UNIT-IV

METHODS OF TEACHING

Introduction

Methods of teaching have an intimate relationship with teaching and instructional objectives. So the main aim of teaching is to bring about socially desirable behavioral changes inthe children. Though teaching is an art. Methods are the way or mode to understand and practice the art. So it is essential that every teacher should be acquainted with different methods of teaching computer.

According to **Valtaire and Spancer** "Every method has some goodness in it, no method is all good. Children should be told as little as possible and induced to discover as much as possible".

Some methods are more appropriate for teaching students as a group whereas some techniques are specially developed for individualized instruction. These methods are discussed indetail in this chapter.

4.1 Teacher centered Instruction

In these Methods, the teacher occupies a central position in the classroom. In these methods focus is given on telling, memorization and recalling informations. The children are justpassive recipients and they are in the background of educational process of knowledge. These include: Lecture method, Demonstration and Team teaching Method.

4.1.1 Lecture Method

This is a teacher centered method. In this method the teacher is an active participant and the child is a passive learner. This is not a psychological method. In this method the teacher speaks or delivers a lecture on a particular topic and the children listen. It is one way traffic because the teacher gives ideas and the children receive them. This is the method of imparting information through a speech. This is a one man's show because the children remain passive throughout the process. Lecture method is more useful at higher level classes. In this method it isdifficult to know the extent to which the student has been able to learn. It is useful in relating some of the historical and mathematical incidents.

Guidelines for using Lecture Method:

☐ To introduce the new lessons and new topics.

☐ To develop interest and to motivate the child.

☐ To correlate the new knowledge with the previous knowledge.

☐ To give necessary instructions regarding new knowledge.

☐ To summarize the lesson or content which has been taught.

☐ To give an illustrative and motivational talk.

☐ For critical appraisal and to give at random important information.

☐ To fulfill queries and information.

☐ To prepare the child mentally to study the new lessons or topics.

☐ To present interesting and personal experiences.

☐ To give the information which are not easily available.

☐ To impart recent mathematical knowledge.

☐ To give the information regarding historical development of computers.

☐ When a large number of children are to be taught at the same time.

Steps in Lecturer Method

There are three steps in the process of lecture method –

1. Planning by the teacher
2. Presentation by the teacher
3. Receiving by the learner.

It is clear from above steps that there is no place of pupil's activities. The teacher is active only and the pupil remains a passive learner. He listens the lecture of the teacher. The process of lecture maybe shown as follows—

| Planning by the Teacher | → | Presentation by the teacher | → | Receiving by the learner |
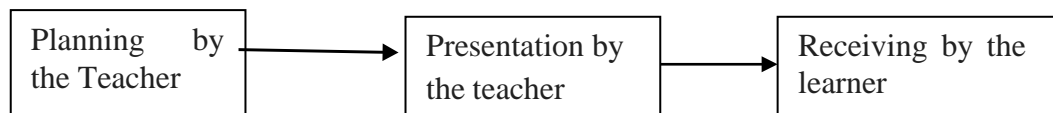
It is a convenient method for the teacher. The teacher is always active. The flow of thought is maintained and the teacher tells about many new things. More information can be given in a short period because it is easy, brief and attractive for teachers.

Effective and Interesting Lecture Method

- To make teaching-learning more effective and interesting, a computer science teacher should keep the following points in his mind-
- The analysis of the topics/ contents should be done properly and should be presented in a systematic and logical manner.
- Where and whenever required, the teacher should use black-board.
- Teaching points, definitions and other important information should be written on black-board,
- Teacher should present appropriate examples to make teaching-Learning process more effective and interesting.
- In order to keep the child active, question should be put up to the students from time to time.
- The language of lecture should be simple, clear and appropriate.
- The voice of the speaker/lecture should be clear and effective but the speed of delivering lecture should be slow.
- At the end of lecture, summary of the lecture should be presented and students should be asked to note own the points.
- While preparing lecture, the previous knowledge of the child should be given due importance.
- To make lecture more interesting teacher should use proper a Audio-visual aids.

Merits of Lecture Method

- This is an easy, attractive and brief method.
- ☐ It is economical with respect to time and money

- It simplifies the work of the teacher.
- It is useful to give fact based knowledge and historical development
- It is a short and quick method.
- A single teacher can teach a large group of students at a time.
- More information may be given in a short time.
- It is more useful for higher classes.
- It is a method of presenting the word picture of ideas and experiences.
- It is useful for introducing new knowledge.

3

Demerits/ Limitations of Lecture method

- This is a teacher-centered method. So this is against psychological principles.
- The learner remains passive and inactive
- It does not provides opportunities to develop various mental abilities like-reasoning, logical thinking, mathematical training etc.,
- In this method, there is no provision for practical and creative work.
- The Teacher is the active participant.
- The knowledge imparted through lecture/speech is not durable.
- This method is not useful for lower level of education.
- There is no consideration of the intelligence, abilities and interests of the students.
- It is not necessary that the children are attentive and understanding all, what the speaker/teacher is saying
- Except the sense of hearing no other senses are used in this method.

4.1.2 Demonstration Method

In teaching demonstration method is very important. In this method both the teacher and pupil are active. The teacher makes a theoretical investigation and proves it in the class – room. The teacher performs the experiment while teaching in the class and the pupils acquire knowledge with careful observation of the experiment.

Demonstrations may be performed by a single teacher or a group of teachers. The teacher should emphasize major points in the demonstration and preferably should write them on black-board. The teacher should be Well-versed in the handling of the apparatus and equipments. While demonstrating teacher should ask some reflective type of questions to stimulate the power of reasoning and interest of students in the classroom.

Criteria of a Good Demonstration

1. The purpose of demonstration should be stated before the students clearly.
2. All experiments should be performed infront of the children.
3. The demonstration table should be arranged properly so that all pupils are able to see it properly. The demonstration table should be at a higher level than pupil's table.
4. The equipment required for the demonstration should be kept on the demonstration table.

5. The help of students should be taken while demonstration and experimentation.

6. Doubts of pupils should be cleared simultaneously.

7. The teacher should use easy and simple language.

8. After the completion of demonstration the teacher should discuss the observationsand results of the demonstration.

9. Demonstration should be the result of active participation of the teacher and students.

10. Demonstration should be speedy and simple.

11. Demonstration should be supplemented with the other audio-visual aids to makeitmore interesting and effective.

12. The teacher should maintain interest and discipline in the class. Lecture-Cum-Demonstration Method.

Merits of Demonstration Method

1. The teaching becomes effective even if the number of apparatus are less

2. The pupil develops the power of observation, reasoning and thinking.

3. Demonstration method is appropriate for lower classes.

4. It is less time consuming.

5. The pupil learns by seeing and observing.

6. It is economical method.

7. The sight and hearing sense of children are more active.

8. The pupil can understand the principles/laws/formulae clearly.

9. It is useful where the experiments involve some complex and difficult operations.

10. It is more useful where the apparatus is costly and sensitive to break.

Demerits of demonstration Method

- The pupils do not get a chance to perform experiments. Therefore first handexperience is not possible with the use of this method.

- It is not based on the principle of Learning by doing.

- The pupils only observe, what the teacher 'does'?

- The pupils do not get direct experiences.

- Some pupils do not observe properly.

4.1.3 Team Teaching

Team Teaching is an innovative way of teaching. It is teaching large groups in which a group of expert teachers are involved in planning, executing and evaluating the learning experiences of a group of students. And it is also known as co – teaching. It is the development in the field of education where a team of expert teachers teach collectively in their respective fields. It first organized in USA around 1950.

Definition

T – Together

E – Everyone

A – Achieves

M – More

According to Naik"In Team teaching method two or more teacher plan of the subject co – operatively, carry in out and always evaluate its effective on the students periodically".

According to **J.T.Shaplin,**"Team teaching is a type of instructional organization involving teaching personnel and the students assigned to them in which two or more teachersare given responsibility, looking together, for all or a significant part of the instruction for some group of students".

Types of Team Teaching

1. Teaching with a single Discipline
2. A team of expert teachers to the same course
3. Combined team with related innovation

Teaching with a single Discipline

In this type of teaching the teachers co – operate with each other in the same subject. For instance the subject computer science may be taught by two or more teachers in the same class.

A team of expert teachers to the same course

Different teachers who are expert in their own course. They are ask to teach the same course together.

Combined team with related innovation

Few teachers are interested some innovation here in teaching time combined to teach in a group. That is, One teacher newly introduce one point other teacher introduce one skill or used TLM

in the same class.

Procedure of Team Teaching

The following procedures are followed in Team Teaching:

1. Planning
2. Execution
3. Evaluation

1. Planning

In team teaching the first stage in the planning stage in which the teacher has to do in the following task.

1. The teaching subject or the topic should select that is to be taught in the classroom.
2. After selecting the topic of teaching point, the main objectives of teaching has to determine appropriately. The teaching objectives must be in written form.
3. Then the teaching materials or teaching aids should select.
4. And then the task of responsibilities should discuss among the team teaching members according to their respective fields.
5. The blueprint or the flowchart for conducting team teaching in prepared.
6. The evaluation process how the evaluation will be and the devices all are determine.

2. Execution

It is the main stage in team teaching, where all the plans which have been prepared are executed in this execution stage. Here the following steps are undertaken –

1. The teacher should decide the teaching points and the question which is being asked to test the previous knowledge of the students on the topic. It is pre – designed task. To know how a teacher makes the presentation step by step in the class.
2. The techniques and the strategies which a teacher uses in the classroom communication should select.
3. The competent teacher of the team will deliver the main point of the teaching. And the other teacher will explain the lead points in a very simple language.
4. The teacher shall supervise the student's activities and he will try to motivate the students and also give reinforcement.

3. Evaluation

It is the final stage of team teaching. Evaluation is the measurement of overall performance of the students and to know whether the teaching objectives are fulfilled or not. In the evaluation

stage –

1. The teacher gives assignment to the students according to the instructional objectives.

2. The team teachers evaluate the overall performance of the students.

3. And the difficulties of the students are determine or diagnosed and then remedial measures like reteaching are provided by the teacher.

Advantages of Team Teaching

1. The students are highly benefited because they get to interact with the expert teachers.

2. In team teaching, a team of teachers who are expert in their respective field interactwith the students so that they give their best.

3. Such teaching provides more flexibility than traditional teaching.

4. The students get an opportunity to interact and share their problem with the expert teachers.

5. In this teaching develop feelings of co – operation between teacher and students andteacher and teacher as well.

6. The available resources are fully utilized in team teaching.

7. The evaluation of team teaching is very effective as the team evaluates the performance of the students and the teacher can provide feedback to each other by evaluating their teaching.

8. It provides variety of ideas as a group of teacher work together.

9. Teach teaching also builds a community among teachers.

10. It also develops human relation which is very important for social adjustment.

Disadvantages of Team Teaching

1. Team teaching consumes more time and energy.

2. If the teachers do not co – operate among them then the teaching may results as failure.

3. It may create confusion for some students if the team leader does not find appropriate teachers to teach a particular part of the topic.

4. If one person or member deviates from team then it may not work successfully.

5. Some teacher may not accept this new technique of teaching who are habituated in traditional teaching

6. If all the members do not have required skills and subject knowledge then the team teaching may fail.

4.2 Learner Centered Instruction

In the Learner centered instruction, the learner occupies the a central position in the classroom. The whole teaching – learning process is geared to the needs, interests, capabilities and requirements of the child. These are based on psychological principles. The purpose is to develop abilities, skills and discovery attitude amongst the learners.These includes: Self learning,Programmed Instruction, CAI, Keller plan, Project Method, ABL, ALM, Mind Map, Advanced Active Learning Method (AALM).

4.2.1 Self Learning

Self – learning is defined as a method of garnering information and after processing and retaining it without taking the help of another individual. It is the responsibility of the learner to learn and hold on to the knowledge without the help of another human resources. It is a modern way of learning that helps a person to tech himself skills and knowledge that will prove relevant to his daily activities. It has not replaced the instructional learning process that has been used traditionally instead has become an extra key that will open the doors of knowledge for everyonewho is interested in acquiring it.

Principles of Self learning

☐ Take into account the individual differences among the learners.

☐ Freedom for students to learn (choosing what to learn and self – learn the chosen thing athis own convenient time).

☐ Allow the learners to proceed at their own speed.

☐ Ensure 'mastery Learning' for each learner.

☐ Present new ideas based on learner's previous knowledge

☐ Provide feedback for each responses of the learner.

☐ Ensure the active participation of each individual learner.

The above principles are made use of in all the self – learning devices.

Form of Self Learning

Self Learning is characterized by certain learner centered features of learning. It facilitates the learners to learn:

- When they want (according to their own time, frequency and duration convenientto them);
- How they want (according to modes of learning suitable to them); and

- What they want (learning objectives and content)

  As a result of the interest evinced in providing individualized instruction, many self –

  learning devices emerged, of which the following are to be discussed in this lesson

1. Programmed Instruction

2. Computer Assisted Instruction

3. Keller Plan

4. Project Method

5. Activity Based Learning Method

6. Active Learning Method

7. Mind Map

8. Advanced Active Learning Method

Advantages of Self Learning

Self learning can be quite useful for those who do not have the time to enroll in formal courses
and degrees as well as for those who cannot travel to a specific location to educate themselves.
There are many advantages of self – learning we will discuss as follow.

- You can choose your own pace, materials, methods, everything is up to you.

- You are less stressed out about failing in front of another person.

- You don't pay the teacher.

- It is not time – bound and is dependent upon the person who wants to learn for whatever number
  of hours he feels like. It gives him opportunity to set his own pace and remove frustration and
  boredom.

- You set the pace.

- You can do it at any time.

- You get better at doing it.

Disadvantages of Self Learning

Working in teams increases collaboration and allows brainstorming. As a result, more ideas
are developed and productivity improves. Two or more people are always better than one for
solving problems, finishing off difficult tasks and increasing creativity. Team work encourages
communication between team members. Although it has many advantages, it has many

disadvantages as follows:

- No self – discipline.
- No face – to – face interaction.
- Lack of flexibility.
- Lack of input from trainers.
- Slow evolution.
- Good e – learning is difficult to do.
- Lack of transformational power.
- No peripheral benefits.

4.2.2 Programmed Instruction

Programmed instruction is an application of the principles of the behavioral sciences and technology to classroom teaching. It is an innovative step directed towards automation and individualization of instruction. This is a method of self – instruction in which all of the instructional load is carried by teaching machine or programmed texts. The learner takes active role in learning and controls the learning situation.

Definition of Programmed instruction

Edgar Dale defined Programmed instruction as "A systematic step by step self – instructional programme aimed to ensure the learning of stated behavior".

Stolarow defined Programmed instruction as "A process in which the teacher presents a subject matter to a learner so that the next item of information to be presented".

A more comprehensive definition of programmed instruction would be; "Any teaching material which leads a student by very short logically and / or psychologically related steps, resulting in few errors so that the learner practices correct responses rather than wrong responses and these are reinforced immediately by knowledge of results, that enable him to take successively closer approximation to the response which are the desired goals".

Programmed Learning Material (PLM)

The information (content) to be taught is presented in the form known as a programme or Programmed Learning Material and the people for whom the programme is written are called target population. PLMs can be presented either in a book form or stored in a machine.

A programmed learning material

i. accepts the responsibility for arrangement of learning situation.

ii. accepts the blame for a student's failure; and

iii. assures effective learning to every learner at hand.

Basic Principles of Programmed Instruction

The following are the basic principles of programmed instruction:

— Principle of small steps.

— Principle of active responding.

— Principle of immediate confirmation.

— Principle of self-pacing.

— Principle of student testing.

Essential Features of Programmed Instruction

The important features of Programmed Instruction are:

— **Predetermined Objectives**

The objectives to be achieved (i.e. the terminal behaviour) at the end of the programme are stated clearly in behavioural terms.

— **Content presented in a logical sequence of small steps**

The subject matter to be taught is analyzed and broken up into small, meaningful segments of information and are sequentially arranged to approximate the final complex behavior. Each of these steps called a frame contains a small amount of information and a question or an activity requiring the learner to answer or to demonstrate the understanding of the information presented. The items are so skillfully written and the steps are so small that the student practices mostly correct responses. These steps are carefully designed to lead to predefined goals or objectives

— **Active Responding**

The learner actively responds by answering the question given in the frame.

- Immediate Feedback

As soon as the response is completed, the learner is reinforced by informing whether his /her response is right, or wrong. This motivates the student to continue with learning.

Self-pacing

The learner works at his own pace through a series of logical steps.

Mastery criterion

The student is required to exhibit a high level performance of the outcome so as to moveover to the next step.

Self-testing

The learner is able to evaluate his own progress in the learning process.

Successive approximation

The learner is led to the desired goal gradually step-by-step

Prompts or cues

Prompts or cues are given to minimize the probability of error so that the learnerpractices correct responses rather than errors. Prompts or cues are gradually withdrawn.

Testing of the Programmes

The content and sequence of frames are subjected to actual try-out with students and are revised on the basis of the data gathered by the programmer.

Styles of Programming

The two best known and popular styles of programming are.

i. Linear or Extrinsic Programming

ii. Branching or Intrinsic Programming

Linear Programming

Skinner and his associates are the originators of the linear type of programming. According to Skinner " A certain direction can be given to human behavior", for this purpose activities is needed to divide in small parts and make their analysis. A linear programme is so named as the learner works through from his initial behavior to the terminal behavior following a straight path. The student proceeds from one frame to the other until he completes the programme. If the responses is right he goes on to the next frame; if it is not he rereads the information until he understands and then proceeds to the next frame The linear programme can be represented as in the following figure.

Frame (1) → Frame (2) → Frame (3) → Frame (4)

The subject matter is broken down into small segments of information. Each frame contains asmall segment of information and a question for the learner to respond. The responses areimmediately reinforced in the succeeding frames. The frames are arranged in a logical sequence.

Salient Features of Linear Programming

— Every learner follows the same path, following the frames in the same order.

— Programme is composed of small steps called frames. Each frame contains asingle idea, a concept or a rule and a question for the learner to respond.

— Only one response is required for each frame.

— Responses asked for require the student to have a thorough understanding of theidea given in each frame.

— Prompts or cues are given in the earlier frames and are gradually withdrawntowards the end.

— The confirmation of the responses provides the reinforcement for further learning.

Branching Programme

     Norman A Crowder became the pioneer of branched programming or intrinsic method of programming. In this type of programming each frame is of relatively bigger size and may contain two or three ideas of related sequence. A single question usually of the multiple choice type is asked at the end.

     In this type of programming there are diversions and intermediary steps. The mistake made by the pupil in answering questions is used to build knowledge and skills. The pupil is given specific direction to help him find the right answer when he makes a mistake. There are two requirements in this type of programming: (1) there must be two or more choices for answering each question and (2) the incorrect answer should result in directing the pupil to material or information which will correct him and guide him back to the correct programme sequence. Diagrammatically a branching programme can berepresented as in the following figure. In the example represented in the figure, four alternatives A, B, C, D are given.

A B C C
D B

B A D

C D A

☐ ——— Represents the main frame in the sequence

▬ ——— Represents remedial frame
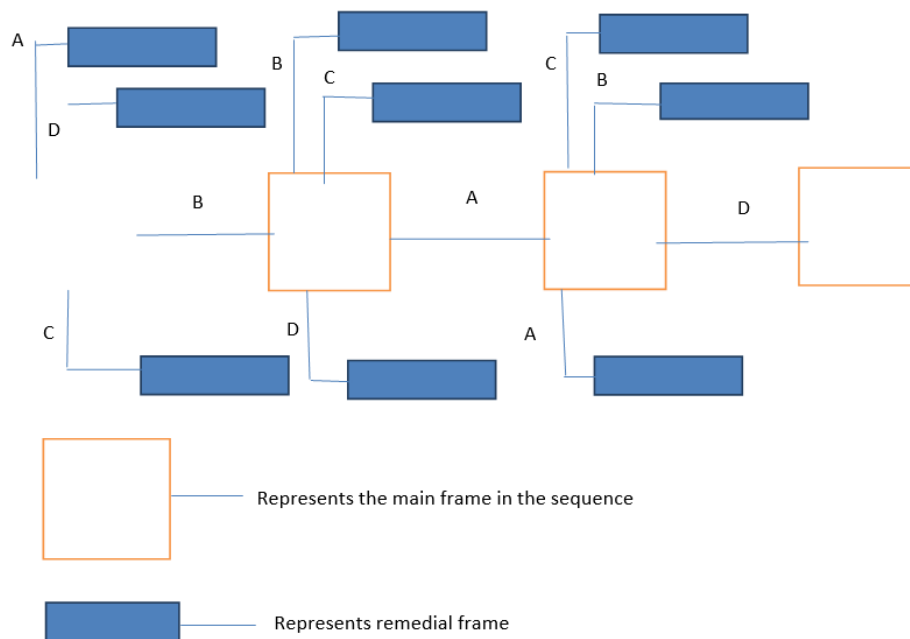
Content Frame

i.   Repeating student's response

ii.   Positive confirmation

iii.   New information

iv.   Question and alternative responses followed by directions to the learner to go to the relevant page.

Remedial Frame

i.   Repeating the student response

ii.   Negative conformation

iii.   Reasons as to why the response is wrong

iv.   Further clarification in simple language

v.   Direction as to where the learner should go next

When the frames of branching are presented in a book form, it is called a 'scrambled book'. The pages in such a book cannot be read consecutively but only in response to the choice of the learner's answer.

Types of Branching

There are two sub - types in branching namely, Backward Branching and Forward Branching.

Backward Branching

In backward branching, if the learner selects the right response, he is directed to the next frame. If the response is wrong, he is taken to an intermediary frame (remedial frame), for further clarification and help and is directed back to the original frame for another attempt. Basedon the responses selected by the learner, he is directed to the next frame or to a particular remedial frame. Hence, in backward branching the learner goes through the same frame twice, once before the remedial material and again after the remedial material.

Forward Branching

In this type, if the learner makes the right response, he goes to the next frame. If the response is wrong, he is directed to a remedial frame where his mistakes are fully explained, probably followed by another parallel question, from which he goes to the next frame in the mainlearning sequence.

Preparation of Programmed Learning Material (PLM)

Preparation of Programmed Learning Material involves three stages.

- Preparatory Phase
- Writing Phase
- Validation Phase

Preparatory Phase

Preparatory phase is an important stage in preparing PLM. It requires the consideration ofthe following.

i.   Selection of a unit or topic and decision regarding the target population

ii. Preparing of a content online

iii. Defining the instructional objectives in behavioural terms.

iv. Deciding about a strategy of learning.

v.   Construction and administration of Entry Behaviour Test and Terminal BehaviourTest.

Writing Phase

With the content being analyzed into learning points and objectives being specified, the instructional tasks and sequence have to be planned and written in the form of frames involving stimulus and response. The following aspects have been considered important for writing the programme.

i. Presenting the learning material in the form of frames in a proper sequence.

ii. Requiring active student responses.

iii. Providing confirmation of student responses.

iv. Prompting or cueing in frames to check or minimize errors in the pupil responses.

v. Gradual withdrawal of prompts or fading.

Validation Phase

After preparing the original draft, it has to be edited for accuracy of subject matter, intelligibility of language and so on. Then the programme is tested for validity in three different phases as listed below.

a) Individual try-out

1) Frame-wise analysis of pupil responses

ii) Editing

b) Group/class try-out

Analysis of pupil's performances and revision.

c) Field try-out

Revising and recasting to reach target level of pupil achievement.

Advantages of Programmed Instruction

The following are the advantages of Programmed Instruction

- Provision for self instruction
- Active role for learner in learning
- Self-testing at all stages of learning
- Feedback to pupil and teacher
- Self-pacing
- Reinforcement of the learning at each step
- Direct two-way communication with the expert
- Easy access to record of student errors for remedial guidance
- Sense of accomplishment and gain of self-confidence for the learner.

4.2.3 Computer Assisted Instruction

The most striking innovation in the field of educational technology is the use of computers in the instructional process. Computer Assisted Instruction is a natural outgrowth of the application of the principles of Programmed Instruction. The main objective of CAI is to provide the needed flexibility for individualizing the educational process. It meets the needs of

a specific learner in a way in which it is almost impossible to do so in a face-to-face student teacher

relationship. A computer is such a device which can cater to the needs of the individual learners by storing a large amount of information. It can process the information suiting to the needs of the individual learner. It can cater to a great variety of educational needs that range widely with respect to educational levels, subject matter, and style of instruction and level of learning from drill and practice to problem solving.

Definition of Computer Assisted Instruction

The phrase computer-assisted instruction' has been defined in different ways.

"Use of a computer to assist in the presentation of instructional materials to a student, to monitor learning progress, or to select additional instructional materials in accordance with the needs of individual learners". **International Directory of Education.**

"Instruction in which a computer is used to present substantial amount of learningmaterial to the student; it often represents an auto instructional technique enabling students to progress at their own individual rates". **The Concise Dictionary of Education.**

Thus the use of computer in the classroom for instructional purposes has been designated by the name Computer Assisted Instruction. In this method the computer is used to provide learning opportunities that are unique.

Uses of CAI

In a CAI system, the computer stores the lesson in memory and enters into a dialogue with the student. During the interaction the computer presents information, invites answers to the questions, maintains records of student's responses, and provides feedback on performance. The system can also generate and score tests, provide study prescriptions, keep record of study paths and generate reports- of course, all the thing a good teacher can do.

Modes of CAI

The various forms that CAI can take are called modes. The common modes of CAI are drill and practice, tutorial, simulation, modelling, problem-solving and gaming.

Drill and Practice

This mode is designed to teach basic facts, for example, the elementary arithmetic operations. The student is asked to type in answers to questions and the computer tells him about the correctness of his response. The pupil is presented with more questions until the material is committed to memory. Control of learning rests with the computer since it initiates and controls the student's activity. Although drill and practice programmes might help students memorise facts and information they can go beyond this and ask questions which involve the use of procedural knowledge to supply answers and provide reinforcement and feedback.

Tutorial

Tutorial is used to teach basic concepts or methods. The tutorial type utilizes written explanations, descriptions, questions, problems and graphic illustrations for teaching concepts much like a tutor. Tutorial mode is very useful when students show varying levels of conceptual understanding and it can provide for individual tutoring needs that may be difficult to satisfy through traditional instructional arrangements. A computer presents information taking into consideration individual differences on aspects like level of understanding, background knowledge and information needs. The computer specifies the tasks and on submission of answers by the student, the computer checks and provides feedback. Control of the learning situation rests with the computer.

Simulation

Simulation deals with the representation of an event, system or equipment. This is an excellent mode which enables students to investigate and experiment with system and processes which are complex, dangerous and expensive. It has the unique ability to compress time and produce expensive, delicate or dangerous systems and equipment. Students can use the pre- stored data or their own data. Simulations allow students to investigate the optimum conditions for carrying out a particular process and gain an appreciation of the situation and constraints.

Modeling

Computer programs can be used to build complex mathematical models and explore them quantitatively, rapidly and in great detail. It is also easy to compare alternative models and investigate their relative behavior with respect to any parameters.

Problem Solving

Computer provides a wide variety of problems and allows the student to focus on the synthesis of ideas and skills that lead to the solution of problem.

Educational Gaming

Educational games can be programmed where the student is placed in a competitive position with either another student or the computer itself. These are best suited to teach rules, procedures etc.

Steps in Developing CAI

The steps in developing CAI are more or less the same as those of PLM and are listed below.

a) Planning
b) Preparation
c) Testing

Planning

Planning a lesson for CAI involves making decisions about the following aspects.

i.   Nature of the target group for whom the instruction is planned:
   - Their age,
   - Previous level of achievement
   - Medium of instruction.
ii.   Nature of the topic
   - Potential for paced, sequenced learning
   - Scope for using illustrations
iii. Length of the topic:
   - Neither too long nor too short
iv.   Nature of the programme
   - User friendly
   - Opportunities for interactive learning

- Visual/graphical presentation
- Programming language

Preparation

Preparation of the lesson for CAI involves the steps listed below.

i.   Stating the objectives.

ii.   Structuring and organizing the lesson pedagogically.

iii. Writing the program.

iv.   Editing

Testing

The programme is to be tried out and its effectiveness assessed with respect to the following:

i.   Program contents

ii.   Content presentation and arrangement of structure

iii. Learner's motivation

iv.   Graphic presentation

v.   Essential elements of educational software.

Learning sequence of CAI

Kemp and Smellie (1989) has listed the following as the learning sequence of CAI

— *Orientation information* **:**The teacher outlines the topic and presents the objectives verbally

— *Directions and procedure:*The directions embedded in the software are read and understood by the student.

— *Learning procedure***:** The students familiarize themselves with the learning procedure.

— *Answering questions***:** The students actively participate by answering questions andevaluate the realization of the objectives.

— *Feedback:* The student's responses are confirmed and immediate feedback is given.

— *Remedial instructions***:** Remedial instruction is provided whenever it is necessary with supplementary materials and references.

— *Choosing the next learning sequence***:** Students choose the direction for the next step to be

taken i.e., to go to the next unit, or go back to the original unit or exit from the program.

Benefits of CAI

The benefits of CAI can be enumerated as under.

— CAI enhances quality of education and saves instructional time.

— It is interactive and involves the student actively in the learning process.

— Learning is more private and the reinforcement and refinement are immediate.

— Learning is student-based and self-paced.

— CAI is instructor – independent and hence it is consistent, well structured andthorough.

— The system can simulate complex problems and permit students to explore andinvestigate.

— CAI is best suited for remedial teaching.

— CAI saves time for teachers and they can devote more time for creative work.

— CAI is particularly helpful for slow learners.

— The graphics facility is a powerful aid in enhancing intuition, especially in givinginsight into mathematical formulae.

— CAI is useful for distance learning and continuing education programs

Disadvantages of CAI

- There is lack of personal touch if the entire course is taught through CAI.

- It is difficult to get suitable software for our Indian requirements.

- Cost may be an important factor of consideration for the Indian schools as computerscan be an expensive proposition.

- Long hours of CAI could result in fatigue.

4.2.4 Keller Plan

Keller Plan is a personalized learning method in which students receive material in small units. When they are ready, they take a test on the unit they have just completed. If they pass, they then move onto the next unit. Learners progress at a comfortable pace. It is developed by Fred Keller, A.S.Sharma and others in 1963. It is also known as Personalized System of Instruction (PSI).

Characteristics of Keller Plan

Self – paced instruction: Each student learns as fast as they are capable independently of others, and is free to specialize in their own interests.

Content chunking: Material is broken down into small units. Prerequisite chunks must be learned before super requisite chunks.

Unit mastery: Each unit must be mastered before students can move onto super requisite units. This means students must score above a certain percent on each unit test before proceeding. Tests can be repeated multiple times.

Statistical tracking: A later innovation. Student's progress can be tracked statistically to compare their learning speed on individual units against their overall learning speed. This way if a student is having trouble on a particular unit, intervention can be taken.

Salient Features of Keller Plan

Salient features of PSI, as appeared in his research article published in 1968, titled "Good – bye, teacher" are:

a) **Mastery Oriented:** In PSI the learning outcome of a student is not peer group referencedbut criterion (objectives) referenced. Only when the learner achieves 80 to 90% of the setobjectives he is allowed to move to the next lesson.

b) **Self – pacing:** Here every student is allowed to proceed at his own speed.

c) **Supplementary – Aids:** Students are motivated by the few lectures, given by the teacher at the beginning of the semester. These lectures are supplemented by films, T.V, and radio programmes, film strips, demonstrations etc.

d) **Printed Study Guides:** To make the learning easier, printed study guides are given, which contain the learning objectives, method of learning, Model Questions, and reference books.

e) **Use of peer – proctors in Tutorials:** Peer – Proctors are employed to help the students personally during their learning, as well as informing them oftheir level of mastery by periodical evaluation.

Advantages of Keller Plan

- It can help the learners to work independently
- Students can learn at his own pace
- It helps to increase self learning habits

- Increase positive attitude towards learning

Limitation of Keller Plan

- This method is very difficult to the teacher for preparing study guide and material

- Students show tendency to post pone learning because there is no compulsion

- Lack of course material, resources guide, test materials etc.

- Proctors are not easily available in the present teaching learning environment of theschool

4.2.5 Project Method

Project Method is of American origin and is an outcome of Dewey's philosophy of pragmatism. However, this method is developed and applied practically by Dr. Kilpatrick. The advocates of project method believe that different branches of knowledge are different aspects ofone whole and they are studied separately for the sake of convenience. Moreover the exponentsof the method contend that knowledge turns into power only through application.

The term project has been defined differently by different educationists. A few definitions have been given below.

Project is defined in Oxford's Advanced. Learner's Dictionary as a 'Plan of action'. It usually involves a task or problem, calling for constructive thought, or action or both. According to Dr. Kilpatrick 'A project is a unit of wholehearted purposeful activity carried on preferably in its natural setting'.

In the opinion of **J.A. Stevenson** "A project is a problematic act carried tocompletion in its most natural setting".

Ballard defined project 'as a bit of real life that has been imported into the school".

All the definitions stated above emphasize that project should be a purposeful activity related to life and it should be carried out in a natural environment. In project method, teaching and learning are considered from the child's point of view and in this method knowledge and skills are learnt by pupils through practical handling of problem in their natural setting. This method is an ideal way of promoting creativity, arousing curiosity and inculcating the spirit of enquiry among the students. However, in this method teaching is more or less incidental.

Basic Principles of Project Method

Psychological Principles of Learning

The project method is based on thepsychological principles of learning namely.

 i. Learning by doing

 ii. Leaming by living

 iii. Children learn better through association, cooperation and activity.

Psychological Laws of Learning

The project method is based on the psychological laws of learning namely,

•   Proctors are not easily available in the present teaching learning environment of the school

4.3.5   Project Method

Project Method is of American origin and is an outcome of Dewey's philosophy of pragmatism. However, this method is developed and applied practically by Dr. Kilpatrick. The advocates of project method believe that different branches of knowledge are different aspects of one whole and they are studied separately for the sake of convenience. Moreover the exponents of the method contend that knowledge turns into power only through application.

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Psychological Laws of Learning

The project method is based on the psychological laws of learning namely,

i. Law of readiness ii.Law of exercise

iii. Law of effect

Principle of Activity

Activity is a significant feature of this method. Children select, plan, execute and evaluate their projects themselves.

Principle of Social Experience

The project is selected from real life situations and every project should be a social experience for the children.iii. Law of effect

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Principle of Reality

The project cannot be motivating and interesting for the learner unless it isnatural and real from the learner's point of view.

Principle of Utility

Knowledge is meaningful and worthwhile if it is practicable and useful

Principles of Motivation

The selected project should be purposeful and therefore motivating for thelearner, Purpose and goal make the project meaningful and significant.

Steps involved in Project Method

- Project method involves the following steps
- Providing a situation
- Selecting and purposing of the project
- Planning of the project
- Executing the project
- Evaluating the project
- Recording

Providing a situation

The project should arise out of the felt needs of the students. The teacher should provide such situations to students which may arouse some suitable questions to which the students seek answer. It should look important, must be interesting, and purpose for the students. The teacher can provide a variety of situations through discussion, questioning, library work, field work etc.

Selecting and purposing

The selection of the project is done by the students themselves. The teacher should refrain from purposing any project; otherwise the whole purpose of the method would be defeated. However, the teacher can guide the students in the selection of a good project, keeping in mind the interest, aptitude and ability of the students. In this step the nature and goal of the project is clearly determined as well as the limits and scope of the project is clearly defined.

Planning

Planning involves the selection of the most appropriate and feasible set of activities to be executed. The students should choose the most practical plan of action. The students themselves should do the planning with the teacher as a guide. While planning, the points to

be taken into consideration are: (i) the nature and scope of the project (ii) the degree of complexity of project

iii) time allotted to finish the project and (iv) and availability of material resources. Discussion may be held among students before the final draft of the plan is agreed upon.

Execution

In this step the teacher helps the students in assigning work to different students in accordance with their interest, aptitude and capabilities. Each member of the group should be actively involved in the execution of the project. The teacher should carefully supervise and guide the students in the execution of the project as per the proposed action plan.

Evaluation

The students along with the teacher should review the progress of the project at frequent intervals. This is to ensure that the students are progressing towards the realisation of the objectives of the project. Without evaluation, the project can move out of focus. The evaluation of the project has to be done in the light of (i) proposed plan (ii) difficulties in the execution and iii) achieved results.

Recording

The students are required to maintain a complete record of work including the choice of the project, the planning, the discussions held and duties assigned. Also reference and books consulted and readings taken, difficulties faced, guidance sought, details of places visited and surveyed and so on should be carefully recorded.

Criteria of a Good Project

A good project can be assessed using the following criteria.

☐ The project should be purposeful, useful, and practically applicable to the dailylife of the students, with clear, well defined objectives.

☐ The project should help in providing useful and meaningful learning experiencesto each member of the group.

☐ The project should be within the reach of the students in accordance with theirinterest and ability levels.

☐ The project should be feasible in terms of the availability of human and materialresources and time limit.

- The level of complexity of the project should match the ability level of the students.
- The learning activities of the project should be life-like, purposeful and natural.

Role of the Teacher

The teacher should assume the following role while following project method.

- Help students in planning and allotting activities to each member according to the nature of abilities.
- Help in creating a friendly and democratic atmosphere in the classroom promoting operation and harmony.
- Guide students in selecting the project according to their interest, aptitude and ability.
- Be available to the students and willing to help as and when it is necessary.
- Supervise and check whether the project is running in time as planned.
- Suggest extra resources, if necessary, for the successful execution of the project
- Check the records maintained by the students
- Help in the periodic assessment of the progress of the project.

Merits of Project Method

- It is based on sound psychological principles and laws of teaching.
- It provides scope for independent work and individual development
- It promotes habits of critical thinking and encourages the students to adopt problem solving methods.
- It provides for individual differences as the students can select the activity and work at their own pace.
- It promotes social interaction, inculcates spirit of co-operation and exchanges of experiences among the students.
- It encourages practical applications of the subject, making the subject functional and meaningful to the learner.
- It provides opportunities for children to acquire a lot of skills – observation, reference, interpretation and so on. .
- In this method the children are active participants in the learning task.
- It develops self-confidence and self-discipline among the students.
- It upholds the dignity of labor.
- It widens the mental horizon of the students.
- It makes the learning more interesting and facilitates better understanding of the subject

matter as the learning is related to reality and the world around him.

Demerits of Project Method

☐ The project method is uneconomical in terms of time and is not possible to fit intothe regular timetable.

☐ It does not provide any training in mathematical thinking and reasoning

☐ The learning is incomplete and uniform learning or balanced learning is notpossible for all students as each student performs a different activity.

☐ Textbooks and instructional materials are hardly available.

☐ For the success of this method the teachers should be exceptionally resourcefuland gifted and knowledgeable

☐ It is an expensive method as it makes use of a lot of resources which are not immediately available in the school.

☐ Syllabus cannot be completed on time using this method.

☐ Teaching is disorganized.

4.2.6 Activity Based Learning Method

Activity based learning is a natural extension of the constructivist and situated approaches to learning and its essence is to actively engage learners in authentic learning activities and to put learners in the kinds of situations in which they need to use those skills.

Activity-based learning utilizes backward design, whereby the instructor begins the design by articulating the desired outcomes is terms of knowledge, attitude and skill, and then designsthe learning activities.

Activity based learning engages the student in the process of constructing his own learning rather than passively receiving information which may or may not have meaning for him. And the best part is - it's fun for both children and teachers.

The process of ABL Approach

The process of ABL approach has the following steps:

- Competencies are split into different parts/units and converted into different activities.
- Each part/unit is called a milestone.

- In each subject, the relevant milestones are clustered and linked as chain and this chain ofmilestones is called a "ladder".
- Each milestone has different steps of learning process and each step of learning process isrepresented by a logo.
- Milestones are arranged in a logical sequence from simple to complex and also activities ineach milestone.
- To enable the children to organize in group, group cards are used.
- Evaluation is inbuilt in the system. Separate cards activities are used for this purpose.
- Each child is provided with workbook/worksheet for further reinforcement activities,
- Children's progress is recorded through annual assessment chart.
- Each milestone has different type of activities such as introduction, reinforcement, practice,evaluation, remedial and enrichment activities represented by different logos.

Groups in ABL Method

Children of the class will sit in six groups as following.

Group 1 :Group responsible for preparation of teaching – learning activities – incharge of teacher

Group 2:Partly manageable by the teacher

Group 3:Fully manageable by the peer group

Group 4:Partly manageable by the peer group

Group 5:Individually learn by themselves

Benefits of ABL approach

- Children learn at their own pace.
- Provision of more time for self-directed learning and teacher-directed learning is reducedconsiderably.
- Group learning, mutual learning and self-learning are promoted.
- Teachers teaching time is judiciously distributed among children. Only needed children areaddressed by teachers.
- Children's participation in every step is ensured in the process of learning.
- Evaluation is inbuilt in the system; it is done without the child knowing it.
- Rote learning is discouraged and almost no scope for rote learning.

- Periodical absence of child from school is properly addressed.
- Classroom transaction is based on child's needs and interests.
- Freedom to child in learning as he chooses his activity.
- Multigrade and multilevel in learning is effectively addressed.
- No child can to the next higher step of learning unless he attains the previous one.
- Sense of achievement boosts child's confidence and morale.
- Attractive cards and activity create interest among children.
- Scope for child's development in creative and communicative skills.
- Children will have a feel of security as they sit in rounds in the groups.
- Children are allowed to move in the classroom as they choose their activity.

Demerits of ABL Method

- Teachers work load increases
- If the number of students in the class is more than class discipline fails
- Learning affected by a teacher who took frequent leave
- Evaluation of learning is difficult
- Since we are teaching only minimum skills which are required, we are not competent withprivate schools.

4.2.7 Active Learning Method

"Active learning shifts the focus from the teacher to the student and from delivery of subject content by teacher to active engagement with the material by the student. Through appropriate inputs from the teacher, students learn and practice how to apprehend knowledge anduse them meaningfully".

Active learning "derives from two basic assumptions:

1. That learning is by nature an active Endeavour and
2. That different people learn indifferent ways".(Meyers and Jones, 1993)

The quality of teaching and learning is improved when students have enough opportunities to clarify, question, apply and consolidate new knowledge. There are many teaching strategies that can be employed to actively engage students in the learning process. Some of these are group discussions,problem solving, case studies, role plays, journal writing and structured learning groups.

The benefits of using such activities include improved critical thinking skills, increased

retention and absorption of new information, increased motivation and improved interpersonal skills.

Research also indicates that by re-organizing or adopting the ways they present material to students, instructors can create environment in which knowledge retention is significantly increased; of course, such situations require the cooperation of the students themselves. One of the best methods is to implement so called active learning.

Active learning is involving students direct and actively in the learning process itself. This means that instead of simply receiving information verbally and visually, students are receiving, participating and doing.

Objectives of Active learning

- Engaging students in doing something other than listening to a lecture and taking notes.
- Students may be involved in talking and listening to one another, or writing, reading and reflecting individually or in small groups.

Merits of Active learning:

- Students are involved in more than listening,
- less emphasis is placed on transmitting information and
- greater emphasis on developing students' skills,
- students are involved in higher-order thinking (analysis, synthesis, evaluation),
- students are engaged in activities (e.g., reading, discussing, writing), and
- greater emphasis is placed on students' exploration of their own attitudes and values.

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Format of Typical Lesson Plan based on ALM TIGER method

T – Teacher as a facilitator

 I – Individual Work

G – Group work

E – Evaluation

R – Reinforcement

The following steps are involved in TIGER method

Introduction (10 min)	Evocation Recallsurvey
Understanding (40 min)	Concept Teacher solving problems Individual solving problems
Group work (30 min)	Concept Teacher solving problems Individual solving problems
Evaluation (10 min)	ReinforcementHome work Remedial measures

4.2.8 Mind Map

Mind mapping is a learning technique which uses a non – linear approach to learning thatforces the learner to think and explore concepts using visual spatial relationships flowing from the central theme to peripheral branches which can be inter – related.

A good Mind Map shows the "shape" of the subject, the relative importance of individualpoints, and the ways in which facts relate to one another. Research shows that this is of particularbenefit when dealing with complex information.Mind mapping can also help you to break down large projects or topics into manageable chunks, so that we can plan effectively without getting overwhelmed and without forgetting something important.

Procedure to prepare Mind Map

According to **Buzan and Buzan**, a mind map should be drawn on blank paper that is larger than standard 81/2 by 11 inch paper. The rationale behind using a large sheet of paper is that it allows the student the opportunity to break away from the boundaries established by standard sized paper. The medium for drawing the mind map is usually colored pens or pencils. Students begin by drawing an image in the center of the paper that reflects the central theme, or topic, of the mind map which is to be created. By placing this central image in the center of the paper it allows the student 360 degrees of freedom to develop their mind map. Next, the student draws main branches with key words extending from this central image. The branches represent different categories which the student perceives as being relevant to the content of the key concept of mind map. From these main branches, sub – branches are created.

One key tenet of the mind map is that each of the branches and sub – branches should contain pictures to aid in recalling the information. This sub – branches of key words or pictures can be linked together resulting in the integration of different parts of the mind map.

Recently, many on – line computer versions of mind mapping have emerged such as mindMap (Tony Buzan), MindMeister (MindMeister Labs), Visio (Microsoft), and MindNode (MindNode Software).

Uses of Mind Map

Mind Maps are useful for:

 * Brainstorming – individually, and as a group.

 * Summarizing information.

* Taking notes.

* Consolidating information from different sources.

* Thinking through complex problems.

* Presenting information clearly.

* Studying and memorizing information.

Mind Maps are also good for refreshing information in our mind. When we commit the shape and structure of a Mind Map to memory, we can often get the cues we need to remember the information it contains just by glancing quickly at the Map.

Advantages of Mind Map

1. **Engages the mind:** Mind mapping is beneficial because it ignites your mental powers, enabling you to think critically about a core subject matter and how ideas are linked and connected. Mind mapping is an excellent way of developing analytical skills.

2. **Breaks down complex concepts:** Mind maps are great for distilling complex ideas into smaller chunks of information. Because mind maps are keyword – focused and condensed, this helps to simplify concepts and focus on critical points.

3. **Improves memory:** Mind mapping involves identifying a central idea and pinpointing how sub – ideas connect and link to the central idea. These connections are illustrated in a hierarchical non linear manner with the use of visuals and color, which enhances the brain's ability to recollect information.

4. **Boots productivity:** A widely held benefit of mind mapping is that it supercharges and increases productivity, allowing you to make more meaningful use of time. People, who use mind maps for studying, note – taking, project management, and presentations often attest that this tool helps them take full control of tasks and stay highly organized and creative.

5. **Easy to review:** Mind maps are structured in a way that a central topic is connected to several related sub – ideas using branches. This approach makes it easy to scan and get a quick overview of a mind map. Unlike traditional linear note – taking where you have to read line by line, you can easily scan a mind map, identify the central and sub – keywordsto know the focus of a mind map.

Disadvantages of mind maps

1. **Cause confusion:**Mind maps involve identifying meaningful connections between ideas and concepts. A lot of ideas can be generated when mind mapping, and if one does not take charge of the process, this can lead to an unduly large and populated mind map. Reading such poorly

constructed mind maps can be very confusing.

2. **Time consuming:** This usually applies to people who are new to mind mapping. When creating a mind map for the first time, it can take effort and gulp up time when you are brainstorming and trying to come up with associations between ideas. However, overtime as you mind map, you get the hang of things and draw up mind maps in less time.

3. **Space limitation:** This usually applies to mind maps manually drawn on paper. As you try to generate more connections to the central point of a mind map, more branches and sub – branches are created and the map becomes longer. It can take up a whole lot of space if you're using A4 paper and drawing by hand. However, with mind mapping software, you can take charge of the diagram and canvas.

4.2.9 Advanced Active Learning Method

Advanced Active Learning formats are designed to engage a student's critical thinking skills and apply previous and new knowledge to real – life scenarios. They still employ the critical elements associated with active learning " in doing things and thing about the things they are doing (reflection)" with more emphasis on the higher order learning processes. They are processes designed for students to be responsible for their own learning with structured, and open – ended guidance from instructors.

Importance of AALM

Active learning involves student development of critical thinking and problem solving skills. More advanced engaged learning activities that require additional planning by the instructor are case – based learning, team – based learning or problem – based learning. Students continue to fail in their ability to demonstrate complex thinking skills because their educational experiences have provided little support for development of these skills for maximal performance. Multiple teaching styles exist to encourage students to apply critical thinking skills to open – ended problems utilizing multiple points of view

Implementations of AALM

The traditional model of students as passive recipients of learning has been shown to be inadequate to foster a student's understanding and enhance a student's interest. As student's become active learners, faculty becomes active teachers. A teacher's responsibility moves beyond providing a didactic lecture and more towards encouraging students to be more independent after providing a conducive, team – based learning environment.

Case – based learning

Three – part case based learning, or scenario – based story, helps students develop a deeper understanding of the material. The instructor is responsible for creating a complex and engagingscenario or case which parallels the concepts of the lesson. Student may be additionally directed using guided questions however, students will use critical thinking skills to dissect the scenario while communicating a collaborating as a group. Using this technique, students are presented with real –life scenarios that are multi – faceted. Though these are often clinical scenarios, case based learning can be used in basic science courses to portray foundational knowledge that is applicable to clinical practice adding relevance to the material.

Team – based learning (TBL)

This approach utilizes student – student interaction in small teams to develop critical, practical, and creative teaching in their courses. Students assume the role of being inquires and faculty burnout is decreased with increased student responsibility and student engagement. Key characteristics of TBL include the creation of heterogeneous work groups, a readiness process to ensure content knowledge, and small group activities. The team based learning module is especially appropriate in larger class sizes by allowing the class to function as multiple small classes.

Problem – based learning (PBL)

In this approach, a students learning is facilitated by an instructor presented problem. Students will work through this carefully constructed, open – ended problem by engaging and applying new knowledge. The success of PBL independent on several factors: problems should allow for free inquiry, collaboration is encouraged and essential, and feedback in the form of reflection on their learning should be provided. The premise of PBL resides in the students to apply previous knowledge to new situation.

4.3 Conclusion

Method deals with the "How the children will learn effectively, depends on the method the teacher adopts?", "how to impart mathematical knowledge?" and "How to enable the children learn computer science?" are the questions to be discussed in this unit. Methods are way or mode to understand and practice the art of teaching. Therefore the process of imparting the worldof knowledge to students mind is called the method of teaching. It is a just a way to teach. Generally, children like that method which makes the subject matter more clear and easily understandable.