

## Semester I

### C-6&7

## Pedagogy of Computer Science-I

### **Unit I-THE TECHNIQUES AND TECHNOLOGY OF COMPUTER**

- Introduction; computing needs; Generations of Computers;
- Principles of computing; Techniques of computing;
- Hardware & Software;
- 

### **UNIT -II: NATURE AND SCOPE OF COMPUTER SCIENCE**

- Nature of Computer Science – Meaning and Characteristics; basic concepts, facts and generalizations in Computer Science
- Scope of Computer Science – Relation with other Sciences and its uses in day to day life.
  - Role of ICT in teacher education

### **UNIT – III: AIMS & OBJECTIVES OF TEACHING COMPUTER SCIENCE**

- Aims and Objectives of teaching Computer Science at different levels
- Blooms taxonomy of Educational objectives
- Instructional objectives with specifications

### **UNIT – IV: INSTRUCTIONAL METHODS, TECHNIQUES AND PLANNING FOR TEACHING**

- Strategies: Team Teaching, lecture, lecture cum Demonstration, Inductive-Deductive, Analytic-synthetic, Problem solving, seminar, small group strategies, cooperative learning , group learning, debate, discussion, Individualized strategies, Library based learning, programmed learning, CAL, Web based learning
- Techniques: Brainstorming, Buzz session, Simulation, symposium, Team teaching. – meaning, organization and importance

•

## **Unit I-THE TECHNIQUES AND TECHNOLOGY OF COMPUTER**

### **• Introduction; computing needs; Generations of Computers;**

Computing is any goal-oriented activity requiring, creating algorithmic processes e.g. through computers. Computing includes designing, developing and building hardware and software systems; processing, structuring, and managing various kinds of information; doing scientific research on and with computers; making computer systems behave intelligently; and creating and using communications and entertainment media. The field of computing includes computer engineering, software engineering, computer science, information systems, and information technology.

Computing is the study of how computers and computer systems work and how they are constructed and programmed. Its primary aspects of theory, systems and applications are drawn from the disciplines of Technology, Design, Engineering, Mathematics, Physical Sciences and Social Sciences. Computer science has many sub-fields; some emphasize the computation of specific results (such as computer graphics), while others relate to properties of computational problems. Still others focus on the challenges in implementing computation. For example, digital hardware design focuses on the electronic systems that execute programs and the communication networks that connect them; programming language theory studies approaches to describing computations; while computer programming applies specific programming languages to solve specific computational problems.

Computing is a discipline, like mathematics or physics, that explores foundational principles and ideas (such as techniques for searching the Web), specifically, computing is not 'ICT'; ICT is a skills-based course focusing, typically, on the use of applications such as word processing and spreadsheets.

### Computing needs:-

1. Managing various kinds of information
2. For scientific researches
3. Developing and building systems
4. For entertainment media
5. Useful in communication
6. Helpful in other Subjects
7. Development of Skills
8. Speeded up work
9. Source of Information
10. Helping in Different fields

### Generations of Computers:-

#### First Generation of Computers (1942-1955)

The beginning of commercial computer age is from **UNIVAC (Universal Automatic Computer)**. It was developed by two scientists **Mauchly** and **Echert** at the Census Department of United States in 1947. *The first generation computers were used during 1942-1955.* They were based on vacuum tubes. Examples of first generation computers are **ENIVAC** and **UNIVAC-1**.

#### Advantages

- Vacuum tubes were the only electronic component available during those days.
- Vacuum tube technology made possible to make electronic digital computers.
- These computers could calculate data in millisecond.

#### Disadvantages

- The computers were very large in size.
- They consumed a large amount of energy.

- They heated very soon due to thousands of vacuum tubes.
- They were not very reliable.
- Air conditioning was required.
- Constant maintenance was required.
- Non-portable.
- Costly commercial production.
- Limited commercial use.
- Very slow speed.
- Limited programming capabilities.
- Used machine language only.
- Used magnetic drums which provide very less data storage.
- Used punch cards for input.
- Not versatile and very faulty.

### **Second Generation Computers (1955-1964)**

The **second generation computers** used transistors. The scientists at Bell laboratories developed transistor in 1947. These scientists include John Barden, William Brattain and William Shockley. The size of the computers was decreased by replacing vacuum tubes with transistors. The examples of second generation computers are **IBM 7094 series, IBM 1400 series** and **CDC 164** etc.

#### Advantages

- Smaller in size as compared to the first generation computers.
- The 2nd generation Computers were more reliable
- Used less energy and were not heated.
- Wider commercial use
- Better portability as compared to the first generation computers.
- Better speed and could calculate data in microseconds
- Used faster peripherals like tape drives, magnetic disks, printer etc.

- Used Assembly language instead of Machine language.
- Accuracy improved.

#### Disadvantages

- Cooling system was required
- Constant maintenance was required
- Commercial production was difficult
- Only used for specific purposes
- Costly and not versatile

#### **Third Generation Computers (1964-1975)**

The **Third generation computers** used the integrated circuits (IC). Jack Kilby developed the concept of integrated circuit in 1958. It was an important invention in the computer field. The first IC was invented and used in 1961. The size of an IC is about  $\frac{1}{4}$  square inch. A single IC chip may contain thousands of transistors. The computer became smaller in size, faster, more reliable and less expensive. The examples of third generation computers are **IBM 370, IBM System/360, UNIVAC 1108 and UNIVAC AC 9000** etc.

#### Advantages

- Smaller in size as compared to previous generations.
- More reliable.
- Used less energy
- Produced less heat as compared to the previous two generations of computers.
- Better speed and could calculate data in nanoseconds.
- Used fan for heat discharge to prevent damage.
- Maintenance cost was low because hardware failure is rare.
- Totally general purpose
- Could be used for high-level languages.
- Good storage

- Versatile to an extent
- Less expensive
- Better accuracy
- Commercial production increased.
- Used mouse and keyboard for input.

#### Disadvantages

- Air conditioning was required.
- Highly sophisticated technology required for the manufacturing of IC chips.

### **Fourth Generation Computers (1975-Present)**

The fourth generation computers started with the invention of Microprocessor. The Microprocessor contains thousands of ICs. **Ted Hoff** produced the first microprocessor in 1971 for **Intel**. It was known as Intel 4004. The technology of integrated circuits improved rapidly. The LSI (Large Scale Integration) circuit and VLSI (Very Large Scale Integration) circuit was designed. It greatly reduced the size of computer. The size of modern Microprocessors is usually one square inch. It can contain millions of electronic circuits. The examples of fourth generation computers are **Apple Macintosh & IBM PC**.

#### Advantages

- More powerful and reliable than previous generations.
- Small in size
- Fast processing power with less power consumption
- Fan for heat discharging and thus to keep cold.
- No air conditioning required.
- Totally general purpose
- Commercial production

- Less need of repair.
- Cheapest among all generations
- All types of High level languages can be used in this type of computers

#### Disadvantages

- The latest technology is required for manufacturing of Microprocessors.

#### **Fifth Generation Computers (Present & Beyond)**

Scientists are working hard on the **5<sup>th</sup> generation computers** with quite a few breakthroughs. It is based on the technique of **Artificial Intelligence (AI)**. Computers can understand spoken words & imitate human reasoning. Can respond to its surroundings using different types of sensors. Scientists are constantly working to increase the processing power of computers. They are trying to create a computer with real IQ with the help of advanced programming and technologies. **IBM Watson** computer is one example that outsmarts **Harvard University Students**. The advancement in modern technologies will revolutionize the computer in future.

#### **• Principles of computing; Techniques of computing;**

1. Based on systematic information
2. For scientific researches
3. Developing and building systems
4. Based on Programming techniques
5. Helpful in curriculum

## Techniques of computing

☐ Computing information is considered an extremely important asset to any institution. Techniques are set of management disciplines with the help of computing information that allow any institution to manage their technological fundamentals to create competitive beneficial advantage. Computing information techniques includes

- ☐ Integrated planning
- ☐ Design, optimization
- ☐ Operation and control of technological products.
- ☐ Processes and services.

### • Hardware & Software

#### Hardware

Hardware refers to the physical elements of a computer. This is also sometime called the machinery or the equipment of the computer. Examples of hardware in a computer are the keyboard, the monitor, the mouse and the processing unit. However, most of a computer's hardware cannot be seen; in other words, it is not an external element of the computer, but rather an internal one, surrounded by the computer's casing (tower). A computer's hardware is comprised of many different parts, but perhaps the most important of these is the motherboard. The motherboard is made up of even more parts that power and control the computer.

In contrast to software, hardware is a physical entity. Hardware and software are interconnected, without software; the hardware of a computer would have no function. However, without the creation of hardware to perform tasks directed by software via the central processing unit, software would be useless.

#### Software



Software commonly known as programs, consists of all the electronic instructions that tell the hardware how to perform a task. These instructions come from a software developer in the form that will be accepted by the platform (operating system + CPU) that they are based on. For example, a program that is designed for the Windows operating system will only work for that specific operating system. Compatibility of software will vary as the design of the software and the operating system differ. Software that is designed for Windows XP may experience a compatibility issue when running under Windows 2000 or NT.

Software is capable of performing many tasks, as opposed to hardware which only perform mechanical tasks that they are designed for. Software is the electronic instruction that tells the computer to perform a task. Practical computer systems divide software systems into two major classes:

- **System software:** Helps run computer hardware and computer system itself. System software includes operating systems, device drivers, diagnostic tools and more. System software is almost always pre-installed on your computer.

- **Application software:** Allows users to accomplish one or more tasks. Includes word processing, web browsing and almost any other task for which you might install software. (Some application software is pre-installed on most computer systems.)

Software is generally created (written) in a high-level programming language, one that is (more or less) readable by people. These high-level instructions are converted into "machine language" instructions, represented in binary code, before the hardware can "run the code". When you install software, it is generally already in this machine language, binary, form.

## **UNIT -II: NATURE AND SCOPE OF COMPUTER SCIENCE**

### **• Nature of Computer Science – Meaning and Characteristics; basic concepts, facts and generalizations in Computer Science**

Computer science is the study and development of the protocols required for automated processing and manipulation of data. This includes, for example, creating algorithms for efficiently searching large volumes of information or encrypting data so that it can be stored and transmitted securely.

**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.

Its fields can be divided into a variety of theoretical and practical disciplines. Some fields, such as computational complexity theory (which explores the fundamental properties of computational and intractable problems), are highly abstract, while fields such as computer graphics emphasize real-world visual applications. Still other fields focus on the challenges in implementing computation. For example, programming language theory considers various approaches to the description of computation, while the study of computer programming itself investigates various aspects of the use of programming language and complex systems. Human-computer interaction considers the challenges in making computers and computations useful, usable, and universally accessible to humans.

While consideration of the body of knowledge is one major issue in determining whether a specific program meets the necessary requirements to be called a computer science degree, other issues must also be addressed. Typically, these issues are concerned with the overall nature of the discipline, the breadth and depth of a program, plus other factors relating to practical, personal, and transferable skills.

In general terms, we expect that institutions will define aims and objectives that characterize their particular programs and indicate that their curricula are at the level of a undergraduate degree in computer science. Degree programs in computer science can take various forms, each of which could prepare their students for different but valid careers. At one extreme, a degree program might provide opportunities for its students to take courses on a wide range of topics spanning the entire area of computer science. Graduates from such programs would have great flexibility and might be of particular value either in emerging areas where specialist courses may not be established or in contexts where their ability to span the field would be useful. At another extreme, a program might take one very specific aspect of computer science and cover it in great depth. The graduates from such programs will typically tend to seek opportunities in the area of specialization they have studied, whether it be the development of multimedia systems, network design, the formal verification for safety-critical systems, electronic commerce, or whatever other specialities emerge and become important.

Despite such differences in emphasis and content, however, there are certain minimal characteristics that should be expected of any graduate in computer science. The purpose of this chapter is to explore what those characteristics ought to be.

### **General characteristics of computer science**

These characteristics can be expressed as follows:

- ▣ ***System-level perspective.*** The objectives associated with individual units in the body of knowledge tend to emphasize isolated concepts and skills that can lead

to a fragmented view of the discipline. a computer science program must develop a higher-level understanding of systems as a whole. This understanding must transcend the implementation details of the various components to encompass an appreciation for the structure of computer systems and the processes involved in their construction and analysis.

☐ *Appreciation of the interplay between theory and practice..*

☐ *Familiarity with common themes..*

☐ *Adaptability*

### GENERALIZATIONS IN COMPUTER SCIENCE

Computer , One of the most powerful forces today, is being put to use everywhere. It is used in weather forecasting, designing of machines & buildings, Air-Railway reservation of seats, science and technology , Medical case, etc. Let us have a brief idea of the impact of computer usage on various sectors of our society.

\* **Business and Industry:** In Business, Computers are being used for many data processing tasks such as word processing, filing, assembling numbers and facts associated with general office functions like accounting, payroll processing and personal record keeping. Different paper works which took a lot of power and time, can be done with little effort and in short time by computer.

With advances in computer technology , the industrial sector has progressed remarkably in terms of: New efficient methods of production, optimal usage of available resources, Greater efficiency, Better quality of products, Reduction in cost of production and Improved safety and reliability.

\* **Recreation and Entertainment:** Our entertainment and pleasure time pursuits have also been affected by computerization. Musical instruments can be linked to a personal computer ,thereby Creating a variety of sounds. -

**For Example:** In movies, computer generated graphics gives freedom to designers so that special effects and even imaginary characters can play a part in making movies, videos, and commercials.

\* **Telecommunication:** Satellites are used for telecommunication . For the live telecast on television and telecasting of programs on different television channels, computers are used.

\* **Government:** Various departments of our government use computers for their planning, control and law enforcement activities. Computers are used for Traffic, Tourism, Information and Broadcasting, Education, Railway, Aviation.

\* **Health Care:** Computers are also being used for planning and control purposes by health care professionals. Computer equipment is used to monitor pulse rate, Blood pressure and other vital signs. This leads to correct and fast diagnosis. Medical researches are using computers as a tool in their search for cures of deadly diseases like cancer and AIDS.

\* **Humanities:** In recent years computer usage has increased in people having interests in history, literature, music, graphics, arts and other branches of humanities. They use it to ease manuscript preparation, translate texts from one natural language to another, discover significant stylistic patterns in text.

\* **Science and Technology :** Thousands of scientific applications are processed daily, on the computers. One of the most important daily activity is weather forecasting, which involves solution of mathematical equations using world wide data about air pressure, temperature, humanity both values.

- **• Scope of Computer Science – Relation with other Sciences and its uses in day to day life.**

- Gaming graphical designing
- Applications programming,
- Web development,
- Embedded systems,
- Computer science classroom.
- recent developments and innovations
- In the institutions the courses are way more than outdated.
- Provide Knowledge about gadgets: - In this scenario it becomes far more important that one starts to learn current gadgets from the web. The fact I understood is that one's profile should be good. Every student undergoes internships during their course and for you to get an upper hand in placements it is always better to do internships abroad during your engineering course.
- System Administration and Banking.
- Controlling Learning Activities
- Special Education
- Providing Individual Attention
- **Practice Purpose:** Computer can be used for practice purpose. The student can work on computer to practice what they learn in classroom, immediate feedback is provided to them. There are so many types of practice softwares who focus on previously learned knowledge and new knowledge.
- **Developing Problem solving Ability and Creativity :** There are so many programs available on problem solving and creativity. Students can have a variety of practice for solving problems, giving new ideas, constructing and developing new concepts. Students become more creative in their educational outcomes.
- **Tutor Services:** Computer has been proved to be very effective in providing tutorial services to a number of students at a time on individual basis. It has showed its capacity as a good teacher, Subject Expert, demonstrator and supervisor. It can ask questions, answer them, solve problems, assign and heck

work etc. infact computer helps at each and every steps of teaching learning process.

□ **Guidance:** Computers are now - a - days serving 'as sincere, resourceful and energetic officers. They are used to guide the students educationally, vocationally and for personal guidance also. With the help of computer, student can get guidance from any part of working through internet.

□ **Simulation:** Simulation are being used to provide necessary training to the students. Students acquire valuable training experience without involving in risks and danger. Computers are providing simulation of real life situation to the student teachers.

□ **Lab Work:** Students feel difficulties in their practical work in computer Lab. Computers are helping a lot in this direction. Science and other practical subjects are being demonstrated to them. Computers store the data, analysis it and produce result very fast and accurately.

□ **Upgrading knowledge:** It is very difficult for the persons to study books for upgrade their knowledge. Internet is an ocean of knowledge. Internet provides fast and easy access to the knowledge. Students as well as teachers can upgrade themselves in their subjects with minimum effort and time.

□ **Administration:** Computer is helping in administration also. The activities like Making Time table, organizing co-curricular activities, discipline, observation, record maintenance, arranging information, keeping accounts and financial responsibilities etc. are being done in school - colleges on computer.

□ **Data Analysis:** Data Analysis and lot of Calculations are required in research work, which is very difficult manually. Computer made it very easy and fast. Students can perform complex calculations or data analysis within seconds with help of computer.

□ **Record Maintenance:** In education we need to store large amount of data. Data may be related to student's Detail, their result, progress etc. Computer can store the data in the form of files and we can retrieve the information any time very fast.

□ **Library Service:** Library is the centre of all the knowledge for school college students. They may face problems in finding books . They may need more books in the library. With the help of internet, the libraries of the world can be brought to their own library. Students can get their desired book just by clicking. Students can directly read magazines or books from the terminal . This type of computerized learning is called CAL (Computer Aided Learning)  
**Evaluation:** Computers are playing a leading role in the task of evaluation of student's progress. They are preparing progress reports and maintaining records. The evaluation process is designed according to the needs of each individual and they get the result immediately.

Role of ICT in 21st Century's Teacher Education:-  
ICT helps teachers in both pre-service and in-Service teachers training. ICT helps teachers to interact with students. It helps them in preparation their teaching, provide feedback. ICT also helps teachers to access with institutions and Universities, NCERT, NAAC NCTE and UGC etc. It also helps in effective use of ICT software and hardware for teaching – learning process. It helps in improve Teaching skill, helps in innovative Teaching. It helps in effectiveness of classroom. It also helps in improving professional Development and Educational management as well as enhances Active Learning of teacher Trainees. It is now replacing the ancient technology. As we know now-a day's students are always have competitive mind. So teacher must have the knowledge of the subject. This can be done through ICT. ICT helps teachers in preparation for teaching. In order to introduce ICT in pre-service teacher education different methods and strategies are applied. Different tools are used such as word processing, Database, Spreadsheet etc. Various technology based plans are used to help the teachers for their practice teaching. ICT prepares teacher for the use of their skills in the real classroom situation and also make students for their future occupation and social life. ICT used as an „assisting tool“ for example while making assignments, communicating, collecting data & documentation, and



conducting research. Typically, ICT is used independently from the subject matter. ICT as a medium for teaching and learning. It is a tool for teaching and learning itself, the medium through which teachers can teach and learners can learn. It appears in many different forms, such as drill and practice exercises, in simulations and educational networks. ICT as a popular tool for organisation and management in Institutions. Teachers must provide technological support to learn using motion picture, animation, simulation training which helped student teachers to give model presentation. If the teacher is highly equipped with technology, the student will also be equipped with technology. It removes the traditional method of teaching and prepare teacher to apply modern method of teaching. ICT is plays an important role in student evaluation. ICT is store house of educational institution because all educational information can safely store through ICT. ICT helps Teacher to communicate properly with their students. So ICT bridge the gap between teacher and students. ICT helps Teacher to pass information to students within a very little time. ICT helps Teacher to design educational environment. ICT helps Teacher to identify creative child in educational institute.

### **UNIT – III: AIMS & OBJECTIVES OF TEACHING COMPUTER SCIENCE**

#### **• Aims and Objectives of teaching Computer Science at different levels**

#### **AIMS OF EDUCATION**

*According to James Ross, “The aim of education is the development of valuable personality and spiritual individuality.”*

Aims of education are formulated keeping in view the needs of situation. Human nature is multisided with multiple needs, which are related to life. Educational aims are correlated to ideals of life.

The goal of education should be the full flowering of the human on this earth. According to a UNESCO study, “the physical, intellectual, emotional and ethical integration of the individual into a complete man/woman is the fundamental aim of education.”

### ***Aims of Teaching of computer***

- Social Aim
- Intellectual Aim
- Disciplinary Aim
- Cultural Aim
- Moral Aim
- Aesthetic Aim
- Social Aim
- Vocational Aim
- Appreciation Aim
- Problem solving Aim
- Scientific Aim
- Skill Aim

### **General objectives of Computer Science**

According to the ACM and IEEE, “*Learning objectives are central components of any body of knowledge; basically they capture important elements that are typically absent from a mere list of knowledge topics. They are intended to capture what students are able to do with knowledge.*”

□ **Provide knowledge:**

1. To provide knowledge of basic objectives of teaching computer education.
2. Programming Languages and its principles
3. Hardware and software
4. Operating systems
5. Number system
6. Internet – Meaning, its uses, terminology

□ **Understanding**

1. When subject taught properly and deeply knowledge is transformed to understanding.
2. Explain working of computer.
3. Discrimination between the languages and software.
4. locate errors.

□ **Application**

1. Provide knowledge to the pupil how to use computer to solve the problems in daily life.
2. Give new ways of using application software and developing software.

□ **Skill**

1. Handle mouse properly.
2. Develop software
3. Type correctly by keyboard
4. Use all application software properly.

□ **Attitude**

1. Analyze problem
2. Think logically
3. Verify result
4. Intellectually honest

□ **Appreciation**

1. Role of computer in daily life activities

2. The way computer was discovered
3. Role of computer in development of society
4. Synthesis of solution of problems

□ **Interest**

1. Learning computer subjects.
2. Reading computer literature
3. Practical work in computer laboratory
4. Activates related to computer.

□ **Interest**

1. Learning computer subjects.
2. Reading computer literature
3. Practical work in computer laboratory
4. Activates related to computer.

## **OBJECTIVES OF COMPUTER SCIENCE**

Objectives are the guiding steps and it is after achievement of objectives that we reach near to aims. Objectives are always expressed in measurable terms called behavioural. They are the basis through which the long term product aims are to be achieved in a more practical and definite way.

The aims of teaching computer education may thus be broken into some objectives, for providing definite learning experience to bring desirable individual changes. Consequently, Objectives of computer education teaching thus provide clear cut well defined short term purposes or tasks before a computer education teacher at the time of teaching a particular topic or providing particular type of learning

experiences. The objectives of computer education can be classified into following categories; Instructional Objectives, Behavioral objectives, Educational objectives.

• **Blooms taxonomy of Educational objectives**

Bloom's Taxonomy was created in 1956 under the leadership of educational psychologist Dr Benjamin Bloom in order to promote higher forms of thinking in education, such as analyzing and evaluating concepts, processes, procedures, and principles, rather than just remembering facts (rote learning). It is most often used when designing educational, training, and learning processes.

"Taxonomy" simply means "classification", so the well-known taxonomy of learning objectives is an attempt (within the behavioral paradigm) to classify forms and levels of learning. It identifies three "domains" of learning (see below), each of which is organized as a series of levels or pre-requisites. It is suggested that one cannot effectively — or ought not try to — address higher levels until those below them have been covered (it is thus effectively serial in structure). As well as providing a basic sequential model for dealing with topics in the curriculum, it also suggests a way of categorizing levels of learning, in terms of the expected ceiling for a given programme. Thus in the Cognitive domain, training for technicians may cover *knowledge*, *comprehension* and *application*, but not concern itself with *analysis* and above, whereas full professional training may be expected to include this and *synthesis* and *evaluation* as well.

**There are 3 domains of Learning:**

- **Cognitive:** mental skills (*knowledge*)

- **Affective:** growth in feelings or emotional areas (*attitude or self*)
- **Psychomotor:** manual or physical skills (*skills*)
- 1. **Cognitive:** the most-used of the domains, refers to knowledge structures (“knowing the facts” is its bottom level). It can be viewed as a sequence of progressive contextualization of the material.



1. **KNOWLEDGE** – The remembering of previously learned material. It may involve recall or the bringing to mind of appropriate information. Knowledge is lowest-level learning. Terms that are appropriate for “KNOWLEDGE” objectives are define, describe, identify, label, list, match, name, outline, reproduce, select, and state.
2. **COMPREHENSION** – The ability to grasp the meaning of material. Comprehension may be shown by translating material from one form to another, interpreting material, or predicting future trends. Terms that are appropriate for “COMPREHENSION” objectives include defend, distinguish, estimate, explain, extend, generalize, infer, paraphrase, predict, rewrite, and summarize.
3. **APPLICATION** – The ability to use learned material in a new and concrete situation. The

application of rules, methods, concepts, principles, laws, and theories is typical of these kinds of processes used in application. Terms like change, compute, demonstrate, discover, modify, operate, predict, prepare, produce, relate, show, solve, and use are appropriate for “APPLICATION” objectives.

4. ANALYSIS – The ability to break down material into its component parts so that the relationships between parts can be analyzed and the underlying organizational principles are recognized. Terms that are appropriate for “ANALYSIS” objectives are breakdown, diagram, differentiate, discriminate, identify, illustrate, infer, outline, point out, relate, select, separate, and subdivide.

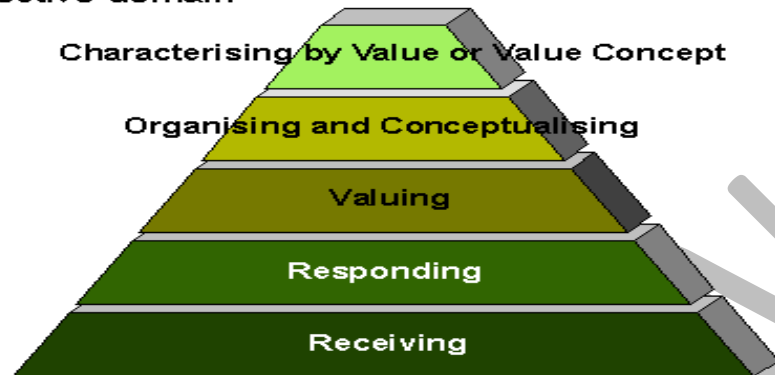
5. SYNTHESIS – The ability to resolve contradictions and to put parts together to form a new whole.

Emphasis is upon the formulations of new patterns of structures. Term that are appropriate for “SYNTHESIS” objectives include categorize, combine, compile, compose, create, devise, design, explain, generate, modify, organize, plan, rearrange, reconstruct, relate, and reorganize.

6. EVALUATION – The ability to judge the value of compiled material for a given purpose. Criteria are established as a basis for evaluation. This learning is the highest in the cognitive hierarchy because it

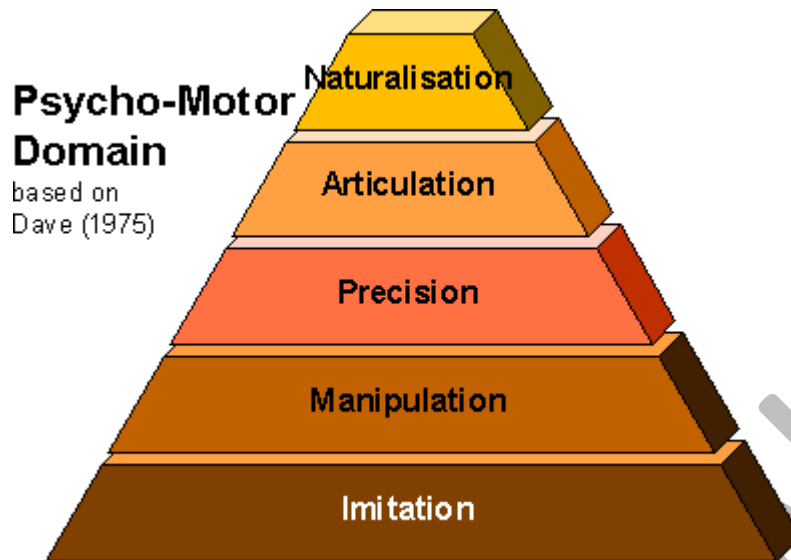
2. **Affective:** the Affective domain has received less attention, and is less intuitive than the Cognitive. It is concerned with values, or more precisely perhaps with perception of value issues, and ranges from mere awareness (Receiving), through to being able to distinguish implicit values through analysis

**Affective domain**



3. **Psycho-Motor:** Bloom never completed work on this domain, and there have been several attempts to complete it. One of the simplest versions has been suggested by Dave (1975)





• *Instructional objectives with specifications*

The teacher should be kept certain objectives in view while teaching computers to the students. At the time of imparting instructions to the students, a teacher has to place before him some definite and very specific objectives for being attained within a specified classroom period and resources in hand. Through classroom teaching learning objectives, a teacher tries to bring desired changes in the behaviour of pupils. The classroom teaching learning objectives known as Instructional objectives.

- The term Instructional objectives in relation to the teaching of Computer Education may be defined as a group of statements formulated by the teacher for, describing what the pupils are expected to do or will be able to do once the process of classroom instruction is over.
- In fact, Instruction and outcomes is the teaching learning product in the form of behavioural changes in the pupils that a teacher expect as a result of his instruction related with a particular lesson unit of the subject.
- Instructional objectives are thus nothing but descriptions of the pupils terminal behaviour expected out of the ongoing classroom instruction.

Therefore, Instructional objectives may be termed as teaching learning objectives for behavioural objectives.

- The main purpose of Behavioural objectives is to provide statements or skills, concepts of behaviour learner are expected to demonstrate after going through a particular instruction.
- **According to Crowford :** “Instructional objectives for teachers are narrow in scope than educational objectives. Instructional objectives guide the teacher in the selection, emphasis and omission of subject matter, materials and activities while preparing lesson plan and classifying instruction.”

#### **UNIT – IV: INSTRUCTIONAL METHODS, TECHNIQUES AND PLANNING FOR TEACHING**

**• Strategies: Team Teaching, lecture, lecture cum Demonstration, Inductive-Deductive, Analytic-synthetic, Problem solving, seminar, small group strategies, cooperative learning , group learning, debate, discussion, Individualized strategies, Library based Learning, programmed learning, CAL, Web based learning**

#### **Team Teaching**

In team teaching a group of teachers, working together, plan, conduct, and evaluate the learning activities for the same group of students. In practice, team teaching has many different formats but in general it is a means of organising staff into groups to enhance teaching. Teams generally comprise staff members who may represent different areas of subject expertise but who share the same group of students and a common planning period to prepare for the teaching. To facilitate this process a common teaching space is desirable. However, to be effective team teaching requires much more than just a common meeting time and space.

**(i) Why Should I Use Team Teaching?**

In view of the additional complexity which team teaching initiatives introduce into departmental organisation and in view of the time needed for staff to adapt to the new structures, it is relevant to ask what benefits accrue from team teaching. How, for instance, does team teaching benefit lecturers, part-time tutors, students, and departments as a whole?

- **For Lecturers**, who so often work alone, team teaching provides a supportive environment that overcomes the isolation of working in self-contained or departmentalized class-rooms. Being exposed to the subject expertise of colleagues, to open critique, to different styles of planning and organisation, as well as methods of class presentation, teachers can develop their approaches to teaching and acquire a greater depth of understanding of the subject matter of the unit or module.
- **Part-time staff** can be drawn more closely into the department as members of teams than is usually the case, with a resulting increase in integration of course objectives and approaches to teaching.
- **Team teaching can lead to better student performance** in terms of greater independence and assuming responsibility for learning. Exposure to views and skills of more than one teacher can develop a more mature understanding of knowledge often being problematic rather than right or wrong. Learning can become more active and involved. Students could eventually make an input into team planning.
- **Team teaching aids the professional and interpersonal dynamics of departments** leading to closer integration of staff.

### **LETCURE METHOD:**

Lecture Method is inexpensive method to teach the subject matter of computer education in our schools. Where teaching is only is to supersede the subject

matter, there the best method is lecture method. In ancient time, there was a absence of text books to teach students so at that time teachers used only chalk board to teach students . That is why it is often named as ‘chalk and talk method’. In recent time also, Lecture method is the most used method. This method is very helpful for covering the syllabus rapidly within the limited time.

In lecture method, teacher prepares the lecture about a particular topic from the textbooks and other available sources and then delivers the lecture to the students on that particular topic with in a prescribed time period without the use of scientific equipment (teaching aid) . The Teacher doesnot bother whether the subject matter has been grasped by students or not.

### **Methods of Lecture Method**

1. Lecture Method does not require the use of subject laboratories, scientific equipments as a teaching aid material . So this is inexpensive method.
2. With the help of Lecture method, a single teacher can teach many students.
3. Lecture method is very helpful for covering the syllabus rapidly with in a limited time. So this method saves time.
4. Lecture method becomes essential while introduction a topic in a class.
5. Lecture method is very helpful to summarise of early taught lesson.
6. Lecture method is very essential while giving instructions before performing any experiments in the laboratory of computer.

### **Demerits of Lecture Method**

1. In Lecture method, only teacher becomes active and students remain passive so specialities and interests of the students are ignored.
2. Lecture method does not help in the development of viewpoints of the students.
3. Lecture method is unpsychological teaching method because no attention is paid to the readiness of students to get the knowledge of subject matter.

4. In Lecture method, everything is done theoretically not practically so there is no place for 'learn by practice' method. The main aim of computer education is finished through this method.
5. The thinking and research power of the students is not appreciated in the Lecture method.
6. Teacher does not bother whether the subject matter has been grasped by the students or not, in the Lecture method.

### **Lecture – cum – Demonstration method**

This is the method generally used by computer teachers. Students cannot learn computer either by lecture or by demonstration used in isolation. Even most effective demonstration cannot guarantee learning in Computers. This may also be true for the lecture-cum-demonstration method. It can be succeed when lecture is based upon concrete experiences of the student's environment and a demonstration focuses them into scientific phenomenon, while discussion between teachers and students goes on in a permissive atmosphere. Demonstration method when combined with a well-directed discussion is a successful teaching technique. It can be modified by allowing limited students participation and by problem solving at times. It fits well into the regular method of uniform class procedure for all students but does not permit of very wide individualizations. If widely individualized or modified it approaches to a method usually called the problem solving or project method.

Through contrived situations in this method students themselves form concepts. Therefore lecture – cum- demonstration method should achieve the advantages of both lecture and demonstration methods and minimize their disadvantages. Though it is widely used in our computer classes has a limited role in the teaching learning process. This is because all students do not participate actively.

### **INDUCTIVE METHODS:**

It leads from concrete to abstract, particular to general and from examples to formula. It is the method of constructing a formula with the help of a sufficient number of concrete examples. It is based on induction which means proving a universal truth by showing that if it is true for a particular case and is further true for a reasonably adequate number of cases, it is true for all such cases. A formula or generalisation is thus arrived at through a convincing process of reasoning and solving of problems. After a number of concrete cases have been understood, the student successfully attempts the generalisation.

### **Deductive Method:**

It is the opposite of Inductive Method. Here the learner proceeds from general to particular, abstract to concrete, and formula to examples. A pre constructed formula is told to the students and they are asked to solve the relevant problems with the help of that formula. The formula is accepted by the learners as a pre-established and well-established truth.

### **Synthetic Method**

Of those methods listed above, the synthetic method has become, by far, the most used and accepted by teachers and students because of certain inherent characteristics that minimise intellectual effort and arrive at solutions quickly and mechanically. This method, originally, is meant to follow analytic method to bring to shape and size all the thinking that takes place in the active mind of the child. In course of time, for reasons already stated, it has been adopted as an independent method to the exclusion of the analytical component in the process. According to Butler and Wren (1965).

The synthetic process (method) consists in the drawing of a series of necessary

conclusions until the desired conclusion is reached. The hypothesis implies as a necessary consequence, this hypothesis of some axiom, postulate, or previously established theorem: these hypotheses imply the conclusions associated with them, which in turn make further implications, and •this chain of necessary deductions is pursued until the desired conclusion is reached.

It can be seen from these observations that the synthetic procedure is essentially, interested in drawing conclusions, and arriving at consequences from a given situation. But Butler and Wren caution that, although, the simplicity, the elegance, and rigour of this form of argument make it highly desirable, it is far from desirable as a sole procedure to be followed in deriving mathematical proofs. As a technique it makes no provision for the pupil to understand the reason for making significant constructions or applying auxiliary theorems, let alone developing general sable problem solving skills.

### **The Analytic Method**

The analytic method, on the other hand, starts with a consideration of the desired conclusion that is implied by some propositions in the problem. The stress in this process is why a mathematical operation is to be carried out and what relationships exist between the conclusion and the other elements of the problem. In this method the child proceeds from the unknown to the known by breaking up the entire problem situation into its constituent elements. It is to be established by way of reasoning that G is dependent upon E and F with an operation there upon, which (E and F) in turn depend upon A and B with an operation and C and D with an operation respectively. The main question is what are the dependency relationships between the elements of the problem and how are they dependent upon one another.

A comparison of various aspects of the two methods of teaching problem solving will, perhaps, throw better light on the relative merits and demerits in terms of their contributions to the development of general sable problem solving skills in children.

## **DIFFERENCE B/W THESE METHODS:**

### **Synthetic Method**

- I. It puts together known truths and by the combination of these truths perceives and unknown truth.
2. It is a method of presenting discovered truths.
3. It is short, concise, and elegant.
4. It is a method for learner's practice.
5. It encourages memory and mechanical manipulations
6. It is informational with no heuristic element in it.
7. It is the product of thought, finished, certain and formal

### **Analytic Method**

It pulls apart the problem into simpler truths, verifying their relationship with the unknown truth.

It is a method of discovering truths, an exploratory method.

It is lengthy, laborious, and time consuming.

It is a method for discoverer's creativity.

It promotes originality, based on the power of reasoning.

It is formational, based on heuristic approach.

It is a process of thinking, informal and tentative.

## **PROBLEM SOLVING METHOD**

A problem is a sort of obstruction of difficulty which has to be overcome to reach the goal. According to yoakam and simson," A problem occurs in a situation in which a felt difficulty to act is realised. It is a difficulty that is clearly present and recognised by the thinker. It may be a purely mental difficulty or it may j physical and



involve the manipulation of data. The distinguishing thing about a problem however is that it impresses the individual who meets it as needing a solution. He recognises it as a challenge”.

The problem method aims at presenting the knowledge to be learnt in the form of a problem. It begins with a problematic situation and consists of continuous, meaningful, well integrated activity. The problems are set to the students in a natural way and it is ensured that the students are genuinely interested to solve them.

Problem solving method as a method of teaching represents a method which provides opportunity to the pupil for analysing and solving a problem faced by him on the basis of the previous stock of his knowledge enriched with the present means available to him, quite independently by following some systematic and scientific steps and arriving at some basic conclusions or results to be utilised in future for the solution of similar problems in the identical situation.

### **Definitions:**

- **In the words of Risk,** “Problem solving may be defined as a process of raising a problem in the minds of student in such a way as to stimulate their reflective thinking in arriving at a rational solution”
- **According to Gagne,** “Problem solving is a set of events in which human beings use rules to achieve some goals.”
- **According to Ausubel,** “Problem solving involves concept formation and discovery learning.

The problem solving method has the following characteristics on the basis of the above definition.

1. Problem should be well defined.
2. The problem should be meaningful, interesting and practical.
3. It should have correlation with other study subjects also.
4. It should be related with the previous knowledge of the child.
5. It should develop imagination and critical powers.

6. It should have some educational values.
7. As much as possible the problem should be related with the daily life of the child.
8. It should be challenging so that the powers of thinking and reasoning can be developed.
9. It should be according to the mental and physical level of the child.
10. It should develop scientific attitude amongst the children.

### **STEPS IN PROBLEM SOLVING METHOD**

1. Selection and formation of problem.
  2. Presentation of the problem
  3. Formulation of hypothesis
  4. Collection of data and information
  5. Analysis and organisation of data
  6. Drawing conclusions.
  7. Testing of conclusions.
- 1) **Selection and Formulation of Problem:** The nature of problem should be made very clear to the pupils. The pupils should feel the necessity of finding out the solution of the problem which is selected and formulated. The selection of the problem should be done by the teacher and child both.
  - 2) **Presentation of the Problem:** After selecting and formulating a problem, teacher should present the problem before the students. The teacher should also make it clear that how this problem can be solved and how the related data and informations can be collected to get the solution of the problem.
  - 3) **Formulation of Hypothesis:** Formulation of hypothesis means, preparation of a list of possible reasons of the occurrence of the problem. Formulation of hypothesis develops thinking and reasoning powers of the child It should be kept in mind that formulated hypothesis must be testable.

- 4) **Collection of Data and Information :** The child should be stimulated to collect data and information in a systematic and scientific manner. The teacher can suggest many points regarding collection of data to the students . He can ask them to refer extra books and literature.
- 5) **Analysis and organisation of Data :** On the basis of collected data and information, the formulated hypothesis are tested. Various Statistical techniques are used to analyse and organise that data.
- 6) **Drawing conclusions :** After analysing and organising the data, conclusions are drawn. The selection and rejection of hypothesis is made on the basis of data. Case should be taken that judgements are made only when sufficient data is collected . Discussions and conclusions should be arranged collectively or individually with each child.
- 7) **Testing of conclusions:** No conclusions should be accepted without being properly verified . The students must be asked to be critical while testing conclusions. Thus the correctness of the conclusions is proved by applying them in new or different situations.

#### **Merits of Problem solving Method**

- 1) Problem solving method develops analytical, critical and generalization abilities of the individual.
- 2) Problem solving method is based on the principle of learning by self-effort.
- 3) By using this method, the individual learns how to act in the new situation.
- 4) Problem solving method is scientific in nature.
- 5) This method helps to develop the power of expression on the students.
- 6) Problem solving method stimulates thinking, reasoning and critical judgement in the students.
- 7) By using this method, the students get valuable social experiences like patience, co-operation etc.

- 8) Problem solving method helps in maintaining discipline in a class room.
- 9) This method is helpful in the development of harmonious relationship between the teacher and the learners.
- 10) This method provides valuable opportunity to the proper development of the cognitive abilities of the students.
- 11) Problem solving method is a psychological sound method on account of its being child-centered and problem oriented.
- 12) Problem solving method proves quite helpful in making the study of computer education more useful and practicable in the day to day life.
- 13) This method is helpful in maintaining discipline in a class -room.
- 14) Problem solving method helps in developing good study habits and reasoning power among the students.

#### **Demerits of problem solving method**

1. Problem solving method is a time consuming method.
2. It requires independent efforts on the part of students to find out the solution of the problems.
3. In the problem solving method, a particular problem works as a center of teaching learning process.
4. Entire syllabus of computer education can't be covered by the problem solving technique.
5. Problem solving method does not suit the students of lower classes.
6. The task of thinking about the possible tentative solution is quite challenging one in the problem -solving method. There is always doubt of drawing wrong conclusion.
7. In problem solving method, there is a each of suitable books and references for students.

8. Mental activities are more emphasised as compared to physical activities in problem solving method.

### **Seminar Method:-**

A tutorial arrangement involving the instructor and groups, rather than instructor and individual.

### **Uses of Seminar Method**

1. To provide general guidance for a group working on an advanced study or research project.
2. To exchange information on techniques and approaches being explored by members of a study or research group.
3. To develop new and imaginative solutions to problems under study by the group

### **Advantages**

1. Provides motivation and report.
2. Stimulates active participation.
3. Permits adaptive instruction.

### **Disadvantages**

1. Requires highly competent instructor.
2. Poses evaluation problems.
3. Is more costly than most other methods.

**Cooperative Learning**, sometimes called **small-group learning**, is an instructional strategy in which small groups of students work together on a common task. The task can be as simple as solving a multi-step math problem together, or as complex as developing a design for a new kind of school. In some cases, each group member is individually accountable for part of the task; in other cases, group members work together without formal role assignments.

According to David Johnson and Roger Johnson (1999), there are five basic elements that allow successful small-group learning:

- **Positive interdependence:** Students feel responsible for their own and the group's effort.
- **Face-to-face interaction:** Students encourage and support one another; the environment encourages discussion and eye contact.
- **Individual and group accountability:** Each student is responsible for doing their part; the group is accountable for meeting its goal.
- **Group behaviors:** Group members gain direct instruction in the interpersonal, social, and collaborative skills needed to work with others occurs.
- **Group processing:** Group members analyze their own and the group's ability to work together.

Cooperative learning changes students' and teachers' roles in classrooms. The ownership of teaching and learning is shared by groups of students, and is no longer the sole responsibility of the teacher. The authority of setting goals, assessing learning, and facilitating learning is shared by all. Students have more opportunities to actively participate in their learning, question and challenge each other, share and discuss their ideas, and internalize their learning. Along with improving academic learning, cooperative learning helps students engage in thoughtful discourse and examine different perspectives, and it has been proven to increase students' esteem, motivation, and empathy.

Some challenges of using cooperative learning include releasing the control of learning, managing noise levels, resolving conflicts, and assessing student learning. Carefully structured activities can help students learn the skills to work together successfully, and structured discussion and reflection on group process can help avoid some problems.

## **COMPUTER ASSISTED INSTRUCTION METHOD**

Computer Assisted Instruction Method uses computer to help students to learn. In the teaching of computer Education, computer itself is an apparatus of assistance method. It is used for Individual instruction. The improvement of instruction has been a goal of educators as far back as the teaching of the Greek philosopher socrates. Although there are a wide variety of approaches, in most cases instructions can be characterized by the following tasks.

1. Setting objectives
2. Teaching content based on these objectives.
3. Evaluating performance

In 1965, Lorance stolure and Denial Devis developed the most complicated teaching reflection in which, in place of teacher, computer was used for the representation of the instructions.

Computerised instruction is the use of computer system to supplement a learner's education. The student sits at a computer terminal. The computer screen displays lessons, questions or other information often with accompanying pictures or sound. The learner reacts by typing responses on the computer's keyboard or by moving a handheld control device called mouse. Computer Assisted Instructions can help students to learn and also help them to acquire the computer literacy. There are various definitions of Computer Assisted Instructions method given below:

1. According to Pridemore and Klein, "Computer Assisted Instruction is effective in part because of the availability of immediate feedback."
2. According to Fletcher Flinn, "There are currently a number of research opportunities on the internet. A recent meta-analysis of the efficiency of computer assisted instruction showed it to be an effective educational technique."
3. According to Brothen, " Computer and internet sites provide the opportunity for students to actively participate in research.

## **Merits of Computer Assisted Instruction Method**

1. Computer assisted instructional method is an effective educational technique.
2. Computerized Instruction can provide each student with instruction at a proper level.
3. Computer Assisted instruction method uses computer to help the students to learn.
4. Computer has to choose propitious instructions on the basis of entering behaviour of the students. So computer is called electronic brain.
5. This method is a psychological teaching method. It paid attention to the readiness of student to the acquisition of knowledge.
6. Computer Assisted Instruction method helps in the development of investigation and research power of the students.
7. This method gives the quick and accurate conclusion to the students.

## **Demerits**

1. Computer Assisted Instruction method is very expensive method of teaching.
2. Only computer Literate pupils can get the instructions through the computer Assisted Instruction method.
3. In this method, computers are used for the representation of instructions in the place of teachers.
4. Computer Assisted Instructions method is a method of managing the instructional process without requiring live lectures from teachers.

## **Web Based Learning**

**Web-based learning** has got much attention as being an incredible opportunity to study nowadays. Despite of its popularity the notion still remains unclear and confusing.



What is web-based learning? First of all it has many names. You have probably heard the following terms: online learning, e-learning, computer-based training, technology-based instruction etc. Generally the meaning and the basic concept of them are the same. **Web-based learning is one way to learn, using web-based technologies or tools in a learning process.** In other words, learner uses mainly computers to interact with the teacher, other students and learning material. **Web-based learning consists of technology that supports traditional classroom training and online learning environments.** "Pure" web-based courses are wholly based on computer and online possibilities. In this case all the communication and learning activities are done online. On the other hand, web-based courses may have some face-to-face sessions besides the distant learning tasks. In this case they are called blended courses as they blend web-based activities with face-to-face activities.

Web-based learning can be also formal or informal. **Formal web-based learning** is purposed and learning activities are organized by teachers. **Informal learning** takes place while you are searching material from the Internet. It is self-paced, depending on your goals and ambition to learn.

*Techniques: Brainstorming, Buzz session, Simulation, symposium, Team teaching. –meaning, organization and importance*

## **BRAINSTORMING**

**Uses :-**

Discover new ideas, thoughts and responses very quickly.

□ **Advantages :-**

1. Leads to a very animated and energizing session.
2. More reserved participants feel free to contribute.

□ **Disadvantages :-**

1. It takes time particularly if it is a large group.
2. May consume a lot of material e.g. flipcharts or writing materials.
3. Requires high level facilitation skills.

### **Buzz session**

#### **Uses :-**

1. To develop and express imaginative ideas, opinions.
2. Stimulate thinking.

#### **Advantages :-**

1. Help trainers to draw breath.
2. Gauge the mood by listening to some discussion.
3. Change pace of discussion.
4. Encourage participants to reflect what was learnt.

#### **Disadvantages :-**

1. Unfamiliarity in use.
2. Time required.
3. Need for group leaders.

### **Simulation Method**

**Prof. Luerhman:** A simulation stimulates active engagement of students. They are playing a role, not just reading and analyzing. They make decisions and see the results of their decisions in the response of other players and the outcome of the sim.

Simulations generate much more energy among students than traditional lectures or case discussions.

**Prof. Ernst:** With simulations, students can explore the impact of multiple decisions at the same time. Simulations also allow students to validate their common sense relative to a particular situation.

**Prof. Shih:** A simulation forces students to synthesize and integrate what they read and make actual decisions based on facts or data presented in the case. Simulations give students a temporal dimension, an opportunity to experience outcomes that change based on their inputs over time.

### **Simulation training:**

- Prepare students to cope with future roles.
- Provide practice in a safe environment with no risk to patient or student.
- Test/challenge trainee's technical and decision-making skills during realistic patient care situations.
- Lead to standardized teaching Skills that can be assessed/practiced using simulation
- Interpersonal and communication skills. Critical thinking and decision-making skills.
- 

### **Symposium:-**

Symposium is defined as a teaching technique that serves as an excellent method for informing the audience, crystallizing their opinion and preparing them for arriving at decision regarding a particular issue or a topic. Symposium is a discussion method in which different view points on a single aspect of a topic is discussed. Symposium is a series of speeches on single aspect of a topic.

#### **Basic Purpose of Symposium**

- To identify and understand various aspects of a theme.
- To develop the ability arrive a decision and provide judgment for a problem.

## Characteristics

- Symposium provides a broad understanding of a topic or problem.
- The listener is provided with an opportunity to take decisions about a problem.

## PRINCIPLES

- The speeches may be persuasive, argumentative and informative
- Original presentation is objective and accurate



## Advantages

- *Symposium can be used to address a large group or class.*
- *This method can be frequently used to present broad topics for discussion at conventions and organization of meetings.*

## Disadvantages

- Symposium does not provide adequate opportunity for all the students to participate actively. It has limited audience participation.
- The speech is limited to 10 to 20 minutes.

SADBHAVNA