and ideas around a certain subject. Text books are the most widely used of all instructional materials. Now a day's text book has become a course of study. A set of unit plans and a learning guide as well. A text book should really design for the pupils rather than the teacher. Text book should stimulate reflective thinking.

Need and Importance of Textbook

1. A text book is written according to the syllabus and gives the outline of the course. Therefore it helps the teacher to decide about the limits and depth of the content to be presented to the students while teaching.
2. A text book provides insight to the teacher in planning lesson, in selecting the problems to be worked out, the methods of teaching to be adopted and the teaching aids to be used. The logical and psychological sequence followed in a text book helps the teacher in presenting the subject matter in an orderly and systematic sequence.
3. A good text book presents a variety of worked out examples on each topic. This helps the teacher in getting acquainted with different types of problems and the methods to solve them. This gives more self confidence while teaching.
4. A text book save a lot of time for the teacher as he need not spend time to prepare problems and the solutions as they are readily available in the text books.
5. A text book is an important aid for learning as It helps the pupils to relate what they are learning to life.
6. It helps to foster the right study attitude among the students since the text book presents defined and concrete details in intensive manner which could arouse the students interest and curiosity.
7. The well graded exercises provided after every topic in the text book help the teacher in assigning suitable homework and assignment to the student.
8. It encourages self study and independent work among the students.
9. The text book provides important source of materials for reviewing and recapitulating the lessons taught in the class.

Need and Importance of Computer Science Textbook / Practical book

Computer science is the scientific and practical approach to computation and its applications. It is the systematic study of the feasibility, structure, expression, and mechanization of the methodical procedures (or algorithms) that underlie the acquisition, representation, processing, storage, communication of, and access to information. A computer science specializes in the theory of computation and the design of computational systems.

- A text book presents all the computational techniques and tools needed to start doing scientific research using computer simulations.

- After working through the text book, the reader will possess the necessary basic background knowledge, from program design programming , fundamental algorithms and data structures, random numbers, and debugging, all the way to data analysis, presentation and publishing. In each of these fields, no preliminary knowledge is assumed. The reader will be equipped to successfully perform complete projects from the first idea until the final publication. All techniques are explained using many examples, codes, as well as the solutions to exercises, are readily available.

Qualities of a text book

1. The author should be a person, well qualified and experienced in the subject.
2. It should be in line with the syllabus for a particular grade.
3. It should include latest developments in a particular topic.
4. It must help in understanding the basic concepts.
5. It should be according to the age, grade and intellectual development of the students.
6. It should inculcate scientific attitude and give training in scientific method.
7. It should be activity based and inspire students for further learning.
8. It should be developed with other disciplines.
9. It should be developed in line with the objectives of computer science teaching and national aims and objectives.
10. It should satisfy the demands of examinations also.
11. It should be easily available in the market.

Advantages of the text book

1. A good text book saves both teacher's and students time.
2. It is the cheapest, brief and most reliable source of information.
3. It helps pupils to acquire the needed information speedily.
4. It helps the students to understand the concepts completely when class work brings only partial understanding.
5. Students who is absent to school by make up the deficiency with the help of the text book.
6. Home work and assignment work can be given easily from the text book.
7. Provides a large collection of well selected and graded exercises.

8. In lower classes text books with colored illustrations attract and encourage learners to learn.
9. It is a reliable source for self study and preparation for examination.

Criteria for Evaluating a text book

A text book could be evaluated under two headings as external and internal details.

External details:

1. The size of the text books must be of the standard regular size.
2. The cover page must be stimulating and motivating.
3. Quality of paper must be good, which increases the life of the text book.
4. Printing should be clear and visible. Main headings and sub headings must be bold. Important points should be in italics.
5. Binding must be proper.
6. Each page must numbered.
7. The price must be cheap.

Internal factors of a text book

i) **Selection of topics**

1. The content selected must be in relation to the syllabus.
2. The content selected should be in relation to the previous knowledge of the student.

ii) **Presentation of the topics**

1. The topics must be sequenced logically and psychologically from simple to complex, known to unknown.
2. The language used should be simple and clear.
3. All new terms should be accurately defined.
4. The style of writing should be interesting.
5. Accurate scientific and technical terms must be used.
6. The errors have to be avoided very carefully.
7. There should be a detailed table of contents.

Diagrams, figures and pictures

1. There should be diagrams, figures, pictures and sketches at appropriate situations.
2. They must be proper size and be clear. The diagrams must be clearly labeled.

Related activities and experiments

1. The content must include related activities and experiments for the students to be performed at home or in the lab.
2. Practice of skills is given by way of exercises.

Exercises

1. At the end of each chapter, questions of different types must be given i.e. from knowledge to evaluation.
2. Exercises problems must be of application type.
3. There should not be too many solved examples.
4. There should also be a few difficult exercises for the intelligent students.

Summary

1. At the end of each chapter, there should be summary discussing the salient features of the chapter.
2. Helps in the systematic and speedy revision of the lesson.

Reference:

1. At the end there should be related references for the students and teachers in terms of reference books, websites, periodicals, journals etc.

Use of text books inside and outside class room

Role of textbooks inside the classroom for Teachers

When the textbooks are used inside the classroom the teacher should know how much of what to be taught is in the textbook and how well is the plan and sequence of the book matches with the way the class is to be developed.

- It is used in giving practical work and assignments to the students.
- It is a guide and support for the teachers who are inexperienced and unsure of their knowledge
- It is used to give correct decision during the discussions in the classroom
- In giving exams and tests to evaluate the students.
- In reading a lesson in advance before teaching to the students in advance.
- To evaluate the answers when the teacher is not sure about the correct answer.

Role of textbooks inside the classroom for Students

The students use the textbooks to

- Get the subject matter easily.
- confirm the subject matter taught by the teacher at that time
- clear the doubts
- understand easily the content with the diagrams and pictures given
- express the subject matter easily without any difficulty
- Revise the lessons thoroughly at the end of the year.

Role of textbooks outside the classroom

The textbooks are used outside the classroom in the following ways,

- Students can revise the lessons taught in the classroom when they come home
- When the assignments are given by the teacher, the students can seek the help of textbook
- The teacher, before taking class can collect materials in advance
- Mistakes committed by the students while taking class during teaching can be corrected in their houses with the help of text books
- The exercises and questions given at the end of the lesson motivate the students to learn even if they are not in the classroom also.
- This is a great boon for the students who do not come to the school for one or more days. Because they can study the lessons taught on those days from the textbook by being in their home even.

Text books are important tool in the hand of a teacher. It helps student to how and what they learn to achieve some definite goals. It is a valuable resource as a part of a balanced program of studies. The textbook has been around since the beginning of schooling and as long as it maintains its course of evolution and growth, it will continue.



19

Self Instructional Material & Computer Assisted Instructional Material

Self Instruction

Self-instruction can be defined as the ability of one to cognitively plan, organize, direct, reinforce, and evaluate one's own independent learning without a teacher's prompting. There are three powerful influences behind self-instruction: First the learning and modelling of materials, the ability of verbalization, and finally, self-regulation (metacognition).

Dickinson, 1987, describes Self-instruction as "situations in which a learner, with others, or alone, is working without the direct control of a teacher".

Jones, 1998, Benson, 2001, describes it as "a deliberate long-term learning project instigated, planned and carried out by the learner alone, without teacher intervention"

Bastable 2008 A method of instruction used by a teacher to provide or design teaching materials and activities that guide the learner in independently achieving the objectives of learning.

Self Instructional Material

Self- instructional material is about how students instruct themselves with self-instructional material without any help of the teacher.

Brockett and Hiemstra 1991 : A process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes.

Characteristics Of Self-Instructional Material

As a teacher, trainer, and line manager or as a learner everyone must have used self-instructional material in open, distance or flexible learning contexts.

- **Self-paced learning:** each individual can work at his/her own pace rather than the pace of the group, which can be too fast or too slow.
- **Private learning:** no danger of loss of face as it might be feared in certain kinds of group studies.
- **Available at any time:** learners can learn when they wish rather than according to external timetable.
- **Available at any place:** in students home or while travelling also.
- **Best Teaching Material** Learners deserve the best teaching and training material that are not affected by the particular preferences of the teacher or trainer. Self-instructional material enables all learners to receive same teaching material.

Advantages Of Self Instructional Material

Arouses interest
Written for learner use
Designed for particular audience
Always gives aims and objectives
Structured according to needs of learner
Major emphasis on self-assessment
Alert to potential difficulties
Always offers summaries
Personal style
Content unpacked
More open layout
Learner evaluation always conducted
Provides study skills advice
Requires active response
Aims at successful learning

Computer Assisted Instructional Material

Computer-assisted instruction is a method of using computer technology in teaching and learning. Computer-assisted instruction (CAI) is an interactive instructional technique whereby a computer is used to present the instructional material and monitor the learning that takes place. **Vichitrejpaisal et al., 2008** Computer assisted instruction is a form of self instruction in which material

can be presented via text, visual, sound, and motion digital files, providing a multimedia approach to learning. Computer can facilitate interaction during the learning process on multiple levels like interaction of student/user with the content and learning material, contents can be updated regularly, encourages greater learning inputs in the areas of subjects interest.

Barad, 2010 Computer assisted instruction is a set of programming instructions which is used in instructional process to develop certain skills for the students' mastery over the subject content. Students' prepared with assignments, problems, exercises, reading materials by a computer for learning. The unique combination of tutorial, interactive, and visual capabilities enables computers to have a beneficial effect on learner motivation.

Characteristics of Computer-Assisted Instruction

Two-way interaction: Computer assisted instruction is an instructional technique based on the two way interaction of a learner and a computer with the objective of human learning and retention.

Stored instructional programme: Computer-assisted instruction is an instructional technique in which the computer must actually instruct the student, and the computer contains a stored instructional programme designed to inform, guide and test the student until a profile level of efficiency is retained.

Student's responses: Computer-assisted instruction is an instructional technique in which the computer is based: To

- control the presentation of stimulization to a student
- accept and evaluate the student's responses

Individualized Instruction

Computer-assisted instruction is an instructional technique. Using the computer which follows for individual, individually paced and individualized instruction since the computer's behavior is dependent upon the responses of the student. It includes, (Vishnoi, 2007).

I. problem-solving
II. Drill and practice
III. Inquiry,
IV. Stimulation and gaming
V. Dialogue system

Steps involved in development of CAI package

The sequence of the steps involved in the development of instructional materials may change according to the nature of the problem. The general steps involved in the development of software can be:

1. Analysis Phase
2. Design Phase
3. Programming Phase
4. Validation Phase

Analysis Phase

Selection of a unit: The computer should be used creatively and judiciously since it demands more money resource than any other media.. If the teacher decided to write a programme for CAI, she should bear in mind: Why use a computer (CAI) approach. There should be a rationale for the use of a computer.

Content Analysis: The process of deciding the topic into sub-topics or sub-points is called content analysis.

Entry Behaviour: The analysis of the target group is very essential. Once the content and target group are analyzed, a teacher can sequence the concepts so that they are logically arranged. The specifications of the learner's entry behaviour are to be finished.

Specification of objectives: It is like preparing a summary of the learning process in terms of the competencies to be learnt.

Development of evaluation measures: A statement of objectives describes the capability to be developed. If this description is clear, it helps us to design a test to assess how well the learner has acquired that capability.

Design Phase:

The analysis phase is followed by a creative phase, which is the design phase.

Development of modular structure: The whole package would be a set of various inter related modules. Though they are inter related, one can select modules to be learnt or the pre test may help the learner in selecting appropriate modules.

Development of flow chart: The flow chart becomes the link between the information and the screen presentation. It is a chart showing the relationship between the events, activities, concepts.

Designing frames: A module consists of a series of frames. Some of these will be criterion frames, teaching frames and some testing frames.

Criterion frames: It acts as a check that the teaching frames achieve their objectives. This is a test of the learner's knowledge.

Teaching frames: It contains all the information needed to complete the course.

Testing frames: These can be in the form of prompt or cue.

Preparing screens with reference to actual programming

Once the frames are designed, they should be converted in a manner useful for screen display. Therefore, screen layout forms are designed at this stage.

The essential characteristics for screen display includes

- Screen layouts
- Text
- Graphics
- Timing
- Animation
- Sound
- User control

Programming Phase

The course ware author may perform the programming task or it could be performed by team of programmers. Generally, a teacher who does the instructional design of the CAI package may not possess programming expertise. Such a teacher is provided programming facility by special tools. These tools are called authoring tools.

Some fundamental features must be provided by any authoring system:

- Present text and questions on the screen
- Accept responses entered using a keyboard
- Analyze the responses
- Store details of responses and values of counters on a file
- Branch to other parts of the learning programme
- Provide feedback
- Interface with sub routines written in computer programming language

Validation Phase

It means testing the whole package. The following factors should be considered while evaluating the package:

- Content
- Accuracy
- Presentation
- Adherence to presentation standards and guidelines
- Use of the authoring language
- Statistics

It should be followed by evaluation by experts, testing, pilot study and field tryout.

CAI Programmes (Modes of CAI)

There are several kinds of CAI programmes that are available and the important ones are as follows

1. Drill and Practice
2. Tutorial Mode
3. Simulation Mode
4. Discovery Mode
5. Gaming Mode

Drill and Practice

In this mode, the computer presents the learner with a series of exercises which he or she does by giving some responses. It provides the learner some feedback about the answer (i.e. responses) in the form of a congratulatory message if it is right, or a corrective comment if it is wrong. Thus, CAI provides drill and practice with repetition at a pace that can be controlled by the learner. The computer proceeds only when mastery is achieved by the learner.

Tutorial Mode

In the tutorial mode, as in programmed instruction, information is presented in small bits followed by questions. The learner's response is analyzed by the computer and appropriate feedback is made available to him/her.

Simulation mode

Learning experiences regarding real life systems or phenomena are provided to the learners through this mode. The thing that cannot be brought into a classroom (real or imaginary) can be represented by simulations.

E.g: Aircraft, Fire safety

Discovery mode

This mode uses inductive approach to learning wherein the problems are presented and the learner solves them through trial and error.

Gaming mode

In gaming mode teaching can be imparted, through play or game.

Use of Computer Assisted Instruction in Areas of Education

The computer-assisted instruction can be used in the following areas of educational system.

1. **Teaching an instruction:** A computer-assisted instruction can be used for teaching purpose in the field of education. The use of computer-assisted instruction has been successfully made in all areas of subjects.

2. **Drill and practice:** The computer-assisted instruction is used for drill and practice problems in mathematics, science and languages etc. In drill and practice, branching type of remedial programme is provided for those learners who are in need of such remedial teaching. The computer has been very effective substitute for a teacher in this exercise.

3. **Simulation:** Computers are used to simulate real life experience, to enhance the efficiency of the workers and to improve the quality of performance. Simulated conditions are shown on the computer screen such as the working of the circulatory system of the human body.

4. **Tutorial and Dialogue:** The subject-matter is literally taught by the computer programme. Explanations are given orally through audio-tape and needed visuals are presented in television. The student responds on a typewriter key-board or by pointing on the screen with a light pen. The computer reacts to the student's response by 'talking' to him. Students make further responses.

5. **Data processing for research:** Computer is used in research institutes or universities for analyzing the data for obtaining the results and verifying the research hypothesis. In India a computer is now being used most frequently in analyzing the research data. It is very economical, speedy and accurate device for this purpose and has made this difficult task simpler.

6. **Educational guidance and counseling:** Now computer is used in guidance and counseling services. The students are diagnosed for educational guidance, their weaknesses are identified and remedial instructions are provided by a computer (Mehtani, 2007).

Advantages of CAI

- Enormous increase in the student's access to information
- Instruction according to individual's abilities, preferences and conveniences
- Increase in the quantum of personalized instruction
- Immediate feedback on the student's comprehension
- Learning at one's pace and in a private learning environment
- Learning using computer engages and stimulates the interest of the students
- The process motivates the students to feel a sense of personal responsibility for their own education.

Limitation of CAI

- **Problem of maintenance:** The computer assisted instruction poses a great problem with regard to the effective maintenance of its learning system.
- **Difficulty in providing learning system:** It is difficult to provide really useful learning systems with a view to provide individualized learning process. It is difficult to teach all subjects and all topics with the help of a computer. There is dearth of a computer programmed for teaching purposes.
- **Costly:** Computer assisted instruction is very costly. Most of our universities and educational institutions can't afford to have a computer for a number of years to come.
- **Non-human quality:** Computer-assisted instruction may inject a non-human quality into educational programs. This new technology may 'dehumanize' man.
- **Non-achievement of affective objectives:** Computer assisted instruction can only be effectively used to achieve cognitive and psychomotor objectives of learning but affective objectives can't be realized by computer-assisted instruction.

Role of the teacher in CAI

1. In CAI the role of the teacher has changed from the traditional method of delivering lectures to a supervisor or a guide
2. No computer can replace a teacher, as teacher's role is very important in the process of teaching and learning
3. Infect the CAI will definitely increase the scope and quality of contribution of teachers in the society
4. In CAI, the teacher has to play many roles like computer engineer, lesson writer and a system operator.



20

Computer Science Laboratory: Planning, Maintenance, Organization and its importance

Computer literacy refers to having the knowledge and understanding of computers and their uses. Computer literacy refers to having the basic understanding of what a computer is and how it can be used as a resource. It can be taught effectively with demonstration of activities which can be performed smoothly and effectively in a lab. Laboratories are most essential and important in science education included Computer Sciences. A computer laboratory is a room that is specially designed and prepared to facilitate the installation of computers and to provide a safe conducive environment for teaching and learning of computer science.

Purpose Of The Computer Lab

Computer Lab are an integral part of the academic community. The goal of the Computer Labs is to provide faculty, staff, and students with a consistent, reliable and customer-friendly computing environment.

1. To give each student the opportunity to enhance their understanding of how to use a computer and software programs that are appropriate for their ability level.
2. Assist and enhance classroom curriculum through the integration of technology.
3. Teach keyboarding skills to all students.
4. Allow students to acquire basic to advanced technology skills that will be vital to all fields of study and understand how it will contribute to their daily lives.

5. Allow students the opportunity to gain a greater self-confidence in themselves.
6. Gain an appreciation and an understanding of the value of building and sharing ideas as a team.
7. Allow for classroom and technology integration through team teaching at all grade levels.
8. Laboratories are helpful in creating and promoting scientific attitude in the students.

Layout / Designing Of Computer Lab

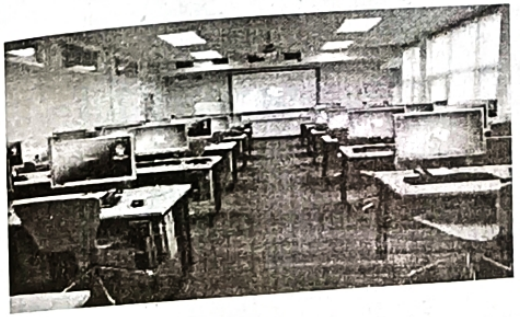
Computer labs must be designed intelligently and serve the purpose they were intended to serve. The design and layout of a computer lab creates rules and defines how the lab can be used. The layout of a computer lab dictates the usefulness of the lab and increases user satisfaction which justifies its expense and assists in future investments in upgrades.

Certainly, the layout of the lab depends on the equipment, the furniture, and space available. The purpose of this document is to discuss some basic computer lab layouts and their advantages and disadvantages.

There are many options when designing the layout of a computer lab. The key is to make sure form is following function. Thought and planning at the beginning of designing the lab ensures that students and instructors are satisfied with what the lab offers. Choosing a sub-optimal layout can negatively affect student learning and reduce the engagement between instructors and students.

Classroom Computer Lab Designs





The classic classroom computer lab design serves as the default layout in many High School and Colleges. However, it does have two major advantages. First, it serves as a great instruction room where students learn computer topics from an instructor at the front of the room. With everyone facing the same direction, it allows instructors to see the faces of the students with which to read non-verbal cues as to whether students are learning the material or need more help. Second, it is similar to the layout of other classroom environment emphasizing that the students are there to learn.

One disadvantage of the classroom layout is the need to disturb other students along the rows of computers as students enter and exit the lab. For labs where students are coming and going, the classroom layout is not ideal. In addition, the classroom layout is not conducive to team work. It is difficult for students to work together, especially on collective projects and in peer-assist teaching models.

Four-Leaf Clover Computer Lab Layouts





The four-leaf clover design offers the most privacy for students and reduces to a minimum the possibility of cheating during tests or exercises. It also eliminates the need for students to disturb others when entering and exiting the lab and allows instructors to go from student to student to address individual problems and concerns.

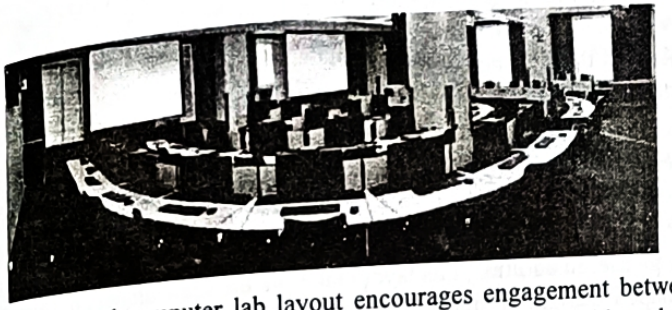
One disadvantage of the four-leaf clover design has to do with attention spans. When students are sitting at their own computers, instructors will not be able to see what each student is doing at his/her workstation. Students may not be paying attention to lessons or may be surfing to inappropriate websites in labs equipped with Internet access.

Four-leaf clover designs can also be more expensive if each computer sits on its own table. Some computer lab furniture is made specifically for this design offering space for four computers on one table or desk.

The next two designs are less traditional but offer some things the classroom layout and the four-leaf clover layout do not.

U-Shaped Computer Lab Designs





The U-shaped computer lab layout encourages engagement between instructors and students. Instructors can enter the U and engage with students one-on-one. This design also serves as the most conducive layout for computer maintenance as technicians do not have to disturb others to gain access to the computers. In addition, students will not interfere with other students' work while entering and exiting the lab.

Unfortunately, the U-shaped design offers little opportunity for instructors to monitor what students are doing and looking at on their monitors. This

design is not compatible with test taking and requires many assistants to monitor students. Furthermore, this design often takes up more space than other layouts.

Inverted U-Shaped Computer Lab Layouts





Like the U-shaped layout, the Inverted U-shape also offers engagement between instructors and students. In addition, the layout allows for the most convenient method of monitoring students. For individual learning, this layout minimizes the distance instructors must walk to move from workstation to workstation and student to student.

Like the classroom layout, traffic into and out of the Inverted U-shape can become constrictive especially when all of the students must enter and exit at the same time. This congestion is reduced if students are entering and exiting individually as in an open lab paradigm where students can come and go as they please. In addition, this layout takes up the same amount of space as the U-shaped design. If space is not a consideration, either of the U-shaped layouts is appropriate.

Planning & Organization Of Computer Lab

The importance and utility of laboratories in Computer- Sci-ences teaching can thus not be overlooked. Laboratories for the teaching of this subject should help in the realization of the relevant objectives. Laboratories for this purpose should be well planned and adequately equipped.

In this connection here we are presenting a few schemes or plans for the establishment of these laboratories. Let us dis-cuss each of these plans separately for being able to choose any one of them according to our needs.

1. The list of the computer systems with numbers should be prepared after careful consultation of the prescribed syllabus of Computer Science.
2. The provision of the annual budget for purchase of new computers and other computers science goods should be taken into account before booking orders. Priority should be given to those who quote least quotation.
3. The quantity of the computer systems and material depends upon the number of the students in the class.
4. The list of most frequently used computer systems and other connections should be made and consideration of the number of students using them should be made to arrange them for the convenient of the students.

The quantity of Computer science apparatus depends on the method of teaching adopted by the teacher.

Demonstration of practical is an entire responsibility of a teacher. He may plan it for the successful delivery of the theoretical knowledge, skills and application of theory with practice.

Laboratory work is entirely a responsibility of the students. It clearly aims to provide them needed opportunities for the development of essential laboratory skills for learning how scientific knowledge and principles work in the practical situation or how the facts are discovered in computer science. Students are required most of the time to do independent practical work.

The decision about the independent as well as co-operative group work done by the students must be taken quite in advance in time with the curricular needs as well as providing rich experi-ences and opportunities for the gifted and creative students. The minimum practical work to be done by each and every student of a Computer Sciences class must be made known to all students of the class. The schedule for doing such practical work must also be made known to them in advance.

The student should be allotted seats for doing practical work independently in the laboratory. The students should be provided separate arrangement (properly locked) for keeping the material and equipments allotted to them for doing practical in the laboratory.

Students must exhibit necessary devotion and seriousness for the conduct of laboratory experiments. In no case they should resort to shortcuts, dishonesty and carelessness. They must be quite methodological in doing their experiments,

science and hon-est in observing and recording the process and product outcomes to their experiments and competent enough for deriving valid conclusions and inferences from their experiments. It case of difficulty, they should not hesitate to seek proper guidance and heal from the teacher of the persons responsible for such guidance.

The proper follow up of the laboratory work done by the students independently or in-group should be a regular feature for deriving gains through such laboratory work. It should be properly evaluated in terms of its process and product outcomes. The keeping of proper records and maintenance of practical note-books by the students may help much in this direction. The teacher in charge should regularly check it and necessary guid-ance thereafter should also be given to the students. The work found unsatisfactory must be asked to get repeated by the students and difficulty, if any should be sorted out then and there while working along with the students in the laboratory.

The students must be told to observe the necessary precautions and disciplinary rules etc. for conducting individual as well as co-operative laboratory work in the laboratories. The teacher along with the assisting staff like laboratory assistants, storekeeper etc. should always be there to help and supervise the students working in the laboratory.

As far as possible the practical work done in laboratory should be in proper tune and close cooperation with the theoreti-cal work done in the classroom lessons or assignments given to the students for independent study and creative output.

The students must be told to have necessary preparation for the conduct of laboratory work in terms of necessary theoreti-cal background of the work and experiments, observation of class room demonstration careful observation and recording of the pro-cess and product outcomes of their laboratory work etc. They must learn the proper way of utilizing laboratory mate-rial and equipments without causing any damage or breakage. After finishing their work they should develop proper habit of cleaning dusting and packing etc. before keeping the material and equipments at their fixed places.

Managing/Maintenance of A Computer Laboratory

Maintenance of records and handling of students when they work in the laboratory constitute the management of a labora-tory.

Name of the students, their group consisting of a specific number should be presented in the lab. Students time table and date on which the laboratory work conducting should be kept in the laboratory the name of the experiment and the nature of the laboratory work to be performed for individuals and group should be maintained.

The period of duration of the practicals should be maintained the nature

of the guidance and follow up work to be given to the students must be planned earlier. The Computer teacher should keep in touch with firms and companies who sup-ply computer products and the prices of these items should be kept in the laboratory and several firms, catalogues and their price lists also must be kept.

Maintenance Of Records

It is important to keep the account of the laboratory in full; the following registers should be maintained.

1. Stock Registers. They are of three kinds :

(a) Register for breakables- In this in the first instance all the breakables are entered in different categories. The repaired systems and their number and date must be entered in this register.

(b) Non-Breakables- In this register working systems, connections and other purchases with their numbers are entered along with their cost.

2. Purchase -Register- The bills in full, of all article pur-chased must be entered with all the particulars such as; 1. Name of the firm, 2. Date on which the goods received, 3. Rate of each item, and 4. The number of articles purchased, 5. Total cost of the articles. The number of folio of stock register entered should be shown. The total amount paid to the firm should also be shown.

3. Necessity indicator register. The teacher should go on noting down any system, article or other necessary items not in the stock but needed urgently for conducting experimentation in the laboratory. This is of great help in making annual demand and framing budget for laboratory expenditure at the end of each year.

Discipline In The Laboratory Rules For The Teacher And Laboratory Staff

1. Teacher and the laboratory staff should not allow any student or person to enter the laboratory in their absence.
2. The teacher and laboratory staff themselves should produce self example for the proper use and maintenance of the laboratory.
3. Teacher and laboratory staff should exercise proper control over the student working in the laboratory.
4. The seats of the students should be fixed. They should not be allowed to move here and there in the laboratory.
5. Full instruction about the conduct of the practicals should be given to students before the beginning of the practicals.
6. The teachers should have full knowledge of the practical items and requirements used by a student in his seat at the time of practical class.

7. All precautions to be adopted by the students during their practicals should be told to the students.
8. The students should switch off electrical connections before leaving his place of work.
9. The work of the students should be under the strict control of the teacher.
10. The disciplinary rules and precautions to be adopted in laboratory should be exhibited.

Rules For The Students In The Laboratory

The students while working in the laboratory should be instructed to follow the following rules:

1. All computers must be handled with care.
2. No article should be taken outside the laboratory.
3. Use only those articles needed for the practicals.
4. In case of problems, the teacher must be informed.
5. No haste should be done in performing practicals.
6. Computers not in use should not be placed on the table.
7. Nothing should be left on the floor.If there is any obstruction it should be removed at once.
8. After the practicals all computers must be cleaned and switched off.
9. In case of doubts, the teacher must be consulted.
10. Perfect discipline should be maintained and useless talking should be avoided while performing practical's.

Security of computer laboratory

Physical security

- Employ security guards to keep watch over data and information centers and backups.
- Apply burglar proof for the computer laboratory.
- Reinforce weak access points like windows, doors, roofing with metal grills and having strong padlocks.
- Set up alarms to alert you in case of break-ins.
- Use system locks (locked key systems) to make it difficult to access internal components like hard disks and memory sticks.
- Use visual deterrents for example stop security plates that are hard to remove since these kill the resale value.

- Encode hardware components with digitally authenticated handshake between systems and computer at power up.
- Use cables to lock the equipment to desk, cabinet or floor.
- Electronic locking mechanism with keys, swipe cards, finger print recognition.
- CCTV Cameras to keep watch over computer systems and centers.

Software security measures

- Computers shared by multiple users in a computer center should have security software installed to limit and block certain activities for example deep freeze.
- Remote administration software should be considered with high number of computers in a computer center.
- Computer management software to monitor and limit web browsing should be installed for example K9 web protection.
- Group policy or security software to prevent malicious software from being executed and installed.
- Assigning unique authorised loin for authentication before granting network access.



21

Pedagogical Analysis

The word 'Pedagogy' comes from the Greek word "paidagogos' in which 'Paida' means "child" and 'agog' means "Lead" literally translated "to lead the child"

Pedagogy generally means the science of teaching. It focuses on **methods and approaches** that are based on **principles,** which are derived from **theories.** So pedagogy is

- The function or work of a teacher; teaching
- The art or method of teaching; education; instructional methods.

Pedagogy is the art (and science) of teaching. Effective teachers use an array of teaching strategies because there is no single, universal approach that suits all situations. Different strategies used in different combinations with different groups of students to improve their learning outcomes. Some teaching strategies are better suited to teaching certain skills and fields of knowledge than are others. Some strategies are better suited to certain student backgrounds, learning styles and abilities. Pedagogy, incorporating an array of teaching strategies that support intellectual engagement, connectedness to the wider world, supportive classroom environments and recognition of difference, should be implemented across all key learning, and subject areas.

The term pedagogical analysis (a composition of two words pedagogy and analysis) stands for a type of analysis based on pedagogy. Analysis as a term stands for a process of breaking or separating a thing into its smaller parts, elements or constituents. We break a teaching unit into its constituents –subunit, topics or single concepts etc. through the process of unit analysis. In addition, we can break the contents of the prescribed course in a subject

into its various constituents – major and minor sections, sub sections, units and sub-units, major concept and minor concepts, topics etc by carrying out a process of content analysis.

Therefore, *"the analysis of a given content material in any subject any topic carried out well in the spirit of the science of teaching (Pedagogy) is known by the term pedagogical analysis of the contents".*

Concept of effective teaching

Effective teaching is the teaching that successfully achieves the learning objectives by the pupils as identified by the teacher. The most effective teaching is that which results in the most effective learning. In addition, the learning is a process not the product, it involves all those experiences and training through teaching of an individual, which helps to change the behavior and prepare to take necessary adjustment and adaptation in change situation. There are essentially two simple elements to effective teaching:

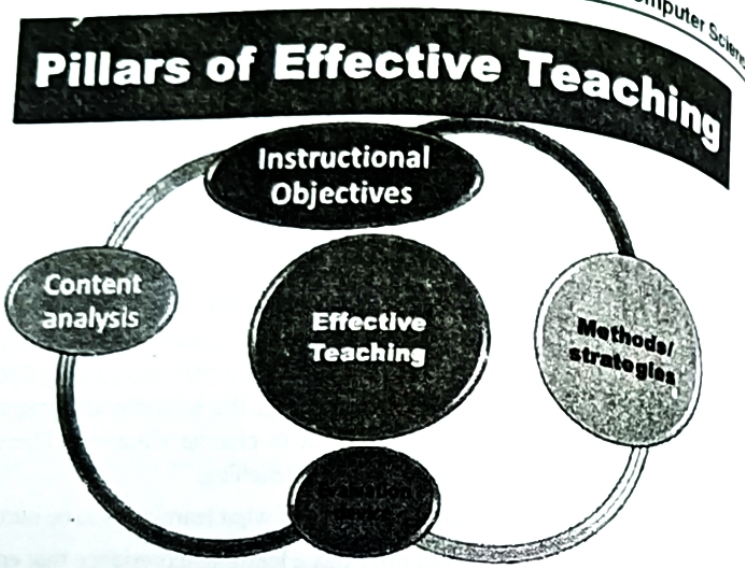
- The teacher must have a clear idea of what learning is to be nurtured.
- The teacher sets up and provides a learning experience that enables this to happen.

The root of effective teaching of a successful teacher is evolved in the following tenets:

1. Pupils learn best in a positive and nurturing environment established by teachers who believe that every pupil is capable of learning.
2. All pupils have areas of strengths and interests that can be useful in advancing pupil learning. Effective teachers establish an instructional environment that will draw on these strengths.
3. Teachers take into account the *whole pupil*; in other words, they attend to the cognitive, affective, social, and physical dimensions when developing an instructional program.
4. Active engagement and interaction facilitate pupil learning.
5. New learning is built upon previously learned information. Learning is enhanced when prior knowledge and cultural and social experiences are valued, acknowledged, and leveraged throughout the curriculum.

There are four pillars of effective teaching ie.

I. Instructional Objectives (Why to Teach?)
II. Content Analysis (What to Teach?)
III. Method/ Strategies (How to Teach?)
IV. Evaluation Devices (What is Achieved)



Components and Operations Involved in the task of Pedagogical Analysis

The term pedagogical Analysis of any subject content we certainly aim to carry out the task of the analyzing the prescribed course material or a particular unit/sub-unit/topic/single concept of the subject being taught to a particular class by systematically executing the following four operations in a close interactive style.

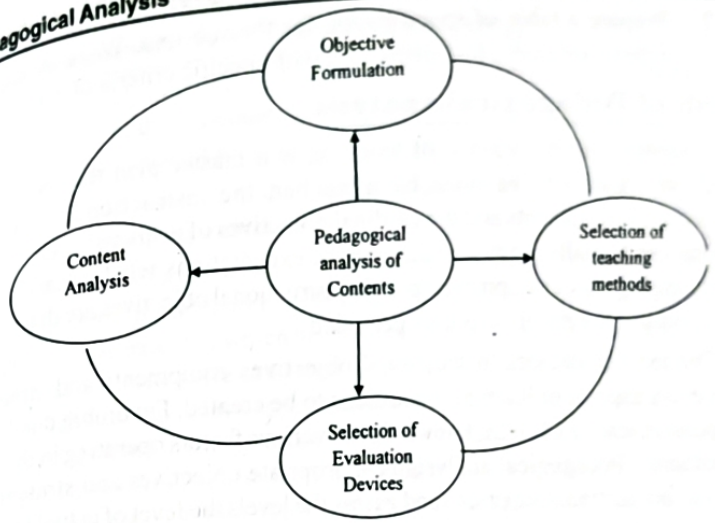
A. Content analysis of the unit/topic/single concept being taught by the teacher in the subject.

B. Setting of the teaching or instructional objectives of the content material of the topic in hand by writing them in specific behavioral terms.

C. Suggesting methods, techniques, teaching learning activities, aids and equipments helpful for the teaching learning of the topic in hand quite in tune with the realization of the set instructional objectives.

D. Suggesting appropriate evaluation devices in the form of oral, written or practical activities and test questions etc for evaluating the outcomes of the teaching learning process carried in relation to the teaching of the topic in hand.

In the light of the relationship and interdependence existing among the above mentioned four components of the pedagogical analysis, operations of the content material in the subject may then be properly illustrated through the following diagram.



To perform pedagogical analysis of the contents of a subject/unit/or topic to be taught in the class a teacher has to go through the cycle of the above mentioned four components namely

1) content analysis 2) objective formulation 3)selection of the teaching methods and materials used 4)selection of the evaluation devices.

Steps of pedagogical analysis

1. Divided the contents of the selected unit in to suitable sub-units and arrange the selected sub-units in to a number of required periods.
2. Briefly write the essence of the content of the selected sub-unit.
3. Write appropriate previous knowledge required for the sub-unit.
4. Write appropriate instructional objectives to be selected for the sub-unit.
5. Select appropriate teaching strategies for the sub-unit according to the following instruction:
   1) Write the name of the method applied.
   2) Mention the teaching aids required.
   3) Briefly illustrate the necessary demonstration and /or experimentation required.
   4) Mention the necessary board work required.
   5) Write probing questions related to the sub-unit and provide appropriate answers for them.
   6) Prepare a work sheet for the sub unit.
6. Give suitable examples/illustration/analogies for the sub unit.

7. Prepare a table of specification for the sub unit. Write at least six criteria reference test-items each with specific criteria of the sub unit.

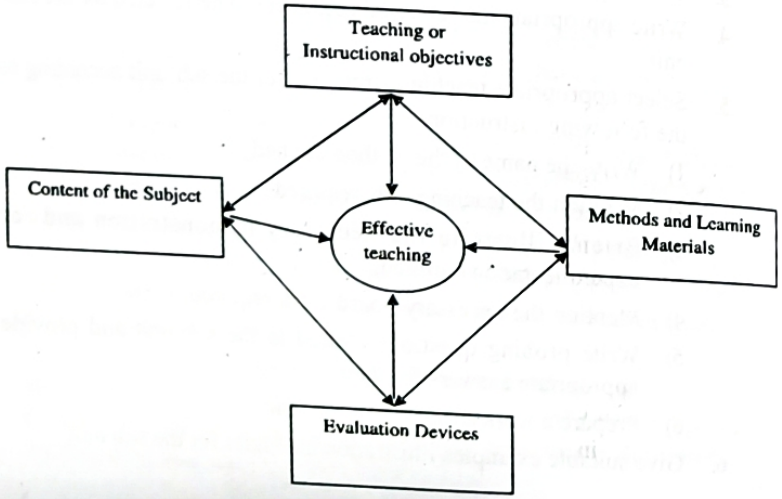
Needs of Pedagogical analysis

Pedagogy i.e. the science of teaching is a master plan that includes a details of what is to be done by a teacher, the instructional strategies, instructional equipments and the cardinal objectives of instruction. Depending on what can actually learn and shat are the expectations sets for learners of a particular stage of development, specific instructional objectives are determined and appropriate sets of activities provided.

The teacher decides instructional objectives equipments and strategies with every aspects of learning conditions to be created. Favorable conditions for positive learning cell for knowledge of various factors operating in different conditions. Pedagogical analysis is appropriate objectives and strategies in various instructional situations and assess the levels the level of actual learning at the end. A comprehensive vision of required tasks, strategies for realization of specific goals facilitates effective teaching. So pedagogical analysis offers enormous in all form of education. It involves various logical steps to arrive at logical inference. It also helps the students to understand concepts, principles or phenomena.

Again the learning environment created accordingly enables to-

1. Relate individuals fragment of knowledge to real experience in life and work.
2. Develop skills and relate facts as a part of a larger organized completely. Realization of specific goals, facilitated by a detailed planning result in effective teaching.



Pedagogy serves in effective Teaching

The science of teaching pedagogy is found to serve the following two main objectives in the schedule task of a teachers teaching.

i. Teaching should be carried out as smoothly as possible and
ii. It should result in to the maximum output in terms of the expected better teaching outcomes.

A teacher has before him content material and learning experiences related to that subject in a particular class. In this way his success in his teaching task depends upon the extent to which he is successful in realization of the teaching instructional objectives. He can go on smoothly in his teaching task only if he follows suitable method, devices, techniques and aid materials etc. for providing the fruits of his teaching to his students. How properly is he proceeding in his teaching tasks and how will he is trying to achieve the set teaching objectives, that now needs the help of a continuous system of testing and measurement known as evaluations of teaching outcomes. The result of such evaluations provides an appropriate feedback to the teacher for bringing alteration in setting of instructional objectives. In this way science of teaching or pedagogy advocates a total mutual relationships and interdependence among the following four pillars of the teaching learning process for attaining best possible results in the task of teaching i.e. effective teaching.

Science of teaching or pedagogy in this way lays down the above mentioned four essentials pillars along with their inherent mutual relationship and interdependence for being considered essential in the realization of the desired success in a teaching task. It is the message and spirit of the science of teaching or pedagogy that needs to properly carry out in any subject and then only then such analysis of the content material may be termed as pedagogical analysis of the given content material.

A teacher may proceed in the way given below for analyzing the contents of the syllabus of his subjects as well as the contents of the topic to be taught in the classroom by preserving the spirit or massage conveyed by the science of teaching or pedagogy.

i. The contents of the subject should be got analyzed properly in to major and minor sections/unit/concepts etc. and sequenced as well as organized as methodically a possible.
ii. Only a desirable amount of the content material enabled to be covered properly in the scheduled subject period should be taken in to hand at a time in the shape of a topic to be taught by the teacher for his scheduled classroom.
iii. The topic in the hand should also be analyzed properly in the form of major and minor concepts/single concepts etc.

iv. The teacher should now clearly lay down the teaching or instructional objectives related to the topic in hand by writing them in to the specific behavioral terms.

v. How can these stipulated instructional objectives be achieved properly by teaching contents of the topic in hand should now be made a point of consideration for proceeding further on the path of pedagogical analysis. Definitely, in this situation it needs the better employment of men material resources by the teacher science of teaching (pedagogy) can help him here to think about the best possible methods, strategies, tactics and techniques to be employed, aid material and likewise sources to be utilized for the teaching of the topic in hand in the existing teaching learning situations. All of the possible things and factors helpful in the teaching of the topic in view of the proper realization of the set teaching objectives then should be properly analyzed and classified in any of the scheme of pedagogical analysis of the topic or contents of subject.

vi. In the last there arises a need of exercising proper control over the different components of the teaching-learning process. Such control can only be possible through a well-organized scheme of evaluation well in tune with the contents of the topic in hand, stipulated teaching objectives and methods and material employed for teaching. For this purpose, an appropriate evaluation scheme should also find a place in any scheme of pedagogical analysis of the topic or content material of that subject.

Effective teaching through pedagogy display skills at creating curricula designed to build on students' present knowledge and understanding and move them to more sophisticated and in-depth abilities, knowledge, concepts and performances. In addition, pedagogy helps to make a range of instructional strategies and resources to match the variety of student skills and to provide each student several ways of exploring important ideas, skills and concepts. Pedagogy makes a teacher: how to work as facilitators, coaches, models, evaluators, managers and advocates. Moreover teachers know how to utilize various forms of play, different strategies for grouping learners and different types of media and materials.

Based on the latest developments in pedagogy, teaching has become more than an activity that conserves valued knowledge and skills by transmitting them to succeeding generations. Therefore, teachers also have the responsibility to challenge existing structures, practices and definitions of knowledge; to invent and test new approaches; and , where necessary to pursue organizational change in a constant attempt to improve the school.

❖ ❖ ❖

22

Pedagogical analysis of the topic: Computer System

Step 1: Content analysis– Computer System

It consists of two parts:

- Major concept
- Minor concept

A) Major concept:

1. Definition of computer
2. Components of computer
3. Functions of computer
4. Characteristics of computer
5. Classification of computer
6. Applications of computer

B) Minor concept

1. Computer
   a. Definition of Computer
2. Components of Computer
   a. Input unit
   b. Central Processing Unit
   - Memory unit
   - ALU (Arithmetic & logical unit)
   - Control unit

c. Output unit

3. Functioning of Computer
   a. Accept data
   b. Share data in memory & recall when it is required
   c. Process data
   d. Communicate information as output
4. Characteristics of computer
   a. High speed
   b. Accuracy
   c. Diligence
5. Computer classification
   a. According to data representation
   b. According to purpose
   c. According to use
   d. According capacity (cost, speed & memory)
6. Computer Application
   a. Education
   b. Marketing
   c. Entertainment

Step 2: Objective Formulation (Behavioral Outcomes)

Students after going through the teaching of the topic "Computer System" will be able to –

a. Recall the term computer.
b. Various Components/elements of Computer.
c. Explain the functioning of computer.
d. Define the term input unit and output unit.
e. Give the characteristics of Computer.
f. Explain the working of central processing unit.
g. On which basis computer can be classified?
h. Applications of computer.
i. Give different examples input devices and output devices.
j. Differentiate Input and Output devices with example.
k. Make model for explaining a Digital Computer.
l. Explain types of Printer.
m. Define term plotter.

Step 3: Methods, Devices, Activities and Aid Material Used

a. **Method and Techniques**

- **Method** – Lecture method, demonstration Method.
- **Techniques** – Illustration, observation explanation, questioning.
- **Activities and material used.**
- While teaching the topic help of blackboard writing, charts will be taken.

1) Charts used for presenting components of computer.
2) Verbal explanation & charts for Computer characteristics.
3) Verbal explanation for depicting the classification of computer.
4) Videos used to explain application of Computer.
5)

Step 4: Evaluation Procedure and Devices Used

Evaluation can be done through oral and written mode

a) In oral mode, student will ask questions during teaching process or after completion of topic and students are required to respond orally to ask questions.

b) Written mode consists of:

- Essay type
- Short answer type questions
- Objective type questions
  - Fill in the blanks
  - True-False
  - Match the column
  - MCQ

Essay type questions:

a. Explain computer system & its characteristics
b. Describe components of computer
c. Classify computer on the basis of purpose

Short answer type questions:

a. What is computer?
b. What is C.P.U?
1) Objective type question :-
i. True/false statement :-
I. If input, output unit is the component of computer?

II. Can computer be classified on the basis of purpose?

ii. Fill in the blanks :-

I. There are _____ components of computer.

Pedagogical Analysis (in tabular form)

Content Analysis	Behavioral outcomes	Method, Devices, activities & material	Evaluation Procedure
1.Computer **Definition of computer:** An electronic data processing device that accept data, process it & produce result.	Understand the concept of Computer.	Lecture Method used & picture of computer	Define computer.
2.Components of Computer:- **Input unit:** With the help of it, we enter data into computer. **CPU:** It contains three main parts. 1) ALU(Arithmetic logic unit) 2) Control unit 3) Memory unit. **Output unit:** We get information from computer with the help of this unit.	Give components of computer system.	Demonstration method observation.	True/False • Control unit is the part of output unit (T/F) • Output get information from computer. (T/F) ____ unit consist 3 parts.
3.Functioning of computer:- • Accept data • Share data in memory & recall when it is required • Process data • Communicate information as output	Able to tell the functioning of computer.	Using lecture and demonstration method & use of blackboard to draw a diagram	Draw the Diagram of computer functioning.
4. Characteristics of Computer **1) High speed-** The unit of speed in computer are millisecond, nanosecond etc. **2) Accuracy-** Computer never commits error in processing **3) Diligences-** A computer can operate 24 hours continuously without taking rest.	Explain the characteristics of computer	Video films may be used to show characteristics of computer	Write any 3 characteristics of computer

5.Computer classification • **Acc. to data representation –** o Digital o Analog o Hybrid • **Acc. to purpose-** o General purpose o Specific purpose • **Acc. to the use-** o Scientific o Business • **Acc. to the capacity-** o Micro computer o Mix computer o Main framing o Super Computer	Understand the computer classification.	Verbal explanation will be provided.	• Which one is the type of Data representation Computer a) Analog b) General computer c) Scientific computer • Computers are classified into ____ groups. A) 2 B) 3 C) 4
6.Applications of Computer • **In education:-** helpful in making soft copy Read & write data or topic • **Marketing:-** It helps in advertising • **In games for entertainment:-** It is helpful	Students get to know Application of computer & able to give some more application.	Videos will be used & explanation for computer application	• Give any 3 areas where computer were used. • Is computer used in education (T/F)



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Pedagogical analysis of the topic : Operating System

Consists of four steps:

Step 1: Content analysis-Topic-Operating System

It consists of two parts:

- Major concept
- Minor concept

Major concept

I. What is operating system?
II. Types of operating system?
III. Functions of operating system?
IV. Services of operating system?

Minor Concept

I. What is operating system?
- Defining the term Operating system.
- Meaning of the term Operating system

2. Types of Operating system?
- Batch Operating system
- Multiprogramming Operating system
- Multitasking Operating system
- Distributed Operating system
- Multiprocessing Operating system

3. Functions of Operating System
- File management
- Device management
- Process management
- Memory management
- Services of Operating system

4. I/O operation
- Communications
- File system manipulation
- Program executions
- Security and execution
- Error detection
- Resource allocation

Step 2: Objective Formulation (Behavioral Outcomes)

Students after going through the teaching of the topic Operating system are able to:

a) Define the term Operating system.
b) Explain the meaning of Operating system.
c) Differentiate between device management and memory management.
d) Give the definitions of Device management.
e) Define the term Resource allocation.
f) Differentiate between Multitasking and multiprocessing.
g) Give example of multitasking.
h) Cite example of different types of Operating system.
i) Recall the structure or diagram of Operating system.

Step 3: Methods, Devices, Activities and Aid Material Used

Methods: Lecture method, Discussion method, Demonstration method

Devices: Explanation , Illustration etc.

Activities and aid material used:

a) While teaching the topic help of blackboard writing, chart and pictures will be taken.
b) Slides and transparencies may be used to show the diagram of Operating System.

c) Audio, Video conferencing, Films and computer presentation may be used to define the structure of Operating System, functions of Operating System etc.

d) Practice opportunities will provided for understanding the concept term of Operating System

Step 4: Evaluation Procedure and Devices Used

Evaluation can be done through oral , written and practical mode

a) In oral mode, student will ask questions during teaching process or after completion of topic and students are required to respond orally to ask questions.

b) In practical mode, the students draw the diagrams of Operating System.

c) Written mode consists of:

- Essay type
- Short answer type questions
- Objective type questions
  - Fill in the blanks
  - True-False
  - Match the column
  - MCQ

Essay type questions:

I. What is operating system? Explain its nature?
II. Give at least three characteristics of Operating System?
III. Discuss the types of Operating System?
IV. Explain the term File management, Device management
V. Difference between Multitasking and Multiprocessing.

Short answer type questions:

I. Discuss the term Operating System.
II. What do you mean by Memory management?
III. Draw the diagram of Operating System.
IV. Give example of Multiprocessing
V. Define Operating System.

Multiple Choice Questions:

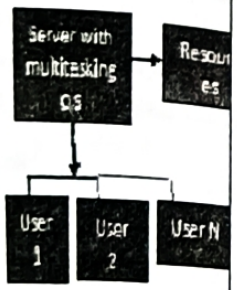
I. Operating System is the user interface between
a. Computer and hardware
b. User and hardware
c. Hardware and Software

II. Full form of FM
a. File management
b. Folder management
c. File and memory
d. None

III. Which are type of Operating System store data?
a. I/O device
b. Memory
c. Device management

Pedagogical Analysis of Operating System (in tabular form)

Content Analysis	Behaviour outcomes	Methods, Devices, activities & material used	Evaluation Procedure
1. What is operating system? Operating system is an interface between the user and hardware. OR It is a set of S/W programs that manages computer h/w resources	After going through the topic students will be able to: Recall the term OS.	Lecture method, Illustration method	Define the term Operating System.
and provide common services for application s/w. **Eg:** a) Keeping track of files and directories on the disk. b) Sending output to the display screen.			

Types of OS a. Single user OS: It is designed for one user to effectively use a computer a time. b. Multi user OS: It allows the multiple user to simultaneously use the system while the processor split the resources.	Recognise & recall the purposes of the different type of OS	Explanation Device Slide presentation will be used	What is difference between single & multi user operating system
Multiprogramming OS In this multiple jobs are performed by the OS simultaneously at a time. **Multitasking OS** It allow a user to perform more than one computer task (such as the operation of an application program) at a time. The operating system is able to keep track of where you are in these tasks and go from one to the other without losing information. **Distributed OS** It is a software over a collection of independent, networked, commu	Concept of multiprogramming OS, Multitasking OS , Distributed OS& Multiprocessing OS	Use of Chart 	Name different types of OS. Explain the purposes of different types of operating

...ing, and physically separate computational nodes. Each individual node holds a specific software subset of the global aggregate operating system. Each subset is a composite of two distinct service provisioners. **Multiprocessing OS** It enable several programs to run concurrently. UNIX is one of the most widely used multiprocessing systems,		Slide presentation will be used & Illustration method will be used	system.
Functions of OS: **Memory management:** Keep tracking which one is allocated or deallocated & how to swap between main memory & secondary memory. **Process management:** Most OS allow a process to be assigned a priority which affect its allocation. **Data & File management:** OS have a variety of file systems that control creation, deletion & access of file of data & programs. **Device management**: OS manages device communication via their respective drivers. Operating System does the following activities for device	Understand the different functions of OS.	Lecture method Use of blackboard for writing functions of OS	Explain different functions of OS.

management. • Keeps tracks of all devices. Program responsible for this task is known as the I/O controller. • Decides which process gets the device when and for how much time. • Allocates the device in the efficient way. • De-allocates devices.			
Services provided by OS: It manages the sharing of internal memory among multiple application. It handles I/O to & from attached h/w devices like printer. OS manage how to divide the program. It helps in Program executions It provides Security and execution It handles Error detection	Understand the importance of services provided by OS	Lecture method Use of blackboard for writing services of OS	What are the services provided by OS?



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Pedagogical Analysis of Networking

It Consists of four steps:

Step 1: Content analysis-Topic-Networking

It consists of two parts:

- Major concept
- Minor concept

Major concept:

I. What is networking?
II. What are benefits of networking?
III. Types of networking?
IV. What is network topology?
V. Types of network topology?

Minor concept:

I. What is networking?
- Defining the term networking
- Meaning of networking

II. Benefits of networking
- Can be easily shared
- No time consuming

III. Types of networking
- LAN
- MAN
- WAN

IV. What is network topology
- Defining the term network topology
- Meaning of networking topology

V. Types of network topology
- Star
- Ring
- Bus

Step 2: Objective Formulation (Behavioral Outcomes)

Students after going through the teaching of the topic Networking will be able to:

a) Define the term networking
b) Explain the meaning of term networking
c) Differentiate between LAN and MAN networking
d) Define the term network topology
e) Explain the meaning of term networking topology
f) Differentiate between Star, ring and bus topology
g) Define the term Bus, ring and star topology
h) Explain the benefits of networking

Step 3: Methods, Devices, Activities and Aid Material Used

Methods: Lecture method, Explanation method, Demonstration method

Devices: Power point presentation, Illustration & Explanation

Activities and aid material used:

a) While teaching the topic help of blackboard writing & sketching, chart and pictures will be taken.
b) Slides and transparencies may be used to show the diagram of Networking.
c) Audio, Video conferencing, Films and computer presentation may be used to show the concept of Networking.
d) Slide Projectors, charts & pictures may be utilised for the presentation of concept i.e. related to networking.
e) Model may be used to discriminate between the types of networking topology.

Step 4: Evaluation Procedure and Devices Used

Evaluation can be done through oral, written and practical mode

a) In oral mode, student will ask questions during teaching process or after completion of topic and students are required to respond orally to ask questions.

b) In practical mode, the students may be asked to perform model showing the working of networking topology.

c) Written mode consists of:

- Long answer type questions:
  - Explain the meaning of networking by giving example
  - Discuss the LAN, WAN, MAN with suitable example.
  - Differentiate between LAN, MAN, WAN with suitable examples.
  - Explain network topology & its type in detail.
- Short answer type questions:
  - Define the term networking
  - Name the type of networking
  - Give example of networking.
  - What is network topology?
  - Name the type of network topology.
  - Define the term Bus, Ring & Star topology.
- Match the column:

1. Network	a) Terminal
2. Star topology	b) Collection of network
3. LAN	c) Physical arrangement of device
4. Topology	d) Local area network

- Multiple choice questions:
  - Two or more computer systems are linked together?

a) Operating system
b) Internet
c) Networking

  - How many types of networking?

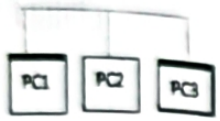
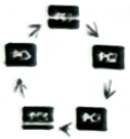
a) Two
b) Four
c) Five

  - LAN stands for:

a) Local air connection
b) Local area network
c) Local area's networking

Content Analysis	Behaviour outcomes	Methods, Devices, activities & material used	Evaluation Procedure
What is networking? **Def:** Physical arrangement of the two or more computer linked together are called networking	After teaching process students will be able to: Recall the term Networking.	Lecture method & use of chart showing the picture of number of computers linked together	What do you mean by networking?
Meaning: Networking consists of two or more computers that are linked in order to share resources such as printers, CDs etc	Explain the meaning of networking	Explaining method, illustration method Example: when we construct a home then electrician put a wire in home for making light connection then al light connections are connected with main meter	Explain the concept of Networking.
Benefits of networking Benefits of networking are as follows: It can be easily shared. It does not consume time.	Recall the benefits of networking	Lecture method Help of blackboard writing will be taken	Explain the benefits of networking.
Types of networking Networking is of several types: **LAN:** local area network. It can be said that LAN is a network of computer & other devices distributed over a limited area & connected by cables. **MAN:** Metropolitan area network. A	Explain the concept of LAN Understand the concept of MAN Understand the concept of WAN	Lecture method & use of chart showing the picture of LAN network. Help of blackboard writing will be taken Slides & transparencies are used to show LAN & MAN process.	Define the term LAN. Define the term MAN. Explain the term WAN. Differentiate Between LAN,

network is like network is designed for a town city Wide area network. Computers are connected by telephone lines or wires etc.			MAN & WAN
What is network topology? Physical arrangement of computer are called network topology. Meaning: topology is the layout pattern of the various element i.e links, nodes etc. of a computer.	Recall the term network topology. Explain the meaning of term networking topology.	Explanation method & by drawing pictures on the blackboard	1.What do you mean by network topology? 2. Physical arrangement & logical arrangement is called network topology(T/F) 3. _____& _____ are devices to help in connecting computer. a) Physical & logical b) Logically c) Data & communication
What are different types of network topologies? There are different types of networking: **Ring topology:** data are transferred into ring form. If one computer is damaged then data is not transferred ahead.	Recall different types of network topologies Explain the term ring topology	Explanation method & by drawing pictures on the blackboard Charts/models will be used to show arrangement of computers in different topologies. Use model that explain working of ring topology 	What is ring topology?

Bus topology: bus topology use terminal, through it data transfer.	Explain the term bus topology	With the help of model we explain bus topology  Like in real life we use bus system	What is bus topology?
Star topology: all the data are transferred through hub.	Explain the term star topology	Use model 	What is star topology?



25

PEDAGOGICAL ANALYSIS TOPIC- MS-WINDOWS

Pedagogical analysis of the topic windows consists four parts:-

Step 1:-

Content analysis-it has two parts:-

1. Major concept
2. Minor concept

1. MAJOR CONCEPT:-

- Concept of window
- Features of window
- elements of M.S Windows
- Types of window according to work done
- Types of window according to characteristics
- Various internet tools of window

2. MINOR CONCEPT:-

a) Concept of window

- Defining the term M.S windows
- Meaning of term M.S Windows

b) Features of window

- GUI
- Clipboard
- Multitasking
- Windows NT

- Windows 95
- Windows 98
- Windows 2000

c) elements of M.S Windows

- Icons
- Start menu
- Taskbar

d) Types according to work done by windows

- Program window
- Document window

e) Types according to characteristics of window

- Main window
- Child window
- Pop up window
- Dynamic data exchange
- Dynamic link libraries

f) Various internet tools of window

- Web publishing wizard
- Front page express
- Personal web server
- Outlook express

Step 2 - OBJECTIVE FORMULATION

Students after going through the teaching of the topic windows will be able to:-

1. Recall the term window.
2. Understand the features of window.
3. Understand the types of windows according to work done.
4. Understand the types of windows according to characteristics.
5. Differentiate between program window and document window.
6. Understand the concept of main window.
7. Recall the term child window.
8. Understand about various types of internet tools by window.
9. Understand the term outlook express.

STEP 3-METHODS, DEVICES, ACTIVITIES & AID MATERIAL USED:-

METHODS:-lecture method, demonstration method, explanation method, illustration method.

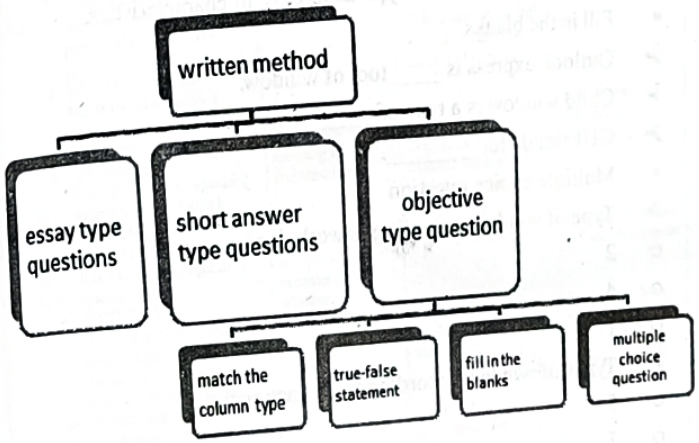
DEVICES:-chart, blackboard.

ACTIVITY & AID MATERIAL USED:-

- While teaching the topic help of blackboard writing will be taken.
- Verbal explanation with slide presentation will be provided for deplicating the role of various types of windows.
- Help of chart will be taken to show the types of windows.

STEP 4:- EVALUATION PROCEDURE & DEVICES USED:-

- In oral mode, students will be asked questions during teaching process or after completion of the topic and students are required to respond orally to the asked questions.
- In practical mode , students will be asked to prepare charts & pictures of various types of window.
- Written mode consists of:-



a) Essay type questions:-

- Define features of window.
- Define the types of window according to work done.
- Define types of window according to characterstics.
- Define various internet tools of window.

b) Short answer type question:-

- Define clipboard.
- Define document window.
- What do you mean by pop up window?
- Define outlook express.
- Define web publishing wizard.

c) Objective type question:-

- Match the column question

➢ DDL	According to characterstic
➢ Main window	acc.to work done
➢ Pop up	internet to

- True-false statement

➢ Window has only two parts.
➢ Child window is the type according to work done.
➢ Pop-up window is the type according to characteristics.

- Fill in the blanks

➢ Outlook express is ____ tool of window.
➢ Child window is a type of_____.
➢ GUI stands for_____.

- Multiple choice question

➢ Type of window according to work done
  - o 2
  - o 4
  - o 1

➢ Types of window according to characteristics
  - o 5
  - o 7
  - o 3

➢ Internet tool in window is
  - o Outlook express
  - o Child window
  - o Program window.

Content analysis	Behavioral objectives	Methods devices and aid material used	Evaluation procedure and devices
1. Concept of window :- Introduction:- MS Window is an operating system marketed by Microsoft corporation USA. A window is simply a rectangular box belonging to a dialog box or an application launched in 1998.it was the first GUI based multitasking system for home based desktop users. The most popular windows versions are MS WINDOWS,WINDOWS-NT,MS-WINDOWS 95/98/2000/2007.	After reading the topic:- Students are able to understand the concept of windows.	Black board is used to draw the picture of window.	When the MS WINDOW launched? What are the most popular versions of window?
2.FEATURES OF WINDOW:- ❖ GUI:- The windows are activated on the basis of GUI operating environment .	Students are able to understand the term GUI.	Explanation method is used,	Give full form of GUI.
❖ CLIPBOARD:- Clipboard is an area in the computer's memory where MS-WINDOWS temporarily storesthe copied data .The clipboard supports cut and paste or sharing between programmes.	Students are able to understand the use of clipboard in windows.	Demonstration method is used. Slide presentation will be used to show the features of window.	What is the use of clipboard in windows?
❖ MULTITASKING:- MS-WINDOWs allow s executing more than one programme at a time.	Understand the meaning of multitasking.	Lecture cum demonstration method is used.	What is the meaning of multitasking?
❖ WINDOWS NT:- It is a client/server operating system.It is developed by Microsoft.	Students are able to understand the versions of window.		By whom windows NT was developed?
❖ WINDOWS 95:- It is a GUI based operating system.			
❖ WINDOWS 98:- It is an improved versions of windows 95.It has enhanced internet services and it is a true 32 operating system.		explanation method is used.	Explain windows 98.
❖ WINDOWS 2000:- It is developed by Microsoft coporation for PCs and server as the successor to WINDOWS NT 4.0. Early beta versions were reffered to as windows NT 5.0. It was officially released on 17th feb.,2000.	Students are able to understand the working if Window 2000.	Explanation method is used.	By whom windows 2000 is launched?
Different elements of Ms windows:			

Task bar: it is the thin strip that contains windows start button. When a user minimises a window, the application creates a icon on the task bar indicating the window is minimised & it can be reopened by clicking it. It contains clocks, volume, connection of internet etc. **Desktop:** after a user install MS Windows, the standard desktop is displayed. The desktop has My Computer icon & recycle bin & network icon. It is a place to add multiple icons to the application & files used frequently. **Icons:** **Folder icon:** when it is clicked, a folder window is opened displaying the contents of folder. **Document icon:** when it is double clicked, the document itself is opened. **For eg:** Word processing program etc. **Shortcut icon:** It provide an alternate way to open program, document & folder. **Start menu:** when a user wants to open an application, the most common place in the window start menu to find it. On the start menu, the user click "All programs" which open a list of available programs installed on the machine.	Recognize different types of icons	Lecture method, narration device Use charts to show: Folder icon  Document icon:  Shortcut icon: 	Define the purposes of various icons with Diagram
3.TYPES OF WINDOWS ON BASIS OF WORK DONE:- ❖ **PROGRAM WINDOW:-** program window opens its own window .The program window contains menus,buttons and others command that allow to work with document created in that program. ❖ **DOCUMENT WINDOW:-** When you create or open a file in a program ,the program displays the file in a document window .If you open several documents in a	Understand the term program window. Understand the	Lecture cum demonstration method used. Helps of charts will be taken.	Define the concept of program window. Define the term document window.

program the program displays each document in its own window. **Types of window according to characteristics:** ❖ **Main window:-** Main windows are generally used as the base window for the first window in a application.They are also commonly used as primary window. You may access and work with other window from the same application & from the desktop. ❖ **Child window:-** Child windows are subordinate to parent window. They move along with their parent window. If the parent window is moved from the desktop,child windows are never active. Child window can open additional child window ,but any child window opened from another child window behaves like children of original child window. ❖ **Pop-up window:-** Pop-up window are used to present application or further explanation of specific item or interest. ❖ **DDE:-** DDE enable two window application it carry on a conversation by sending a message to each other e.g:- the data from a spread sheet package can be accessed by a word processing document and is printed. ❖ **DLL:-** It is a file containing functions to be called at run time by application program	term document window. Able to recall the term main window. Able to give the names of window according to characteristics. Able to understand the working of child window and pop-up window. Recall the full	Explanation method is used. Chart is used to show the picture of various types of windows. Explanation and visual method used. Lecture cum demonstration method used. Chart is used to show DDL.	How many types of window according to characteristics? Main window is commonly used as ____window. Child windows are subordinate window to parent window.(t/f) Define the concept of pop-up window.

running in the windows environment. **5.INTERNET TOOLS IN WINDOW:-** ❖ **WEB PUBLISHING WIZARD:-** Web publishing wizard leads you step by step through the process of transferring a page to a web server. ❖ **FRONT PAGE EXPRESS:-** Front page express is used to create and publish web paper electronically. ❖ **PERSONAL WEB SERVER:-** Configures your to act as a web server allowing you to test your web pages before placing them on the web. ❖ **OUTLOOK EXPRESS:-** Outlook express is a Microsoft internet email program.	form of DDE. Recall the full form of DDL. Understand the concept of web publishing wizard. Recall the term front page express. Understand the concept of personal web server. Recall the term outlook express.	Verbal /explanation method is used. B!ack board is used to explain the topic. Verbal method is used. Explanation method is used.	Give full form of DDE. Give full form of DDL. Define the concept of web publishing wizard. Define the concept of front page express. Define the term personal web server. Outlook express is a_____program.

❖ ❖ ❖

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Pedagogical Analysis Ms-Office

It consists of four steps

Step 1 :- Content Analysis – Topic – MS-Office.

It consist of two parts.

(A) Major Concept

(B) Minor Concept

A. Major Concept

1. MS -Word
2. MS- Excel
3. MS-Power point
4. MS-Access

B. Minor Concept

1. MS-Word

➔ Introduction

➔ Feature

➔ Starting MS-Word

* Copying Text
* Search & Replace
* Macros
* Mail Merge

2. **MS-Excel**
- ➔ Introduction
- ➔ Starting MS-Excel
- ➔ Workbook
- ➔ Worksheet
- ➔ Data types
- Numbers
- Labels
- Formula
- ➔ Open a new worksheet
- ➔ Enter a new worksheet
- ➔ Save &close a worksheet
- ➔ Quit excel

3. **MS-Power point**
- ➔ Introduction
- ➔ Feature
- ➔ Starting MS-Power point
- ➔ Component of a slide
- Title
- Subtitle
- Drawing object
- Clipart & picture
- Charts
- ➔ Creating Presentation
- ➔ Slide View

4. **MS- Access**
- ➔ Introduction
- ➔ Component
- Table
- Primary key
- Queries
- Forms

- Reports
- Field Name, Field, Record and file
- Database uses
- Creating a database file

Step 2. Objectives Formulation

Students after going through the teaching of the topic "MS-Office" will be able to:-
- Recall the definition of MS-Office.
- Recognize the different application of MS-Office.
- Able to recall the term MS-Word/MS-Excel / MS-Access / MS-PowerPoint.
- Able to explain the features of MS-Word / MS-Excel.
- Make a presentation on slide in PowerPoint.
- Able to create database in access.

Step 3. Methods, devices, activities and aid materials used:-

Method:- Lecture Method, Demonstration Method, illustration, Explanation, Observation & Experimentation Devices.

While teaching the topic help of blackboard writing and sketching chart and picture will be taken.

1. Slides and computer presentation may be used to show the process of MS-Office.
2. explanation & slide presentation will be provided for the features of MS-Office.

Step 4. Evaluation Procedure And Devices Used:-

1. In oral mode, students will be asked questions during teaching process or after completion of the topic and students are required to respond orally to the asked question.
2. In practical mode, students will be asked to prepare resume, slides & charts etc.
3. Written mode consist
   - Essay type questions
   - Short answer type questions
   - Objective type questions

- True false statement
- Fill in the blank
- Multiple choice questions.

Essay type question:-

1. What do you mean by MS-Office? Explain.
2. Describe MS-Word in detail?
3. What do you mean by MS- Power point ? Explain it.

Short type question:-

1. Define the term MS-Word?
2. What are the features of MS-Office?
3. Prepare database in MS-Access?
4. Make a presentation on any topics in MS-Power point?
5. How to save a file in excel?

Objective type questions:-

Match the column:-

Column 1	Column 2
1. Use of slides in	rows and columns
2. Mail merge is a useful feature of	power point
3. A spreadsheet consist of	ms-word

True – false questions:-

1. We can do calculation in ms-word. (T / F)
2. Slides can be prepare in powerpoint. (T / F)
3. Rows and columns do not consist in spreadsheet. (T / F)

Fill in the blank questions:-

1. Replace of searched text with some other text is called .....
2. CTRL + V is shortcut key for .....
3. .....cell is an intersection of .....

Multiple choice questions:-

1. How many types of trigonometry function?
   A. 2 B. 3 C. 4 D. 5
2. How many column consist by a worksheet?
   A. 250 B. 254 C. 256 D. 260

PEDAGOGICAL ANALYSIS of MS Office

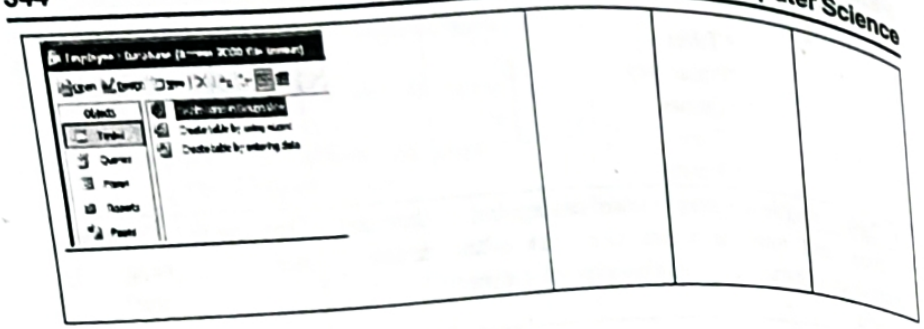
Content Analysis	Behavioral Outcomes	Methods, devices, activities and aid material	Evaluation procedure and devices
Microsoft Office: Microsoft Office is a suite of software. It is also popularly known as MS Office, is a popular software suite of services featuring many interrelated desktop applications, servers and desktop publishing programs. Office includes word processing, spreadsheet, presentation graphics and email communication program that provide functionality which is commonly used to run a business office.	After going through the topic students will be able to: Recall the term MS-Office	Lecture Method	Define the term MS-Office?
Feature of MS-Office:- 1. Universal Software 2. Complete Software Suite 3. Most Business Have a Use for It 4. Ease of Use 5. Online Support From Microsoft Online Tutorials	Recall the features of MS-Office	Blackboard may be used	Define the features of MS-Office
MS-Word :- MS-Word is a software that helps you to create neat and attractive documents easily and quick.	Define the term MS-Word	Lecture Method	What is MS-Word?
Feature of MS-Word:- 1. Spell and grammar check. 2. Easy insertion of new sentences and paragraphs in the already entered text page numbering. 3. Faster and more accurate. 4. Text can be changed by changing the font sizes, styles and colours.	Understand the feature of MS-Word	Slide presentation& demonstration method	What is the feature of MS-Word?
Starting MS-Word:- 1. Double click on the MS-Word icon on the desktop. 2. Click on Start -> programs -> MSOffice -> MS-Word.	Understand how to start MS-Word	Slide presentation & demonstration method	Define the starting of MS-Word?
2. Copying text:- The text from one part of a document can be very easily copied to another with the help of a word processor. The original text remains in its place.	Understand the copy of text	Illustration device	Describe the copy of text?
3. Search and replace:-	Understand	Slide may be	What do we

You can use the word process to search through your entire document and simultaneously replace the incorrect word with the correct one at all the place where its appears.	the search and replace of text	used	search and replace in the text?
4. Mail Merge:- Mail Merge is a very useful feature of MS-Word. It helps you to quickly produce a personalized letter for each and every person.	Understand the mail merge	Slide may be used to show the mail merge	What is mail merge?
5. Macro:-A macro is a series of word documents and instructions that you group together as a single command to accomplish a task automatically.	Understand the macro	Lecture method	What is macro?
MS-EXCEL:- MS-Excel, the spreadsheet programe of MS-Office is used for performing calculations on your data. MS-Excel is an integrated electronic worksheet that is also called spreadsheet.	Understand the MS-Excel	lecture method	What is the MS-Excel?
Workbook:- Workbook is made up of worksheets. An excel document is a workbook and extension of excel file is .XLS.	Understand the workbook	Demonstration method	Explain workbook?
Worksheet:- Any grid or arrange of numbers/text in rows and columns to write down numbers and calculate them easily. By default a worksheet contains 256 columns and 65536 rows.	Understand the worksheet	Picture may be used	Define worksheet?
Application areas of worksheet:- • Payroll • Accounting • Inventory control • Preparation of mark card • Marketing and advertising • Hospital/hotel management	Understand the application area of worksheet	Chart may be used	Describe the application area of worksheet?
Starting MS-Excel:- 1. Click on Start Button. 2. Select Program option. 3. Click on MS-Excel.	Understand the starting MS-Excel	Slide may be used	Explain the starting of ms-excel?
Data Types:- 1. Numbers 2. Labels 3. Formula	Understand the data types	Demonstration method	Explain data types?
1. Numbering:- Rules for entering numeric values. (A) Begin with 0-9. (B) Can't eng a number with a percent sign(%). (C) Right justified. (D) Can't have more than one decimal point. (E) No special character used except +,-,...	Understand the numbering	Lecture method	What is numbering?
2. Labels:- Also referred as text, is an another data type to enter data. Rules for entering a label. (a) Combination of numbers, spaces and non numeric characters. Eg.- 23B6, 129ABC. (b) Left aligned. (c) To display multiple lines, select Wrap text checkbox	Understand the labels	Demonstration method	What is label?

on the Alignment tab. 3. Formula:- (a) Click the cell in which you want to enter the formula. (b) Type = (an equal sign). (c) Enter the formula desired according to your need. (d) Press an Enter key.	Understand the formula	Demonstration method and observation device	How to apply of formula?
Open A New Worksheet:- 1. Click File Menu from the Menu Bar. 2. Click New option OR Click on new worksheet button on Standard Toolbar.	Understand the open a new worksheet	Computer slide may be used	How to open a new worksheet?
Enter data in a Worksheet:- 1. Click the desired cell. 2. Type the data and then press ENTER or TAB key.	Understand the enter data in a worksheet	Explanation device	How to enter data in a worksheet?
Save A Worksheet:- 1. Click in File Menu from Menu Bar. 2. Click on Save As option. 3. Selected the desired folder. 4. Typed desired File Menu. 5. Click Save Button.	Understand the save a worksheet	Explanation device	How to save a worksheet?
Close A Workbook:- 1. Click on Close Button on Workbook Window. 2. Click on Yes to Save change or No to quit without making save change.	Understand close a worksheet	Narration method	How to close a workbook?
Close Excel Using Close Button:- 1. Click Close Button on Excel Window. 2. Click on Yes to Save change OR Click No to Quit without saving the changes.	Understand the close excel using close button	Lecture method	How to close excel using close button?
MS-POWER POINT:- Microsoft power Point is presentation software that is used to create on screen slide shows, overhead projector slides, audience handouts and speaker notes. It is a part of MS-Office suite of software. Power point is most used presentation software.	Understand the MS-Power point	Explanation method	What do you mean by MS-Power Point ?
Application Areas:- 1. Presentation software are widely used by companies while launching their new products, distributing financial information, communicating ideas and discussing marketing plans. 2. They are used by teachers as an aid in teaching. 3. They are used by doctors to advice their patients about the causes and preventions of various diseases. 4. They are used by engineers to demonstrate the needs and benefits of a particular project.	Understand the application areas	Chart may be used	What is the application area of ms-power point?
Features of Power Point:- 1. Power Point can be used to create black and white overhead transparencies. 2. Power Point can be used to create colored overhead transparencies.	Understand the features of PowerPoint	Slide may be used	What is the features of power point ?

3. Power Point can create 35 mm slides. 4. Power Point can create slide shows for computer screen or projector. 5. Power Point contains six slide views for various purposes. Power Point supports pictures for effective slide design. 6. It supports graphs and organization charts.			
Components of a slide:- 1. Title:- A power point slide generally has a title that describes the topic of the slide. It gives the main idea to which the contents are related. 2. Subtitle: It is the descriptive message of few lines that gives the central idea of the information contained in the slide. 3. Drawing Objects: Various drawing objects like auto shapes and word arts can be embedded into a slide to improve its look. 4. Clipart and Pictures:- Pictures and Cliparts related to the subjects of the slide, can also be added to the slide. This helps audience to understand the content effectively. 5. Charts:- Charts are also used to describe numerical and statistical data.	Understand the components of a slide	Lecture method and explanation device	What are the components of a slide?
Starting Power Point:- 1. Click on Start Button. 2. Select Program option. 3. Click on MS-Power Point.	Understand the starting of power point	Slide may be used	How to start power point?
Creating Presentations:- • Auto Content Wizard • Templete • Blank Presentation	Understand the Creating Presentations	Narration method	How to create presentations in power point?
Slide View:- The slide view is displayed by adjusting the zoom level to fit the slide into your screen. To see the full view of the slide, try increasing the zoom level.	Understand the view of slide	Explanation method	What do you mean by slide view?
MICROSOFT ACCESS:- Microsoft Access is a database application, it is [illegible]er known as a relational database application. This means that fields in a record are related and changes made to one field would affect the others. This will be explained in more detail with in these notes.	Understand the Microsoft Access	Lecture method	What do you mean by ms-access?
Starting MS-Access:- 1. Click on Start Button. 2. Select Program option. 3. Click on MS-Access.	Understand the starting of MS-Access	Chart may be used	How to start of ms-access?
Components:- Generally, DBMS (MS-Access) package contains.	Understand the components	Chart and picture will be used	What are the component of ms-

			access?
These components:- • Tables •Primary key • Queries • Forms • Reports			
1. Table:- A table is a group of related data organized in columns and rows on a data sheet. Each column represents a characteristics of information and is referred as field.	Understand the table	Chart can be used	What do you mean by table?
Tables The construction of a table consists of • Fields – The lowest level of data e.g. Name or Surname • Records – A collection of fields e.g. Name and Surname and Age • Table – A collection of records Example: Name | Surname | Age Geeta | Sharma | 12 Mary | Disuja | 14 Sony | Verma | 15 Riya | jain | 16	Understand with example	Illustration method, slide may be used	Make a table with field, records, table?
2. Primary key:- A field in the table, which is unique for each record, is known as primary key.	Understand primary key	Demonstration method	What is primary key?
3. Query:- The process of recovering relevant information from a database is known as query.	Understand about query	Explanation method	What do you mean by query?
4. Forms:- The form of a database displays the data form a particular table or query required by the user.	Understand forms	Illustration device	What is form?
5. Report:- The queries are used to generate the reports on the database.	Understand the report	Explanation method	What do you understand by report?
Databse Uses: → For creating tables → For creating Forms → For creating charts → For creating reports → For analyzing records	Understand uses of databse	Demonstration method	What are the uses of database?
Steps for creating new database : 1) Open Ms Database 2) Click on blank database then ok. 3)Type name of database in name box. then click on create button.	Understand the steps of creating database	Demonstration method	How we can create new databse?



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Pedagogical Analysis
Topic:- Information Technology & Computer System

Pedagogical Analysis consists Four Parts :-

➢ Step-1

Content Analysis: - Information Technology & Computer System

It consist two Parts :-

A. Major part concept

B. Minor part concept

A) Major Part Concept :-

1. Basic of Information Technology
2. Convergence of Technologies
3. Computer

B) Minor Part Concept :-

1. Basic of Information Technology
   a) History of IT.
   b) Need & importance of IT.
   c) Advantages & disadvantages of IT.
2. Convergence of Information Technology
   a) Computer
   b) Communication technology

c) Content technologies

A. Computer :-

a) Definition of computer

b) Characteristics of computer

B. Communication Technology :-

a) Computer networking – LAN , MAN ,WAN

b) Internet

c) Wireless networking technology like Bluetooth , Wi-Fi

d) Wired networking technology like co-axial cable , Ethernet cable optical fiber

C. Content technologies :-

a) Data

b) Information & multimedia

(picture/image , audio , video , animation)

➢ Step-2

Objective Formulation (Behavioural Outcomes)

Students after going through the teaching of the topic "INFORMATION TECHNOLOGY & COMPUTER SYSTEM" Will be able to:-

1. Recall the meaning of information technology.
2. Understand the basic of information technology.
3. Understand the meaning & history of IT.
4. Understand the need & importance of IT.
5. Differentiate IT & Computer System.
6. Understand the communication technology.
7. Understand the content technology.
8. Understand the internet related term like LAN , MAN , WAN .

➢ Step-3

Methods , Devices , Activities & Aid material used :-

1. Method :- Lecture method , demonstration method
2. Devices :- Chart , computer system, slide presentation
3. Activity & Aid material used :-

a. While teaching the topic help of blackboard writing will be taken.

b. Help of chart will be taken to depict the pictures of various networking.

c. Slide presentation for the concept of internet

➢ Step-4

Evaluation procedures & Devices Used :-

1. In oral mode, students will be asked question during teaching process or after completion of the topic & students are required to responds orally to the asked question.
2. In practical mode, students will be asked to share the information by using LAN, MAN, WAN
3. Written mode consist of :-

✓ Essay type question

✓ Short type question

✓ Objective type question

◆ Match the column fill

True/false statement

Fill in the blanks

Multiple choice question

1) Essay type questions :-

a. Meaning ,concept & history of IT.

b. Define need & importance of IT.

c. Define Communication Technology.

2) Short answer type question :-

a. What is IT.

b. What is computer networking.

c. Define LAN, MAN , WAN .

3) Objective type question :-

a. True/false statement :-

I. IT stands for information technology.

II. Combination of two LANs is called WAN.

b. Fill in the blanks :-

I. Information technology refers to both____&_____.

II. Raw material of information is called_____.

c. Multiple choice question :-

I. LAN is the part of which system

a) Internet b) information c) communication

II. Bluetooth is an example of

a) Wireless networking b) wired networking c) internet

Pedagogical Analysis (Tabular Form)
Topic: - IT & Computer System

Content Analysis	Behavioral Outcomes	Method, Devices, Activities & Aids Material used	Evaluation procedures & Devices
Basic of IT:- **Definition Of IT-** It is an application of computer & telecommunication equipment to store, retrieve, transmit & manipulate data.	After reading the topic students are able to:- Recall the term IT. Understand the term IT.	Lecture method is used	Define the concept, meaning of IT.
History of IT:- It is classified as traditional & modern IT. **Tradition IT:-** printed media in form of text books. three dimensional instruments aids like modal etc. audio-visual hardware equipment like radio, TV, tape-recorder etc. **Modern IT:-** Multimedia PC & laptop. Digital video camera. Internet. Audio & video conferencing.	Understand the meaning & differentiate between traditional and modern history of IT.	Lecture cum demonstration method used	Differentiate between traditional and modern history of IT.
Need/importance of IT:- Access to variety of learning resources. anytime & anywhere learning. multimedia approach to education. authentic & up-to-date information. Educational data storage.	Understand the need & importance of IT	Lecture method used	Define need & importance of IT.
Advantages & disadvantages of IT:- **Advantages of IT:-** improved innovation. Improved entertainment Globalization of knowledge. **Disadvantages of IT:-** Cyber sickness. over dependent on IT makes students less active & innovative.	Understand the advantages & disadvantages of IT.	Explanation method used	Define advantages of IT.

Convergence of technology:- 1) Computer:- Definition:- Computer is an electronic device that takes input, processed it & give output.	Understand the concept of convergence of technology	Use of blackboard	Define computer
Characteristics of computer:- ♦ Speed ♦ Accuracy ♦ Storage ♦ Automation ♦ Efficiency	Understand the characteristics of computer	Explanation method used	Define the characteristics of computer.
Communication technology:- Definition:- A technology that allows to share, send& exchange data or information. computer network is a telecommunication network For example – LAN, MAN, WAN. **Internet:-** Internet is worldwide computer network which provides maximum information in the easy way at your computer.	Understand the communication technology Understand the term internet	Lecture cum demonstration method used	Define communication technology.
Wireless networking technology:- Any type of computer network that uses wireless data connecting network nodes. For example – Wi-Fi ,Bluetooth Wi-Fi:- It is local area wireless networking technology that allows electronic device to connect network resources such as internet.	Understand the concept if wireless networking	Lecture cum demonstration method used	Explain Bluetooth

Bluetooth:- It is a wireless technology standard for Exchanging data over short distance using wavelength. It is fixed in mobile, computer & other devices.			
wired networking:- In which wires or cable used to connect computer with internet. For example co-axial cable, Ethernet, optical fiber etc. **Co-axial cable:-** It is widely used for TV systems, office building & other worksite for LAN. **Ethernet:-** It is transmits data over both copper & fiber cables. It is used infrared signals as a transmission medium. **Optical fiber:-** It is a glass fiber. It pulses of light that represent data.	Understanding the concept of wired networking	Showing pictures of different example of wired networking	Given any example of wired networking
Content technology:- **Data:-** Raw material of facts & figure is called data. **Information:-** Processed data as meaningful way is called information.	Understand the concept of content technology	Lecture method used	Explain content technology. Data is raw material of ----- &-----.
Multimedia(MM):- MM refers to content that uses a combination of different content forms. It includes combination of text, image, audio, video and animation.	Understand the term multimedia	Lecture cum demonstration method used	What is multimedia?

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Evaluation Meaning and Importance of Evaluation Formative and Summative Evaluation Diagnostic Testing and Remedial Teaching Types of Tests used in Computer Science

Education aims at making children capable of becoming responsible, productive and useful members of society. Knowledge skills and attitudes are built through learning experiences and opportunities created for learners in school. It is in the classroom that learners can analyse and evaluate their experiences, learn to doubt, to question to investigate and to think independently.

Evaluation is very often the last port of call in the teaching and learning process. The idea of evaluating the teaching and learning process is to find out if the student has learned what was supposed to have been learned.

Teaching of any subject consists of three stages, viz.,

(i) The stage of introduction and motivation,

(ii) The stage of explanation or presentation and

(iii) The stage of evaluation.

Evaluating the students achievement in different stages of learning is a major aspect of the teachers job. The modern concept of evaluation is nothing but evaluation of gains of experiences by the students in the educational institutions. The main aim of

evaluation is to make the latent talents if the pupils apparent. It is a continuous appraisal of the achievement of the aims of education as well as methods of teaching and learning to ensure continuous improvements so that education becomes dynamic and self developing.

Concept Of Evaluation

Evaluation has a wider meaning. It goes beyond evaluation. When from useful information including evaluation, we make a judgment that is evaluation. Evaluation is a concept that has emerged as a prominent process of assessing, testing and measuring. Its main objective is Qualitative Improvement. It is a process of making value judgments over a level of performance or achievement. Making value judgments in Evaluation process presupposes the set of objectives. Evaluation implies a critical evaluation of educative process and its outcome in the light of the objectives.

- Evaluation is a Science of providing information for decision making
- It Includes evaluation, evaluation and testing
- It is a process that involves

a. Information gathering
b. Information processing
c. Judgment forming
d. Decision making

Evaluation is a term, which has overtones that distinguish it from evaluation. The latter implies only a precise quantitative evaluation of outcomes of instruction, whereas evaluation signifies a wider, more comprehensive and continuous process of assessing student progress.

So, evaluation is a continuous and comprehensive process, which takes place in the school, and outside the schools, and involves the participation of the pupils, teachers, parents, and community with a view to make improvement in the child and the whole education process.

Measurement

Measurement is seen as a process of assigning numbers to objects, quantities or events in other to give quantitative meanings to such qualities.

The process of Measurement as it implies involves carrying out actual Measurement in order to assign a quantitative meaning to a quality i.e. what is the length of the chalkboard?

Determining this must be physically done.

Measurement is therefore a process of assigning numerals to objects, quantities or events in other to give quantitative meaning to such qualities.

In the classroom, to determine a child's performance, you need to obtain quantitative measures on the individual scores of the child. If the child scores 80 in Mathematics, there is no other interpretation you should give it. You cannot say he has passed or failed. Measurement stops at ascribing the quantity but not making value judgement on the child's performance

Difference between Evaluation and Measurement

Evaluation	Measurement
Evaluation is a new concept	Measurement is an old concept.
Evaluation is a technical term.	Measurement is a simple word
The scope of evaluation is wider. In this, the evaluation of pupil's qualitative progress and behavioural changes are tested.	The scope of evaluation is narrow because in this, only quantitative progress of the pupils can be explored.
In evaluation, the learning experiences provided to the pupils in accordance with pre-determined teaching objectives are tested.	In Measurement the content, skill and achievement of the ability are not tested on the basis of some objectives. Merely, the result of the testing is expressed in numerals, scores, average and percentage.
The qualities are measured in the evaluation as a whole.	In Measurement, the qualities are measured as separate units.
Evaluation is that process by which the previous effects and hence caused behavioural changes are tested.	Measurement means only those techniques which are used to test a particular ability of the pupil.
In evaluation, various techniques like observation, hierarchy, criteria, interest and tendencies evaluation etc. used for testing the behavioural changes.	In Measurement, personality test, intelligence and achievement test etc. are included.
Evaluation is that process by which the interests, attitudes, tendencies, mental abilities, idcals, behaviours and social adjustment etc. of pupils are tested.	By Measurement, the interests, attitudes, tendencies, ideals and behaviours cannot be tested.
The evaluation aims at the modification of education system by bringing a change in the behavior	Measurement aims at evaluation only.

Definition of Evaluation

The definition of "evaluation" itself is: "Value judgment for an object or its meaning." Education evaluation is analysis and judgment of the value of an educational input, process, and outcome.

Tyler (1951): "Education evaluation is the judgment process for the educational goal (behavioral objectives) realized through education and class activities."

Cronbach (1984): "Education evaluation is the process of information gathering and treatment necessary to make a decision for an education program."

Stufflebeam (1971): "Process of information defining, acquiring, and providing necessary for decision-making process."

Paul (1976) defined evaluation as both a judgement on the worth or impact of a programme, procedure or individual and the process whereby judgement is made.

Yoloye (1981) defined evaluation as the assigning of some values to an entity in relation to some criteria value or objectives.

Acc. to R.C. Sharma Evaluation as a continuous and comprehensive process which takes place in the school and outside school, and involves the participation of the pupils, teachers, parents and community with a view to make changes in the child and in the whole education process.

Acc. to Remmers and Gage Evaluation assumes a purpose or an idea of what is "good" or "desirable" from the stand-point of the individual of society or both.

Alkin, 1970 The process of ascertaining the decision of concern, selecting appropriate information and collecting and analysing information in order to report summary data useful to decision makers in selecting among alternatives.

Aims / Purpose of Evaluation

According to Oguniyi (1984), educational evaluation is carried out from time to time for the following purposes:

- to determine the relative effectiveness of the programme in terms of students' behavioural output
- to make reliable decisions about educational plan
- to ascertain the worth of time, energy and resources invested in a programme;
- to identify students' growth or lack of growth in acquiring desirable knowledge, skills, attitudes and societal values;

- to help teachers determine the effectiveness of their teaching techniques and learning materials;
- to help motivate students to want to learn more as they discover their progress or lack of progress in given tasks;
- to encourage students to develop a sense of discipline and systematic study habits;
- to provide educational administrators with adequate information about teachers' effectiveness and school need;
- to acquaint parents or guardians with their children's performances;
- to identify problems that might hinder or prevent the achievement of set goals;
- to predict the general trend in the development of the teaching-learning process;
- to ensure an economical and efficient management of scarce resources;
- to provide an objective basis for determining the promotion of students from one class
- to another as well as the award of certificates;
- to provide a just basis for determining at what level of education the possessor of a certificate should enter a career.

Features of Evaluation

1. Comprehensiveness. All changes which occur in all the aspects such as the physical aspect concerning pupil's personality, mental, social and moral aspects. Hence, evaluation is a comprehensive method to test the pupils. It includes both evaluation and evaluation.

2. Continuous Process. Evaluation is a continuous process which is closely related to the learning objectives. In this, in accordance with educational objectives, the desirable learning experiences are created in the pupil and the behavioural changes which occur day-to-day are recorded. On the basis of this record, the ranking of pupils is done and they are sent to the next higher class.

3. Cooperative Process. Evaluation is a cooperative process. In evaluation, the necessary material is collected by seeking essential cooperation of all the sources like teacher, pupils and parents. Then his progress is evaluated.

4. Social Process. Evaluation is a social process. In this all the aspects of personality are evaluated on one side, it is also evaluated whether the teaching

has been conducted according to the needs, ideals and norms of the society or not on the other side.

5. Descriptive Process. Evaluation is a descriptive process. In this, the progress which occurs in all the aspects of the pupils is given.

6. Decisive Process. Evaluation is a decisive process. After this, it is decided that—

(i) whether any object or process is useful or not,

(ii) to what extent the teaching is successful according to the determined educational objectives,

(iii) whether the learning experiences provided to the pupils in the class are effective or not.

(iv) how fair the teaching objectives have been achieved. If not achieved then whether the remedial instruction should be given or the teaching strategies are to be modified.

In short, evaluation measures the educational achievements. It also improve the teaching process.

The Evaluation Approach

Evaluation is the estimation of the worth of a thing, process or programmes in order to reach meaningful decisions about that thing, process or programme. It calls for evidence of effectiveness, suitability of goodness of the programme or process.

It consists of the following broad stages:

a. Formulating and selecting worthwhile objectives of teaching in a subject and defining each objective in terms of expected learning outcomes, which produce behavioral changes in the pupils.

b. Developing appropriate learning experiences, which when provided to pupils through suitable course content, activities, aids and teaching devices, result in the realization of expected learning outcomes.

c. Devising and adopting suitable evaluation procedures to collect adequate and trustworthy evidences about pupil achievement.

d. Evaluating the outcomes on the basis of the evidence collected, and modifying the necessary aspects of the entire system for better results.

Thus, the evaluation approach aims at the establishment of close inter-dependence between educational objectives, learning experiences and continuous evaluation so that each may modify itself and grow in correspondence with the rest.

Importance / Scope of Evaluation

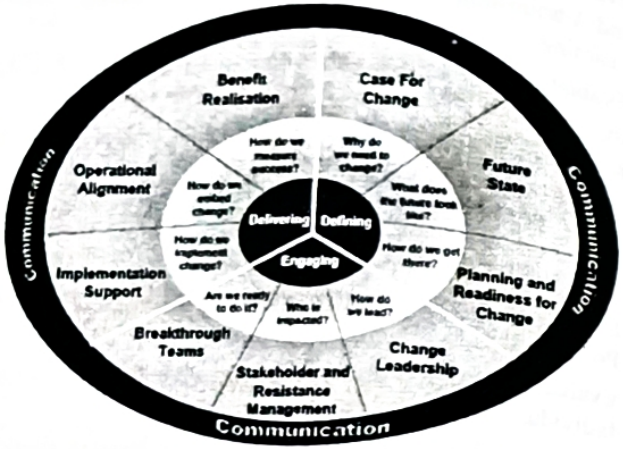
- Evaluation is the process of determining the extent to which the objectives are achieved.
- It is Concerned not only with the appraisal of achievement, but also with its improvement.
- Evaluation is Important to the Class-room Teachers, Supervisors, and Administrators in Directing as well as Guiding Teaching and Learning
- Evaluation also helps to Measure the Validity and Reliability of Instruction
- Evaluation Aids in Devising more Effective Instructional Materials and Procedures of Instruction
- Evaluation Helps Teachers to Discover the Needs of the Pupils
- Evaluation Stimulates Students to Study
- Evaluation Helps Parents to Understand Pupil-Growth, Interests, and Potentialities
- Evaluation can be used to Enforce External Standards upon the Individual Class or School
- Evaluation, Likewise, Helps to Provide Objective Evidences for Effective Cooperation between Parents and Teachers
- Evaluation is Helpful in Securing Support for the School from the Government, Local or National.
- Evaluation is a continuous and a dynamic process. Evaluation helps in forming the following decisions.
  - Instructional
  - Curricular
  - Selection
  - Placement or Classification
  - Personal

Among the above decisions, we shall learn how evaluation assists a teacher in taking instructional decisions. Evaluation assists in taking certain instructional decisions like:

1. to what extent students are ready for learning experience?
2. to what extent they can cope with the pace of Learning Experiences provided?
3. How the individual differences within the group can be tackled?

4. What are the learning problems of the students?
5. What is the intensity of such problems?
6. What modifications are needed in the instruction to suit the needs of students, etc.

Evaluation is an integral part of teaching and learning process. This is explained in the following figure



Procedure of Evaluation

While evaluating, the following points should be paid attention.

1. Determination of Teaching Objectives. Before conducting evaluation, the teaching objective to be evaluated should be determined.
2. Defining Educational Objectives. After determining teaching objectives, the teacher should define them clearly. The teaching objectives should be defined with reference to the behaviours.
3. Identification in New Situations. The teacher should keep the pupils in new environment just to see whether the pupils have experienced behavioural changes as a result of their learning experiences or not. The pupils are to be kept in new situations just to allow them to express desirable behaviour. In other words, the novel situations should be related, to the teaching objectives and awareness should be sought regarding the attainment in those new situations.
4. Creating and Selecting Learning Experiences. After determining and defining the teaching objectives, the teacher should select or determine appropriate learning experiences. In other words, the teacher should create such an environment that the pupils do get appropriate learning experiences.

5. Selection to Tests. To edit the procedure of evaluation, proper selection of a test should have occurred. The teacher should be extra cautious in this regard.
6. Construction of Devices. In order to evaluate such techniques should be developed which may collect directly or indirectly the evidences in connection with the behavioural changes. The teacher should ask himself the following questions in this regard—
   a. What objective is to be evaluated with the ready-made techniques?
   b. Is it possible to collect evidences regarding desirable behaviours with the help of ready-made techniques?
   c. Is it possible for the two persons to come to the same conclusion with the application of the similar technique?
   d. Is the application of the technique simple?
7. Applying Devices and Recording the Evidences. After developing the technique, the teacher should use it in the testing situation. Also, the evidences regarding the behavioural changes should be recorded.
8. Interpretation of Evidences: When the teacher receives evidences in support of behaviour of the pupils, he should then analyse the evidences and should conclude whether the gained changes are in accordance with teaching objectives or not. Hence, the teacher should take care of the following points while interpreting the market evidences with reference to the teaching objectives—
   (i) What are the maximum marks in the examination?
   (ii) What are the maximum marks obtained in the class?
   (iii) What are the minimum marks obtained in the class?
   (iv) What are the average marks obtained in the class?
   (v) What is the rank of individuals?
   (vi) Has the pupil got his best of his ability?

Keeping in view the above things, the summary of the result should be prepared with reference to each objective. Then the present result should be compared with the previous one. But the result should be presented in such a way that the strengths and weaknesses of each pupil may come to light.

Types of evaluation: Evaluation can be classified into three types based on purpose of evaluation.

a) Diagnostic Evaluation.
b) Formative Evaluation.
c) Summative Evaluation.

Diagnostic evaluation

Diagnostic evaluation is done at the beginning of the teaching-learning process in order to find out students' current knowledge of a subject, their skill sets and capabilities, and to clarify misconceptions either in an individual or at class level. Knowing students' strengths and weaknesses helps in better planning what to teach and how to teach it. Thus diagnostic evaluation helps in designing courses specific to learner's needs and capabilities, so that it helps him overcome deficiencies in knowledge, skills and abilities. However diagnostic evaluation does not limit itself to pre-stage or beginning of the instruction. One can make its use throughout his delivered lessons or unit of teaching for diagnosing his students' understanding and interest.

The main objective of diagnostic evaluation is to find out the nature and causes of the persistent learning problems and to formulate a suitable plan of remedial action.

Types of Diagnostic evaluation

- Pre-tests (on content and abilities)
- Self-evaluations (identifying skills and competencies)
- Discussion board responses (on content-specific prompts)
- Interviews (brief, private, 10-minute interview of each student)

Formative evaluation

Formative evaluation is a tool used by the teacher to continuously monitor student progress in a non threatening, supportive environment. It involves regular descriptive feedback, a chance for the student to reflect on the performance, take advice and improve upon it. It involves students' being an essential part of evaluation from designing criteria to assessing self or peers. If used effectively it can improve student performance tremendously while raising the self esteem of the child and reducing the work load of the teacher.

Wally Guyot Formative evaluation is also useful in analyzing learning materials, student-learning and achievements and teachers effectiveness. Formative evaluation is primarily a building process which accumulates a series of components of new materials, skills and problems into an ultimate meaningful Whole.

Some of the main features of Formative evaluation are listed below:

- is diagnostic and remedial
- makes the provision for effective feedback

- provides the platform for the active involvement of students in their own learning.
- enables teachers to adjust teaching to take account of the results of evaluation
- recognizes the profound influence evaluation has on the motivation and self-esteem of students, both of which are cruicial influences on learning
- recognizes the need for students to be able to assess themselves and understand how to improve
- builds on students' prior knowledge and experience in designing what is taught.
- incorporates varied learning styles into deciding how and what to teach.
- encourages students to understand the criteria that will be used to judge their work
- offers an opportunity to students to improve their work after feedback,
- helps students to support their peers, and expect to be supported by them.

Formative evaluation is thus carried out during a course of instruction for providing continuous feedback to both the teachers and the learners for taking decisions regarding appropriate modifications in the transactional procedures and learning activities.

Types of Formative Evaluation

- Observations during in-class activities; of students non-verbal feedback during lecture
- Homework exercises as review for exams and class discussions)
- Reflections journals that are reviewed periodically during the semester
- Question and answer sessions, both formal—planned and informal—spontaneous
- Conferences between the instructor and student at various points in the semester
- In-class activities where students informally present their results
- Student feedback collected by periodically answering specific question about the instruction and their self-evaluation of performance and progress

Thus, Formative evaluation attempts to:

- identify the content (i.e. knowledge or skill) which has not been mastered by the students;

- appraise the level of cognitive abilities such as memorization, classification, comparison, analysis, explanation, quantification, application and so on; and
- specify the relationships between content and levels of cognitive abilities.

In other words, formative evaluation provides the evaluator with useful information about the strength or weakness of the student within an instructional context.

Summative Evaluation

Summative Evaluation is carried out at the end of a course of learning. It measures or *'sums-up'* how much a student has learned from the course. Summative Evaluation takes place after the learning has been completed and provides information and feedback that sums up the teaching and learning process. Typically, no more formal learning is taking place at this stage, other than incidental learning which might take place through the completion course. It is usually a graded test, i.e., it is marked according to a scale or set of grades.

A.J. Nikto. "Summative evaluation describes judgments about the merits of already completed program procedure o plan".

Summative evaluation often attempts to determine the extent the broad objectives of a programme have been achieved It is concerned with purposes, progress and outcomes of the teaching-learning process.

Summative evaluation is judgemental in nature and often carries threat with it in that the student may have no knowledge of the evaluator and failure has a far reaching effect on the students. However, it is more objective than formative evaluation. Some of the underlying assumptions of summative evaluation are that:

1. the programme's objectives are achievable;
2. the teaching-learning process has been conducted efficiently;
3. the teacher-student-material interactions have been conducive to learning;
4. the teaching techniques, learning materials and audio-visual aids are adequate and have been judiciously dispensed; and
5. there is uniformity in classroom conditions for all learners.

Types of Summative Evaluation

- Examinations (major, high-stakes exams)
- Final examination (a truly summative evaluation)
- Term papers (drafts submitted throughout the semester would be a formative evaluation)

- Projects (project phases submitted at various completion points could be formatively assessed)
- Portfolios (could also be assessed during it's development as a formative evaluation)
- Performances
- Student evaluation of the course (teaching effectiveness)
- Instructor self-evaluation

Comparison of three types of Evaluation

Aspect	Summative Evaluation	Formative Evaluation	Diagnostic Evaluation
Nature	Judgemental	Developmental	Prescriptive
Focus	Promotion to the next grade	Improvement of teaching-learning process	Identification of the problem
Purpose	Assigning marks or awarding grades	Helps in finding the worth of program	To identify the strengths and weaknesses of the learners
Time	At the end of course	During the course	Before instruction and after analysis of test results.

Continuous and Comprehensive Evaluation

By continuous comprehensive evaluation, we mean assessing or weighing performance of students periodically to be able to determine progress made in teaching-learning activities. Continuous comprehensive evaluation are used to evaluate the progress of students periodically. Continuous comprehensive evaluation can be done daily, weekly, monthly, depending on the goals of teaching and learning.

Features of Continuous and Comprehensive Evaluation

- The *'continuous'* aspect of CCE takes care of *'continual'* and *'periodicity'* aspect of evaluation.
- Continual means evaluation of students in the beginning of instructions (placement evaluation) and evaluation during the instructional process *(formative evaluation)* done informally using multiple techniques of evaluation.
- Periodicity means evaluation of performance done frequently at the end of unit/term *(summative)*

- The *'comprehensive'* component of CCE takes care of evaluation of all round development of the child's personality. It includes evaluation in **Scholastic as well as Co-Scholastic** aspects of the pupil's growth.
- Scholastic aspects include curricular areas or subject specific areas, whereas co-scholastic aspects include Life Skills, Co-Curricular, attitudes, and values.
- Evaluation in scholastic areas is done informally and formally using multiple techniques of evaluation continually and periodically. The diagnostic evaluation takes place at the end of unit/term test. The causes of poor performance in some units are diagnosed using diagnostic tests. These are followed up with appropriate interventions followed by retesting.
- Evaluation in Co-Scholastic areas is done using multiple techniques on the basis of identified criteria, while evaluation in Life Skills is done on the basis of Indicators of Evaluation and checklists.

Scholastic and Co-scholastic domain

The desirable behaviour related to the learner's knowledge, understanding, application, evaluation, analysis, and creating in subjects and the ability to apply it in an unfamiliar situation are some of the objectives in scholastic domain.

The desirable behaviour related to learner's Life Skills, attitudes, interests, values, co-curricular activities and physical health are described as skills to be acquired in co-scholastic domain.

The process of assessing the students' progress in achieving objectives related to scholastic and co-scholastic domain is called comprehensive evaluation. It has been observed that usually the scholastic areas such as knowledge and understanding of the facts, concepts, principles etc. of a subject are assessed. The co-scholastic elements are either altogether excluded from the evaluation process or they are not given adequate attention. For making the evaluation comprehensive, the scholastic and co-scholastic both should be given importance. Simple and manageable means of evaluation of co-scholastic aspects of growth must be included in a comprehensive evaluation scheme.

In National Policy on Education (NPE) document, 1986 and as modified in 1992 also it is mentioned that the scheme of evaluation should cover all learning experiences of scholastic subjects and non-scholastic areas.

Comprehensive evaluation would necessitate the use of a variety of techniques and tools. This will be so because different specific areas of learner's growth can be evaluated through certain special techniques.

Functions Of Comprehensive And Continuous Evaluation

In the teaching- learning process, the evaluation is expected to take care of scholastic and co-scholastic aspects. If a child is weak in some area, diagnostic evaluation and remedial measures should be adopted.

Important functions of Continuous and Comprehensive Evaluation are as follows:

- It helps the teacher to organize effective teaching strategies.
- Continuous evaluation helps in regular evaluation to the extent and degree of Learner's progress (ability and achievement with reference to specific scholastic and co-scholastic areas).
- Continuous evaluation serves to diagnose weaknesses and permits the teacher to ascertain an individual learner's strengths and weaknesses and her needs. It provides immediate feedback to the teacher, who can then decide whether a particular unit or concept needs re-teaching in the whole class or whether a few individuals are in need of remedial instruction.
- By continuous evaluation, children can know their strengths and weaknesses. It provides the child a realistic self evaluation of how she studies. It can motivate children to develop good study habits, to correct errors, and to direct their activities towards the achievement of desired goals. It helps a learner to determine the areas of instruction in which more emphasis is required.
- Continuous and comprehensive evaluation identifies areas of aptitude and interest. It helps in identifying changes in attitudes, and value systems.
- It helps in making decisions for the future, regarding choice of subjects, courses and careers.
- It provides information/reports on the progress of students in scholastic and co-scholastic areas and thus helps in predicting the future successes of the learner.

Continuous evaluation helps in bringing awareness of the achievement to the child, teachers and parents from time to time. They can look into the probable cause of the fall in achievement if any, and may take remedial measures of instruction in which more emphasis is required.

Many times, because of some personal reasons, family problems or adjustment problems, the children start neglecting their studies, resulting in sudden fall in their achievement.

If the teacher, child and parents do not come to know about this sudden fall in the achievement and the neglect in studies by the child continues for a

longer period then it will result in poor achievement and a permanent deficiency in learning for the child.

The major emphasis of CCE is on the continuous growth of students ensuring their intellectual, emotional, physical, cultural and social development and therefore will not be merely limited to evaluation of learner's scholastic attainments. It uses evaluation as a means of motivating learners in further programmes to provide information for arranging feedback and follow up work to improve upon the learning in the classroom and to present a comprehensive picture of a learner's profile.

Continuous and Comprehensive Evaluation has been fruitful in improving the evaluation skills of the teachers which is a very important competence expected of them to raise the standards of achievement in pupils by constant feedback, remediation, and improvement of classroom instructional strategies based on the evaluation results, this in turn resulting in improvement of quality of education. It is important to equip the teachers with required skills and competencies of evaluation so that they would be able to integrate evaluation well with their teaching- learning process, assist students in the attainment of required standards through proper guidance, feedback and remediation.

Advantages of evaluation

1. **Helps in the improvement of students** Evaluation is an index of student's achievement. Its outcomes tells that there are some improvement or progress is there in a child. It also asses its qualitative value. So the assessment of the progress of the child is its main function.
2. **It reveals the strengths and weaknesses of the child**. Evaluation is a continuous process so it reveals the strengths and weaknesses of learners more frequently, so that the learners have better opportunity to understand and improve themselves.
3. **It has the twin purpose**. The syllabus provides a statement of purpose, means and standards against which one can check the effectiveness of the program and the progress made by the learners. Evaluation not only measures the progress and achievement of the learners but also the effectiveness of teaching materials and methods used for transaction. Hence evaluation should be viewed as a component of curriculum with the twin purpose of effective delivery and further improvements in the teaching-learning process.
4. **It is the fearless examination**. Evaluation is seen as an integral part built into the teaching-learning process; it will become continuous like both teaching and learning when evaluation is subsumed into teaching learning., learners will not perceive test and examination

with fear, so it is the fearless examination which lead to diagnosis, remediation and enhancement of learning.

5. **Classification of students**. Evaluation helps in classifying the students into different grades or categories. Which student is suitable for what type of course and which students is at what level is decided through evaluation.
6. **Helps in goal attainment**. Evaluation is good directed and educational outcomes are judged in terms of goal attainment. Every educational programme should aim for all round development of the personality of the child. Therefore evaluation helps in the achievement of these goals by considering both scholastic and co-scholastic aspects of the child so that desirable behavioral changes should be done in the child.
7. **Improvement in methodology**. The teacher makes use of many methods or techniques of teaching. Which is good for the learner or helps in attaining goal is decided through evaluation.
8. **Preparation for future life**. Evaluation helps in their learners the ability to take risks, to be adaptable, to be flexible, to cope with constant change and become lifelong learners. In this context, learners become dynamic leaders with teachers as enablers.

DIAGNOSTIC TESTING AND REMEDIAL TEACHING

Meaning of Educational Diagnosis

The process of determining the causes of educational difficulties is known as educational diagnosis. The scope of educational diagnosis is much larger than the use of tests and examinations. It is not proper to limit the scope of diagnosis to locating the causes that interfere with the ordinary academic prognosis of the pupils. An adequate diagnosis may involve the use of intelligence tests, both general and specific, and of diagnostic achievement types of laboratory apparatus for measuring sensory activity, co-ordination and the like. Other forms of appraisal such as rating scales, controlled observation, questionnaires and interviews can also be used for diagnosis in education

According to **Tiges** 196 8, major function of diagnosis is to facilitate the optimum development of every student.

According to **Good** 1 945, diagnosis is the procedure by which the nature of a disorder, whether physical, mental or social is determined by discriminating study of the history of the disorder and of symptoms present.

According to **Barr et a l 1947** , the correction and elimination of the weaknesses through a constructive attack on their causes constitute an essential complementary process closely related to diagnosis.

Educational diagnosis is the basis of effective and intelligent teaching. Diagnosis in education means a case study of the condition of learning to determine its nature and to find out the causation, with the main purpose of correcting and remedying the difficulty involved ir active remembering. The major function of diagnosis is to facilitate the optimum development of every student. It is the determination of the nature of learning difficulties and deficiencies.

Importance Of Educational Diagnosis

For attaining maximum effectiveness in teaching, diagnosis of a child's learning difficulties should be made as early as possible. When the nature, extent and causes of a child's retardation and acceleration are known, together with data on his I her capacity for learning, effective developmental or corrective teaching can be planned.

Monroe (1965) suggested two major aspects of diagnosis in teaching. They are:

i. Determination of the extent to which desirable educational objectives are achieved.
ii. Identification of factors that may be interfering with the optimum growth of the individual.

Diagnosis is an understanding of a present situation in terms of its causes, what has brought it about or in terms of what it will cause. Diagnosis, in one way or another involves a conception of cause,

Ross1956 suggested the five levels of diagnosis. They are:

i. Who are the pupils having problem?
ii. Where are the errors located?
iii. Why did i:he errors occur?
iv. What remedies are suggested?
v. How can the errors be prevented?

The first four are grouped as corrective diagnosis and the fifth one is known as preventive diagnosis.

Steps In Educational Diagnosis

The essential steps in educational diagnosis are:

i. Identification of students who are having learning difficulties
ii. Locating the errors of learning difficulties
iii. Discovering causal factors.

Diagnostic Testing

Thorndike and Hagen (1970) suggested that a diagnostic test should provide a detailed picture of the strengths and weaknesses of a pupil in a particular area.

A diagnostic test is a test used to diagnose or reveal an individual's weaknesses and strengths in a certain course of study. These are designed to analyse individual's performance and provide information on the causes of difficulty. The purpose of diagnostic testing is to furnish continuous specific information in order that learning activities may be most productive of desirable outcomes.

Cook 1958 has stated the following characteristics of an effective diagnostic test.

i. It should be an integral part of the curriculum, emphasizing and clarifying the important objectives.
ii. It's test items should require response to be made to situation approximating as closely as possible to be functional
iii. It must be based on experimental evidence of learning difficulties
iv. It should reveal the mental processes of the learner sufficiently to detect point of error.
v. It should suggest or provide specific remedial procedures for each error detected
vi. It should be designed to cover a long sequence of learning systematically
vii. It should be designed to check forgetting by constant review of difficult elements as well as to detect faulty learning
viii. It should reveal pupil's progress in objective terms.

Remedial Teaching

The term remedial is employed in a broader sense to connote teaching which is developmental in its scope. Though our schools posses pupils who do not have any particular defects or faults which need correction, there are a group of students who urgently need assistance in developing increased competence in reading and the other fundamental processes. In their case, it is not prirnarly a problem of re-teaching or the remedying of errors, but it is rather teaching them for the first time those basic skills which are solely needed and are apparently lacking. Remedial teaching involves taking a pupil where one is and starting from that point leading one to greater achievement. It is just effective teaching in which the learner and his / her needs occupy the focal point.

Need For Remedial Teaching

Teaching involves communication. That is, messages are being sent at one end and received at the other. When the messages are received as they are transmitted, then effective communication is believed to have taken place. Sometimes the message may not get across at all or may reach the other end in a garbled, distorted and unrecognizable version. In such instances a 'gap' develops between 'teaching' and 'learning'. Frequently the learner has not learnt what the teacher intended him to learn. In this case, a message is received, but it is not the one which was sent out.

Learning problems are of different kinds and each call for different remedial solutions. Most of the problems are caused by incomplete or inadequate learning.

Remedial teaching is basically cognitive. The aim is to make the learner conscious about the rules; of concept attainment and his own use of it.

The following are the general principles of remedial teaching:

(i) Individual consideration of the backward pupil with recognition of his mental, physical and educational characteristics

(ii) Thorough diagnosis with a pretest

(iii) Early success for the pupil in his backward subject or subjects by use of suitable methods and materials

(iv) Dissipation of emotional barriers through early success, praise, continuous help, sympathetic consideration of his difficulties and sustained interest.

(v) The need for a new orientation towards the backward subject through new methods involving play way approaches, activities and appropriately graded materials

(vi) Frequent planned remedial lessons

(vii) Co-operation with the parents

Types Of Tests for Evaluation

In order to evaluate learning, various types of achievement tests are used. In the following lines we are throwing light on some main achievement tests—

Verbal Tests

The aim of verbal tests is to evaluate immediate verbal expression and activeness of the pupils by verbal questions. These tests were used initially for the pupils of the lower classes, but now these are also used for admissions, interviews, in higher classes.

These tests have the following demerits—

(i) The shy pupils are unable to exhibit their knowledge and ability by these testing system.

(ii) These tests contain sufficient quantity of subjectivity.

(iii) These have no written record or evidence. Hence, the teacher can use his discretion for assigning the scores.

(iv) These tests are not full of justice for many pupils.

Written Tests

Written tests are of two types—(i) Essay type, and (ii) Objective type.

Essay Type Tests

Meaning of Essay Type Tests. The essay type test means such an examination system in which the pupils give responses to many questions of the curriculum in some fixed duration in the form of an essay. The answers to questions in this type of tests are so lengthy that the tester can measure very easily the powers of thinking, comparison, expression, reasoning and criticism along with the ability of organizations of thoughts, language and style etc. Remember that at the recall and recognition level, the achievement of the pupils can be measured by objective type tests, but at the levels of interpretation, application and evaluation, the use of essay type tests is essential.

Merits of Essay Type Tests

The following are the merits of essay type tests:

1. **Easy Construction.** The question papers of essay type tests are too short. These can be prepared in a very small duration and at low cost.
2. **Suitable for All Subjects.** These tests can be used for measuring every subject.
3. **Development of Good Study Habits.** These tests encourage such tendencies in the pupils which establish relationship between the various parts of the knowledge and the preparation of an outline of each lesson, which prove advantageous for them. This develops good habits in the pupils.
4. **Evaluation of Mental Abilities.** The mental abilities like thinking, reasoning, expression and criticism etc. can only be measured by essay type tests. It is clear that these tests are useful in measuring the mental abilities and power of the pupils.
5. **Test 'Application of Knowledge' in Different Spheres.** In these tests, the questions start from 'describe', 'elaborate/ 'discuss' 'criticize'

and 'reason out' etc. In this, the pupils describe the facts on one side, they also learn to use them in other situations.

6. **Definite Improvement in Language and Style.** In these tests, pupils are stressed to write language. This definitely improves the language and style of the pupils.
7. **Evaluation of Teacher's Efficiency.** These tests measure the mental powers of the pupils on one side and measure teachers' teaching, planning and efficiency very comfortably on the other side.
8. **Convenient.** These tests do not possess any special instructions which the pupils fail to understand. From this point of view, the essay type tests are convenient to both pupils and teachers.
9. **Freedom of Response.** In these tests, the pupils are free to express their ideas in a logical way.
10. **Economy of Time, Labour and Money.** Thousands of pupils are examined at a time in these tests. Their answer-books are also evaluated simultaneously. Also, success and failure can be predicted without any difficulty. All these things lead to economy of time, labour and money.

Demerits of Essay Type Tests

The demerits of these tests are:

1. **Lack of Clearly Defined Objectives.** The essay type tests lack clearly defined objectives. The pupils fail to understand till last what the tester wants to evaluate?
2. **Lack of Proper Sampling.** In these tests, five to ten questions are asked from some portions of the curriculum. This improper sampling fails to evaluate properly the development of the pupils.
3. **Emphasis on Cramming.** In these tests, some specific questions are asked. Hence, pupils do not prepare the entire curriculum, but they try to cram a few main portions. It is the major demerit of this test.
4. **More Emphasis on Speed and Style.** In these tests, speed and style are emphasized more. The pupils score more who can answer in a good handwriting and with a higher speed in an effective manner. Contrary to this, the pupils score less who cannot write beautifully and in high speed in spite of their complete knowledge of the facts.
5. **Subjectivity in Awarding Marks.** These tests carry higher subjectivity. Hence, uncertainty and variation occur in scores. Since, in these tests, the interest, ability, mood and mental attitude of the tester affect deeply.

6. **Lack of Validity.** These tests measure the language, style, speed, writing and cramming power of the pupils, therefore, these tests cannot be designated as valid tests.
7. **Lack of Reliability.** The scores of these tests show variations and the results are also not consistent. Therefore, these tests lack reliability.
8. **Lack of Predictability.** In essay type tests, obtaining scores depends upon the cramming power of the pupils. Hence, on the basis of results of these tests, the first divisioner cannot be predicted to be superior in general knowledge and behaviour too.
9. **Interference in Mental and Physical Health.** These tests interfere in the mental and physical health of the pupils, because the pupils start their studies one or two months before the commencement of the examination.
10. **Difficulty in Evaluation.** Proper evaluation is not possible by these tests. No such definite norm has been made which may evaluate properly the progress of the pupils.
11. **Costly and Time Consuming.** It costs more in preparing question papers, their printing and arrangement of answer books in essay type tests. Also, it takes months to measure the achievements of the pupils by these tests. Hence, these tests are more expensive and more time consuming.

Objective Type Tests

Meaning of Objective Type Tests. The objective type tests mean those good techniques or tests of evaluation which are constructed to eliminate the defects of essay type tests. In these tests, variation of scores is controlled by avoiding subjectivity.

In other words, in objective type tests, the achievement of subject-knowledge of pupils, their aptitudes, attitudes, interests and intelligence etc. are measured by receiving answers of 150 to 200 short and pointed questions based on the entire curriculum in a very short duration.

These tests have objectivity. This evaluation cannot be supported by any type of partiality. Also, there can not be any type of difference regarding answers among the examiners. This will not affect the scorability of the pupils.

Merits of Objective Type Tests

The following are the merits of objective type tests—

1. **Objectivity. These tests are objective.** The subjectivity of the examiners does not influence these tests.
2. **Comprehensibility.** These tests measure the entire subject area. Hence, these tests are more useful than the easy type tests.

3. **Validity.** The objective type tests measure for what these are made. Hence, these tests are valid.
4. **Reliability.** These tests are reliable. In these tests, if their administration is repeated on a pupil or a group of pupils, the results obtained every time show relationships.
5. **Administrability.** The administration of these tests is very simple for teachers. Also, since their directions are easy to understand, hence, pupils follow them very easily.
6. **Utility.** Objective type tests are more useful because these are constructed to achieve some objective. After achieving the objectives, on the basis of the results, the pupiis can be guided easily.
7. **Easy Scorability.** In essay type tests, evaluation of scripts takes much time, but objective type tests take a few hours to score them.
8. **Practicability.** These tests consume less time. The pupils and the teachers both like them. Hence, these tests are practicable.
9. **Discrimination.** These tests discriminate both foolish and intelligent pupils. Hence, objective type tests are also known as discriminatory tests.

Demerits of Objective Type Tests

The following are the demerits of objective type tests—

1. **Difficult Construction.** The number of questions in the objective type tests ranges from one hundred to two hundred. These questions can only be constructed by experienced, competent and efficient teachers. In other words, the construction of questions in these tests is very difficult.
2. **Lack of Organization of Thought.** In these tests pupils answer smaller questions. This develops neither their imagination and original thin nor they can organize their thoughts in a sequence.
3. **Over Simplification.** Sometimes, these tests are so easy that even very weak pupils do write correct answers of such questions. This does not guide the pupils' future properly.
4. **Partial Information.** These tests carry very small questions. Their answers are shown either in symbols or in one or two words. This keeps the teacher away from full information regarding a pupil.
5. **Standardization of Instruction.** These tests try to bring similarity in the teaching strategies instead of developing thinking, reasoning and logic powers of the pupils. This violates the principle of individual differences which results mental activity into a mechanical activity.

6. **Difficulty of Measuring Mental Abilities.** In essay type tests, it is easy to measure the thoughts, logic and criticism powers of the pupils. In objective tests, the evaluation of these abilities cannot be done.
7. **Guessing and Cheating.** While answering questions in these tests, pupil seeks the help of guessing. Sometimes, they bluff the teachers and copy the script of other pupils.
8. **Very Costly.** The preparation and printing of question papers of these tests is very costly.

Practical Tests

In practical tests, pupils accomplish some pre-fixed task through some experiment. Such type of tests are used in Computer Science,Chemistry, Physics and Geography etc.

Performance Tests

In performance tests, the pupils do not respond in writing. They exhibit their skill by doing some task. Such tests are used in Computer Science,music, art and science subjects.

Characteristics Of A Good Test

A test is not something that is done in a careless or haphazard manner. There are some qualities that are observed and analyzed in a good test. Some of these are discussed under the various headings in this section. Indeed, whether the test is diagnostic or achievement test, the characteristic features described here are basically the same.

i. **A good test should be valid:** by this we mean it should measure what it is supposed to measure or be suitable for the purpose for which it is intended.

ii. **A good test should be reliable:** reliability simply means measuring what it purposes to measure consistently. On a reliable test, it can be confident that someone will get more or less the same score on different occasions or when it is used by different people.

iii. A good test must be capable of **accurate evaluation** of the academic ability of the learner: a good test should give a true picture of the learner. It should point out clearly areas that are learnt and areas not learnt. All being equal, a good test should isolate the good from the bad. A good student should not fail a good test, while a poor student passes with flying colours.

iv. **A good test must represent teaching-learning objectives and goals:** the test should be conscious of the objectives of learning and objectives of testing.

v. **Test materials must be properly and systematically selected:** the test materials must be selected in such a way that they cover the syllabus, teaching course outlines or the subject area. The materials should be of mixed difficulty levels (not too easy or too difficult) which represent the specific targeted learners' needs that were identified at the beginning of the course.

vi. **Variety is also a characteristic of a good test.** This includes a variety of test type: multiple choice tests, subjective tests and so on. In most cases, both the tasks and the materials to be used in the tests should be real to the life situation of what the learner is being trained for.

Criteria Of Good Test:-

A good test meets the following criteria:

1) Validity

2) Objectivity

3) Reliability and

4) Usability

1) Validity : It refers to the attainment of the purpose for which the test is prepared. A valid test measures the attainment of predetermined objectives for which it is designed, with reference to the subject content. Otherwise, it refers to the truthfulness of the test.

2) Objectivity : It refers to the precision of making the answers. An objectives test yields the same or nearly the same score, irrespective of the person who scores it.

3) Reliability : It refers to the consistency in marking. A reliable test always gives the same or nearly the same score when scored at different times. The reliability of a test, in addition to other factors, depends upon

(i) The length of a test (a longer test is more reliable)

(ii) Objectivity of scoring and

(iii) Clarity of instructions.

4) Usability : If refers, among others, to how well the test lends itself to administration, scoring and to the summarization of results.



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Concept, Planning and Preparation of Achievement Test

An Achievement Test attempts to measure what an individual has learnt, that is his present level of performance. These are particularly helpful in determining individual or group status in academic learning. Achievement test scores are used in placing, advancing, or retaining students at particular grade levels. Frequently, achievement scores are used in evaluating the influences of courses of study, teachers, teaching methods and other factors considered to be significant in educational practices. An Achievement test is an important tool in the school evaluation programme. It is necessary for the teacher to know how for the pupils have attained in a particular subject area. Therefore, achievement test is employed for measuring the amount success or level of an individual in a specific field or an area of accomplishment. So, achievement test is post-oriented. Therefore, any test designed to measure the various achievements of a student in a school after a period of training of learning is called an Achievement Test.

Definitions of Achievement Test

According to Thorndike and Hagen : "The type of ability test that describes what a person has learned to do is called an Achievement Test."

According to N.M. Downie : "Any test that measures the attainments or accomplishments of an individual after a period of training of learning is called as an Achievement Test."

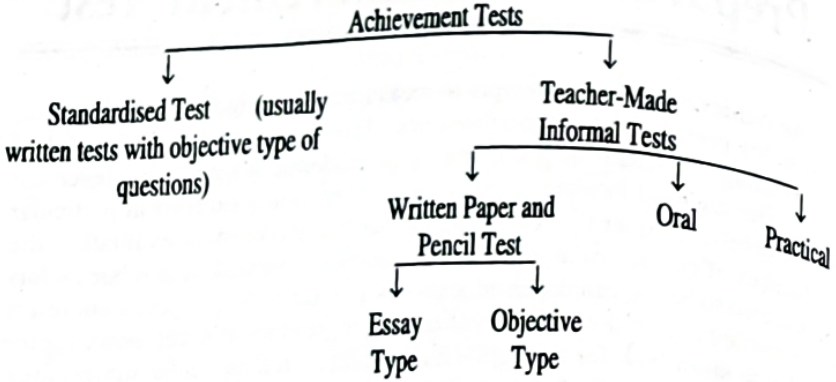
According to Super : "Any Achievement or proficiency test is used to ascertain what and how much has been learnt or how well a task can be performed, the focus is on evaluation of the past without reference to the future, except for the implicit assumption that acquired skills and knowledge

According to Freeman, "Achievement Test is a test designed to measure knowledge, understanding and skills in a specified subject or a group of subjects."

Assessment involves collecting information about students knowledge, skill and abilities. An Achievement Test is a formal assessment. The test helps the teacher to understand the level of comprehension of the students in a particular subject and helps him to estimate the capabilities of the students.

In the school evaluation programmes, various forms of achievement tests are used to measure the extent of learning of the pupils. So it is necessary for the teacher to know how to construct an achievement test efficiently.

Types of Achievement Test



Difference between Teacher-Made and Standardised Tests

Teacher-Made Test	Standardised Test
1. Quality of test item is unknown	1. Quality of Test items is known.
2. Used to evaluate the content and outcomes of the school curriculum	2. Used to evaluate common content and outcome of a number of schools
3. These are not reliable	3. These are reliable
4. These are flexible in Administration	4. The administration produced is standard based on given instruction.
5. Scores cannot be compared with another sample or content	5. Scores can be compared on norm groups.

Important Features of Achievement Test

(1) Its main purpose is to measure the modification of behaviour brought about by learning.
(2) In achievement test weightage should be given to knowledge, understanding, application and skill according to behaviours to be measured.
(3) A good achievement test is tried out and selected on the basis of its difficulty level and discriminating power.
(4) It is accompanied by norms which are developed at various levels and on various age groups.
(5) It should have description of measured behaviour.
(6) It includes a test manual for its administering and scoring.

Purpose of Achievement Tests

(1) Its purpose is assessing the performance of the students.
(2) It motivates the students.
(3) Its purpose is to diagnose the strength and weakneses of the students.
(4) It report the parents about the achievement of their children.
(5) It tells about the effectiveness of methods adopted by the teacher.
(6) It predict the future progress of the child.

Functions/Uses of Achievement Test

(1) To find at the beginning of the year where each student stands in the various academic areas.
(2) It helps the teacher in selecting the appropriate methodology so that all the students got the maximum benefits.
(3) The teacher can classify the brilliant and slow-learners.
(4) To provide basis for promotion to the next class.
(5) The teacher is able to diagnose the strength and weakness of the students in various subjects.
(6) To expose pupil's difficulties which the teacher can help them to solve.
(7) Students are motivated to work hard for removing their shortcomings.
(8) These tests help to select students for the awards and scholarships.
(9) It helps the teacher to evaluate whether his teaching is proper or not.
(10) It helps in placement of students in various fields.
(11) Tests help to determine the efficiency of one school with the others.
(12) To evaluate, revise and improve the curriculum in the light of these results.

(13) Tests help to select talented or gifted students for special classes or courses.

(14) Tests help to evaluate the extent to which the objectives of education are being achieved.

(15) Tests help to classify school objectives.

Construction of an Achievement Test

Generally the Achievement Tests that are conducted in schools are prepared by teachers by considering certain principles and objectives in mind. A teacher prepares the test, and gives due weightage to instructional objectives, content distribution and difficulty level. These tests help in :

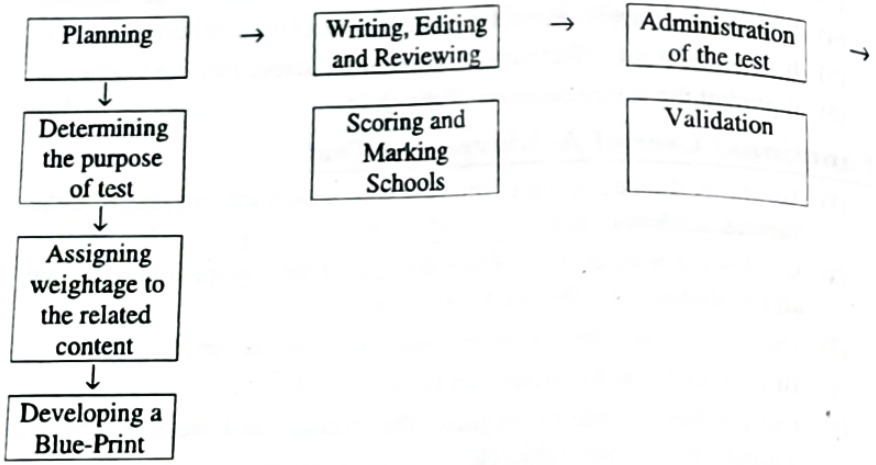
(a) Understanding the success of a teaching method.

(b) Identifying the strengths and weakness of the students.

(c) Developing the remedial measures.

(d) Application of knowledge gained.

Steps in the construction of an Achievement Test



Construction of Achievement Test

(1) **Planning** : The test constructor, who plunges directly into item writing, is likely to produce an inconsistent test. Without any advance plan, some area of syllabus will be over emphasized while others may remain untouched. A test constructed without a blueprint is likely to be unbalanced and representative of teacher's interest. Much of the criticism has been done of the objective test system for over emphasis on rote memory and disproportioned in coverage of the syllabus. Test specification should draw up before the items are prepared.

1.1 Determining the purpose of Test : The test is developed by the teacher to assess the student's achievement. This step also includes determining the contents to be included and the related instructional objectives to be achieved.

1.2 Assigning Weightage to the Related Content : This includes assigning marks to the topics that are included in the contents according to their importance and relevance. This can be done according to instructional objectives, units and sub-units of types/forms of questions. Important factors to be considered in design for the test are:

- Weightage to objectives
- Weightage to content
- Weightage to form of questions
- Weightage to difficulty level.

A sample is shown below:

Sample of Weight age of Distribution of Mark

Weightage to objectives

- This indicates what objectives are to be tested and what weightage has to be given to each objectives.

Sl.No	Objectives	Marks	Percentage
1	Knowledge	3	12
2	Understanding	2	8
3	Application	6	24
4	Analysis	8	32
5	Synthesis	4	16
6	Evaluation	2	8
Total		**25**	**100**

Weightage to content

- This indicates the various aspects of the content to be tested and the weightage to be given to these different aspects.

Sl.No	Content	Marks	Percentage
1	Sub topic - 1	15	60
2	Sub topic - 2	10	40
Total		**25**	**100**

Weightage to form of questions

- This indicates the form of the questions to be included in the test and the weightage to be given for each form of questions.

Sl.No	Form of questions	No. of Questions	Marks	Percentage
1	Objective type	14	7	28
2	Short answer type	7	14	56
3	Essay type	1	4	16
Total		**22**	**25**	**100**

Weightage to difficulty level

- This indicates the total mark and weightage to be given to different level of questions.

Sl.No	Form of questions	Marks	Percentage
1	Easy	5	20
2	Average	15	60
3	Difficult	5	20
Total		**25**	**100**

Developing Blue Print

A blue-print is a sort of the design for the test paper in which a detailed question-wise distribution of marks over specific objectives, topics and forms of questions are presented. All the steps discussed above should be borne in mind before preparing a blue-print.

- Blue print is a *three-dimensional chart* giving the placement of the *objectives, content* and *form of questions.*

- **A Sample of Blue Print**

- Examination _____ Paper _____ Subject _____
- Class _____ Time _____ M.Marks _____

Objectives	Knowledge			Under-standing			Application			Analysis			Synthesis			Evaluation			Grant Total
Form of Qtn Content	O	SA	E	O	SA	E	O	SE	E	O	SA	E	O	SA	E	O	SA	E	
Sub Topic- 1	2 (4)			1 (2)			2 (4)	2 (1)				4 (1)		2 (1)			2 (1)		15
Sub Topic – 2	1 (2)			1 (2)				2 (1)			4 (2)			2 (1)					10
Total Marks	3	0	0	2	0	0	2	4	0	0	4	4	0	4	0	0	2	0	25
Grand Total	3			2			6			8			4			2			

Note: O – Objective Type, SA – Short Answer Type, E – Essay Type

The number outside the bracket indicates the marks and those inside indicates the number of questions.

Writing, Editing and Reviewing

The second step in the construction of the achievement test is the writing the test items. Following the scheme in Blue-Print the investigator write the multiple choice items related to the different content areas.

Questions can be written in the following ways – writing all the questions at one time, writing questions according to their form or types of writing questions unit wise so that the whole syllabus to be covered in the test. Questions should not be ambiguous or out of syllabus. Various types of questions like sentence completion, True or False, Matching Type , short answer type & essay type questions can be included according to the blueprint prepared.

Editing and Reviewing

A preliminary draft of the achievement test thus prepared was firmly edited by the teacher herself and secondly it was given to some other subject expert to check the accuracy of the content and language. It was accordingly edited and reviewed. After required correction, final draft of the Achievement Test was prepared.

TYPE OF TEST ITEMS

- Objective type
- Short answer type
- Essay type

1. Objective type

An objective type of test item is one which the response will be objective.

Objective type test item broadly classified into two:

- *Supply type (Recall Type)*

  The respondent have to supply the responses.

- *Selection type (Recognition Type)*

  The respondent have to select the responses from among the given responses.

Advantages of Objective Type Items

- A large amount of study material can be tested in a very short period time
- Economy of time.
- Objectivity of scoring.
- No bluffing
- It reduces the subjective element of the examiner to the minimum.
- If carefully planned, it can measure the higher mental process of understanding, application, analysis, prediction and interpretation.

Limitations of Objective type items

- Difficulty in preparing good items.
- Problem of guessing.
- Problem of cheating.
- Inefficiency in testing complicated skills
- High printing cost.
- Emphasis on testing superficial knowledge.

2. Short answer type

- A question requiring three value points at most may be defined as a short answer question.
- Value points diminish the subjectivity.
- Help in ensuring wide coverage of content.

Advantages of Short answer Type Items

- Large portion of the content can be covered in a test.
- No opportunity for guessing.
- Easy to construct, because it measures a relatively simple outcomes.
- It can be made quit objective by carefully fixing the value points.
- Useful in evaluating the ability to interpret diagrams, charts, graphs, etc.
- If carefully prepared, deep level objectives understanding, application and problem solving skill can be evaluated.

Limitations of Short answer Type Items

- It is more subjective than the objective type of items.
- It may encourage student to memories fact and develop poor study habits.
- Mechanical scoring is not possible

3. Essay type

- It is free response test item.
- Help in ensuring a wide coverage of content and variety of objectives.
- Help in evaluating complex skills.

Advantages. Essay Type Items

- Easy to prepare.
- Useful in measuring certain abilities and skills.
- Permit the examinee to write down comprehensively what he knows about something.
- Promote originality and creative thinking.
- Possibility of guess work can be eliminated.
- Reduce chance on the spot copying.
- Low printing cost.

Limitations of Essay Type Items

- Minimum validity.
- Lack of reliability.
- No objectivity.
- Rote memory is encouraged.
- It is a time consuming test item.

3. Preparation of the scoring key and marking scheme

- In the case of objective type items where the answers are in the form of some letters or other symbol a scoring key is prepared.

Scoring Key

Q.No	Answer	Marks
1	A	½
2	C	½
3	A	½
4	D	½
5	B	½

- In the case of short answer and essay type questions, the marking scheme is prepared.
- In preparing marking scheme the examiner has to list out the value points to be credited and fix up the mark to be given to each value point.

Marking Scheme

Q.No	Value points	Marks	Total Marks
1	Value Point – 1	½	2
	Value point – 2	½	
	Value point – 3	½	
	Value point – 4	½	
2	Value Point – 1	½	2
	Value point – 2	½	
	Value point – 3	½	
	Value point – 4	½	

Administration

The achievement test would have served its purpose only after it is properly administered. Decision regarding time and place of administration have to be taken. The best of tests when badly administered can give faculty and unreliable results, hence utmost care has to be given to the conduct of the test.

Instructions : (i) Do not discuss anything with your neighbours.

(ii) Do not make unnecessary haste to finish the test.

(iii) Please see that no item is left out, you have to answer all the items.

(iv) Please go through the written instructions carefully before starting.

(v) Please write your Roll No. and Name before Start.

Time-Limit : Instructions related to time are given.

Pre-Try-Out

For the pre-try-out the test is printed and administrated on a sample of 30 students of class who had already studied the contents covered in the test. Detailed instructions were provided to the students. During pre-try-out, some students found difficulty in understanding the language of questions, it should be noted down that questions and made appropriate corrections side by side. The main purpose of the pre-try-out was to identify the non-functional alternatives among questions and to indicate very difficult and very easy items, which was fulfilled very carefully. According to Conard (1957), pre-try-out is useful in identifying any major weakness, omission, ambiguity and inadequacies of items as well as useful in identifying any weakness or vagueness in directions or instructions.

Try-Out

After making the required improvements, the test is printed and it administrated on a sample of students of class, who had already studied the contents covered in the test. The scoring was done with the help of scoring key, which has already been prepared .

Item Analysis

The following steps were followed for the item analysis.

1. All the sample sheets were arranged in the descending order from highest score scripts at the top to the lowest scores ones at the bottom.
2. The 50 upper scripts with highest scores were selected and labeled as "upper group". The 50 scripts with lowest scores were labeled as "lower group" and the middle group of the scripts was set aside. The top 27% of the sample students (50 answer sheets) and bottom 27% were taken into the consideration for computing internal discrimination

index and difficulty value. The middle 46% of the total no. of answer sheets were kept aside.

Difficulty Value

After the formation of two groups, the number of correct responses to an item in each group was marked and tabulated. The difficulty in answering of an item is indicated by the total number of students, who answered it correctly. The larger will be the total number, the easier will be the item. Item difficulty was estimated by determining the percentage of students, who answered the item correctly. The percentage was converted into proportions. The average of the proportions of correct responses on each item in the two end groups was taken to be an estimate of the difficulty value of that particular item. This point of view is supported by Guilford (1954).

Formula for computing the difficulty value 'dv' of each item is:

$$D_V = \frac{R_u + R_L}{N} \times 100$$

D_V = Difficulty Value,

R_U = Right Responses in Upper Group,

R_L = Right Responses in Lower Group

N = Total Pupils

Discrimination Index or Power/ Internal Consistency

Discrimination Index (rb)

: It refers to the degrees to which it can effectively discriminate between pupils with high score and those with low scores.

$$D.P. = \frac{R_U - R_L}{1/2\ N}$$

where DP = Discrimination Power, N = No. of Pupil

R_U = Right Responses in Upper Group,

R_L = Right Responses in Lower Group

This tells about the overall effectiveness of distracters in the given item.

Item Selection for Final Draft

Final selection of the items is made on the basis of difficulty value and discrimination index of each item by adopting Kelley's (1939) method.

Table : DV of Items of the Achievement Test

DV	Remarks
Above 0.75	Rejected
Between 0.20 and 0.75	Accepted
Below 0.20	Rejected

Table : DV of Items of the Achievement Test

DP	Remarks
Between 0.40 and 0.90	Very Good Items
Between 0.30 and 0.39	Good but subjected to improvement
Between 0.20 and 0.29	Marginal Items subjected to modification
0.19 and below	Poor Items

Reliability of the Achievement Test

Reliability is one of the most important characteristics of a measuring tool. Reliability refers to the degree to which a measuring tool gives consistent results. If it gives the same result in successive measurement, it may be called reliable.

Reliability has been defined by many workers in the field of educational and psychological testing. Cattell (1954) considers reliability as an. extent to which the test gives the same results with the same sample on different occasions. Ebel (1966) defines reliability as the consistency with which a set of test scores measures whatever they do measure.

The test-retest method was found to be the most suitable method to calculate reliability. This method measures stability of the test and not the internal consistency. In this method, if the same test is administered to the same subjects twice with some interval of time, two sets of scores would be obtained for each individual. The correlation between the two sets of scores is computed. This coefficient usually the Pearson's 'r' is the reliability estimate. If the test is given more than twice the average of inter correlation among the various scores may be taken as the reliability estimate.

The test formula used is given below:

Where: $\dfrac{\sum xy}{\sqrt{\sum x2\ \sum y2}}$

where; r = reliability coefficient

x= deviation from Actual mean of X

y=deviation from Actual mean of Y

Validity of the Achievement Test

Validity of a test refers to the degree to which it measures what it intends to measure. Mouley (1970) remarked, "The validity of a test must be established prior to its use. Validation is an aspect of its development, not of its use in the solution of the problem".

Regarding the method of establishing the validity of a test Mouley (1970) states, "At the most elementary level, it is necessary for all the tests to have content validity i.e., each question must be related to the topic. There must be an adequate coverage of the overall topic the question must be clear and unambiguous". A more adequate approach to validation consists of checking the agreement between the responses elicited by the questionnaire against the criterion. In some cases, is possible to validate questionnaire responses against the actual behaviour of the respondent. The tests were validated against the criterion of content validity. Thorndike and Linguist (1970) maintain that the problem of content validity is parallel to the problem of preparing a blue print for a test and then building a test to match the blue print:

The following procedure was followed to determine content validity of the achievement test. To determine content validity, the test items and a list of the outcomes were given to the panel of outcome experts in the subject matter and five experts in test item. Content of items, clarity, their correspondence to the outcomes along with the validity and objectivity of data were used to make modification in some items. Out of the seven, five experts have also solved the tests so that the scoring key could be verified. The experts agreed with the investigator on the assignment of the test item .86 percent of the time. This correspondence was taken as evidence at content validity.

Question

Q1. Define the steps of construction of achievement test.

