CHAPTER III

THEORETICAL CONSTRUCTS OF MODELS OF TEACHING

3.1 Models of Teaching

3.1.1 Concepts for Describing a Model

3.1.2 Concept Attainment Model

3.1.3 Inquiry Training Model

3.1.4 Advance Organizer Model
MODELS OF TEACHING

Theories of learning and development have some implications in the classroom teaching. A teacher can always act upon these theories for teaching children in the classroom. But these theories are sometimes inadequate for the development of a theory of teaching and maximising learning on the part of pupils. Further it is mentioned that theories of learning and development are descriptive in nature. A theory of teaching, on the other hand is prescriptive. It is prescriptive in the sense that it sets forth rules concerning the most effective ways of helping children to achieve knowledge skills etc. A theory also provides a yardstick for evaluating any particular way of teaching. A theory of teaching must attempt to set forth the best means of maximising learning on the part of children. Theories of learning describe the process of learning. A theory of teaching, on the other hand sets forth the rules for improving pupil’s learning.

The said description regarding need for a theory of teaching does not imply that theories of learning and development are irrelevant to a theory of teaching. Both of them are closely related. A theory of teaching cannot however, be treated just as a mirror image of the theories of learning. But it needs to be congruent with those theories of learning and development to which it subscribes.

A number of instructional strategies to realise different instructional goals have been developed recently by different researchers. The work done by Joyce and Weil (1980) is monumental in this area. They have transformed existing knowledge in the learning and teaching processes into ‘Models of Teaching’ which can be used by teachers in the teaching-learning process for realising different instructional objectives. There is a need to incorporate a few ‘Models of Teaching’ in the curriculum of teacher education programme.
at the secondary as well as elementary level so that prospective teachers attain a higher degree of 'ability to teach'.

Over the years, a large number of learning theories have been developed by educationists and psychologists. Such theories of learning alone do not suffice the purpose. Hence based on these theories, researchers have developed a number of teaching strategies to realise specific instructional goals. These teaching strategies show that there is no single best way to teach everything, but different strategies are required to realise different instructional goals. These prescriptive teaching strategies which help to realise specific instruction goals are known as 'Models of Teaching'.

Bruce Joyce and Marsha Weil describe a Model of Teaching as a plan or pattern that can be used to shape curricula, to design instructional materials and to guide instruction in the classroom and other settings. "Models of Teaching are really models of learning. As we helps students acquire information ideas skills, values, ways of thinking, and means of expressing themselves, we are also teaching them how to learn. In fact the most important long term outcome of instruction may be the students' increased capabilities to learn more easily and effectively in the future, both because of the knowledge and skills they have acquired and because they have mastered learning processes (Joyce and Weil, 1997:7)"

Models of Teaching are designed for specific purposes—the teaching of information concepts, ways of thinking, the study of social values and so on—by asking students to engage in particular cognitive and social tasks. Some models centre on delivery by the instructor while others develop as the learners respond to tasks and the student is regarded as a partner in the educational enterprise. However all mature Models emphasize how to help students learn to construct knowledge—learning how to learn including learning from the sources that are often stereotyped as passive, such as learning from lectures,
films, reading assignments, and such. "Quite a number of Models of Teaching are designed to increase students' ability to process information more powerfully. These include methods for presenting information, so that students can learn and retain it more effectively by operating on it more conceptually, systems that assist memorization and teach students to collect and organize information conceptually, and ones to teach students to use the methods of disciplines, to engage in causal reasoning and to master concepts" (Joyce and Weil, 1997:39).

Eggen, Kauchar and Harder (1979) have discussed six Information Processing Models - General Inductive Model, Concept Attainment Model, Taba Model, General Deductive Model, Ausubel's Model and Suchman's Inquiry Model.

The most comprehensive review of teaching models is that of Joyce and Weil (1980) who have identified 23 models which are classified into four basic families based on the nature, distinctive characteristics and effects of the models. These four families are:

1. Information Processing Models
2. Personal Models
3. Social Interaction Models and

Within the families, there are specific models which are designed to serve particular purposes.

I. Information Processing Models

These models focus on intellectual capacity. They are concerned with the ability of the learner to observe, organize data, understand information, form concepts, employ verbal and nonverbal symbols and solve problems. The primary purposes are:
1. The mastery of methods of inquiry
2. The mastery of academic concepts and facts
3. The development of general intellectual skills such as the ability to reason and think more logically

The models which belong to this family are:

a. The Concept Attainment Model
b. Taba Inductive Thinking Model
c. Inquiry Training Model
d. The Advance Organiser Model
e. The Memory Model
f. Cognitive Growth Model
g. Biological Science Inquiry Model

II. Personal Models

Models which belong to this family deal with the individual and the development of selfhood. The emphasis of these models is on developing an individual into an integrated, confident and competent personality. They attempt to help students understand themselves and their goals, and to develop the means for educating themselves. Many of the personal models of teaching have been developed by counsellors, therapists and other persons interested in stimulating individual's creativity and self expression.

The primary goals are:

- to increase the student's self worth,
- to help students understand themselves more fully,
- to help students recognise their emotions and become more aware of the way emotions effect other aspects of their behaviour,
to help them develop goals for learning,
to help students develop plans for increasing their competence,
to increase the students' creativity and playfulness,
to increase the students' openness to new experience.

The models which belong to this family are:

a. Non-Directive Teaching Model,
b. Synetics Model,
c. Awareness Training Model,
d. Classroom Meeting Model.

III. Social Interaction Models

The models in this family emphasise the relationships of the individual to the society or other persons. The core objective is to help students learn to work together, to identify and solve problems, either academic or social in nature.

The primary goals are:

to help students work together to identify and solve problems
to develop skills to human relations, and
to become aware of personal and social values.

The models which belong to this family are:

a. Group Investigation Model,
b. Role Playing Model,
c. Jurisprudential Inquiry Model,
d. Laboratory Training Model,
e. Social Simulation Model,
f. Social Inquiry Model.
IV. Behaviour Modification Model

All the models in this family share a common theoretical base, a body of knowledge which referred to as behaviour theory. The common thrust of these models is the emphasis on changing the visible behaviour of the learner.

The models which belong to this family are:

a. Contingency Management Model
b. Self Control Model
c. Training Model
d. Stress Reduction Model
e. Desensitization Model
f. Assertiveness Training Model

3.1.1 Concepts for Describing a Model

The models developed by Joyce and Weil (1980) have a definite structure. The operation of each model is described within this structure. The four aspects of this common structure are: Syntax, the Social System, Principles of Reaction and Effects of the Model.

3.1.1.1 Syntax (Phases or Steps) of the model describes the model in action. It is the systematic sequence of the activities in the model. Each model has a distinct flow of phases.

3.1.1.2 The Social System describes the role of and relationships between the teacher and the pupils. In some models the teacher has a dominant role to play. In some the activity is centred around the pupils, and in some other models the activity is equally distributed.
3.1.1.3 Principles of Reaction tell the teacher how to regard the learner and to respond to what the learner does. They provide the teacher with rules of thumb by which to select model, appropriate responses to what the student does.

3.1.1.4 Support System describes the supporting conditions required to implement the model. ‘Support’ refers to additional requirements beyond the usual human skills, capacities and technical facilities. This includes books, films, laboratory kits, reference materials etc.

3.1.1.5 Effects of the Model: Each model results in two types of effects Instructional and Nurturant.

Instructional effects are the direct effects of the model which result from the content and skills on which the activities are based.

Nurturant effects are those which are implicit in the learning environment. They are the indirect effects of the model.

Every teacher faces a wide variety of problems in the classrooms. An effective teacher can apply these models resourcefully and creatively so as to solve the problems. The Models of Teaching give ample opportunities to the teacher to adapt them to suit the classroom requirement. Only creative, flexible and resourceful teachers will achieve the maximum benefit from the Models of Teaching.

3.1.2 CONCEPT ATTAINMENT MODEL

Family: Information Processing Models.
Major Theorist: Jerome Bruner.

Helping children learn concepts efficiently is a fundamental purpose of schooling. However most educators did not consciously distinguish the learning of
concepts from other types of learning. Today researchers have dwelled in to the meaning of concepts, the process of acquiring them and conditions that facilitate effective learning of concepts. The work of Jerome Bruner (1956) in this area is noteworthy. His method of concept attainment has been shaped into a model of teaching by Bruce Joyce and Marsha Weil (1980). There are three variations of the Concept Attainment Model (CAM).

1. Reception Oriented Model,
2. Selection Oriented Model and
3. Unorganised Model of Concept Attainment

**What is a Concept**

Concept is a mental representation or a mental picture of some object or experience. It represents a category of objects which share common properties. According to Archer (1969) a concept is simply the label of a set of things that have something in common. A concept is different from a fact, a principle and generalisation.

**Elements of a Concept**

Each concept has a set of elements. A concept is attained when all the elements of the concept are correctly identified and learnt. The following are the elements of a concept.

1. **Name** is the term or label given to a category. Fruit, Apple, Square are all names given to a range of objects, configurations etc.

2. **Attributes** The features characteristics of objects are called attributes. Every concept has two types of attributes.

   a. Essential Attributes are the common features or characteristics of the concepts. These attributes should be present in all the examples of the concept.
b. Non-Essential Attributes, some of the slight differences among examples of a category reflect the non-essential attributes.

3. Examples Most of the concepts have more than one example. Examples of a concept have all the essential attributes of the concept present in them. The non-essential attributes are present in some examples and absent in others. Bruner refers to those examples which contain all the essential attributes in them as positive exemplars. The absence of one or more essential attributes makes an instance a negative exemplar of the concept. In concept formation, examples of a concept are grouped together, in concept attainment the positive and negative examples are tested and searched for their features. The positive exemplars represent what the concept is. By arranging the exemplars sequentially, the students can reach a conclusion of what the concept is.

4. Definition : The last element of a concept is the rule. A rule or definition is a statement specialising the attributes of a concept. It is a device for summarising the findings of the search for attributes. A correct rule or statement merely reflects successful utilisation of the other elements of a concept - positive and negative examples, and essential and non-essential attributes.

When a learner can

identify the positive examples of a concept from the negative examples on the basis of essential attributes.

distinguish between the essential and non-essential attributes in the positive examples of the concept and define the concept in terms of its attributes we say that the learner has attained the concept.

Concept learning involves double discrimination

1. discrimination of relevant (essential) characteristics of positive examples from the relevant (essential) characteristics of negative examples.
2. discrimination of relevant (essential) attributes from the irrelevant (non-essential) attributes of the positive examples.

Modality of the Exemplars

"Modality refers to two features - the medium and size of the exemplars. There are three basic types of media-objects, pictures (still or motion) and words or symbols. The choice of media can facilitate or hinder the concept attainment process. Selection of medium depends on the concept and its attributes. Size refers to the complexity of the unit of the exemplar. According to developmental psychology modality of learning should be concrete at the beginning state, advanced as still or motion pictures and gets on the more advanced stage as symbolic material" (Weil and Joyce, 1978: 118)

Types of Concepts

Bruner identified three types of concepts: Conjunctive, disjunctive and relational. "Conjunctive concepts are defined by the joint presence of several attributes. Disjunctive concepts require the presence of some attributes and the absence of others. Relational Concepts have several attributes but these bear some kind of relationship to one another" (Weil and Joyce, 1978: 53-54)

Variations in CAM

There are three variations or models in concept attainment, that have been built from the basic study of Bruner and his colleagues. Each has a slightly different syntax but all are developed from a common conceptual base.

1. Reception Oriented CAM

In this model, the students are more receptive than active. The teacher has a more dominant role, acts as a recorder, keeping track of the hypotheses and supplies
additional examples. This model is more direct in teaching students the elements of a concept and their use in concept attainment.

2. Selection Oriented CAM

This model places responsibility of concept attainment and attribute tracking in the hands of the students. An example is not labelled until the student asks whether it is a ‘Yes’ or ‘No’. Student controls the sequence of the examples. The tracking and analysis of attributes is not as formal in this model as in reception model. This model leads to a quicker attainment of the concept.

3. Unorganized Materials Model

This model is much more a group discussion than an instructional game, like the reception and selection strategies. The teachers’ role is to facilitate discussion and ensure that it focuses on the development of a concept in the material.

The Syntax of the Model

As said earlier although there are three variations of the Concept Attainment Model, only two variations viz., ‘Reception Oriented - CAM’ and ‘Selection Oriented - CAM’ are discussed in this section. The reception model is more direct in teaching students the elements of a concept and their use in concept attainment. The selection model permits students to apply this awareness of conceptual activity in a more active context, one that permits their own initiation and control.

Syntax of the Reception Model of Concept Attainment

There are three phases in the reception model of concept attainment. The activities in each phase are as follows: (Bruce Joyce and Marsha Weil, 1997:173)
Phase one:

Presentation of Data and Identification of Concept

Teacher presents labelled examples
Students compare attributes in positive, negative examples
Students generate and test hypothesis
Students state a definition according to the essential attributes

Phase two:

Testing Attainment of the Concept.

Students identify additional unlabelled examples as Yes or No.
Teacher confirms hypothesis, names concept and restates definition according to essential attributes
Students generate examples.

Phase three:

Analysis of Thinking Strategies.

Students describe thoughts
Students discuss role of hypothesis and attributes
Students discuss type and number of hypotheses.

In the first phase of the reception model, the teacher presents positive and negative examples in the pre-determined sequence. This data may be in the form of pictures, anecdotes, sketches, diagrams, events or any other illustrations.

The pupils are told that there is one idea in common in all the positive examples and that they have to compare and justify the attributes and form some hypothesis about the concept.

When the pupils have analysed the examples and hypothesised, the teacher asks the students to state a definition according to the essential attribute.
In phase two, the teacher presents unlabelled examples. The students identify them as positive or negative. The teacher asks for reasons and confirms their hypothesis. When she knows that the students have attained the concept, she names the concept. She does not ask the students to name it because they are not familiar with the name of the concept. Only when the students have already attained the concept (Prior to the CAM lesson) and the teacher uses the model for concept clarification she may ask the students to name the concept.

To test the attainment of the concept further, the teacher asks the pupils to generate examples and label them as positive and negative instances of the concept.

In the third phase of the model the teacher analyses the thinking strategies employed by the students. The students report their pattern of hypothesizing, whether they focussed on attributes or concepts, whether they did so one at a time or several at once, and how they changed their hypotheses when it was not confirmed.

**Thinking Strategies**

In the reception oriented model, mainly two kinds of thinking strategies are used - wholist and partist.

The wholist strategy is to take the first positive instance of the concept as a whole i.e., comparing all the attributes of the first positive instance to those subsequent instances and modify the hypotheses and subsequent decision depends on the attributes similarity and difference between the first positive instance and the subsequent ones.

In the partist strategy the choice of a hypothesis is based on only part of the initial example. If the initial hypothesis is not confirmed then the partist refers back to all prior instances and chooses another hypothesis. Thus a partist begins with the part of the instance maintains the hypothesis till the positive and negative instances confirm.
changes hypothesis with positive information and chooses hypothesis not
previously made.

Syntax of the Selection Model of Concept Attainment

Phase 1 Presentation of Data and Identification of Attributes

Teacher presents unlabelled examples

Students inquire which examples are positive, based on the first positive
instance given by the teacher

Students generate and test hypothesis

Phase 2 Testing Attainment of the Concept

Students identify additional unlabelled examples

Students generate examples

Teacher confirms hypothesis, names concept and restates definition
according to essential attributes.

Phase 3 Analysis of Thinking Strategy

Students describe thoughts

Students discuss the role of hypothesis and attributes

Students discuss type and number of hypothesis

Teacher evaluates the strategies.

The procedure under selection strategy begins with the presentation of all
the instances representing the various combinations of attributes of a concept. The student
is then told by the teacher that some of the examples presented before him illustrate the
concept in the mind and the others do not. The teacher begins by showing them an
instance that illustrates the concept (a positive example). The pupils' task is to select an example from those presented to them, test them one at a time against the first positive example and label them as positive or negative examples of the concept in the teachers' mind. The pupils may select the examples in any order they choose but one at a time. The pupils thus generate hypotheses, test them and arrive at the definition of the concept.

The second and third phase of the selection model are the same as that of the reception model. Only in the third phase while analysing the thinking strategies the teacher keeps in mind the selection thinking strategies.

Thinking Strategies

According to Bruner and his associates there are four strategies used in selection oriented CAM:

1. Simultaneous Scanning
2. Successive Scanning
3. Conservative Focussing
4. Focus Gambiling

The major differences among them are:
1. in the use of either attributes or concept hypotheses as a basis of searching
2. in the number of attributes or concept hypotheses held at one time.

A Simultaneous Scanner hypothesizes more than one concept with the first instance and his choice of next instance to test will be determined by the elimination of as many hypothetical concepts as possible instance chosen.

A Successive Scanner forms a concept hypothesis from the given positive instance and then tests it against other examples. The disadvantage here is that there is no assurance of giving maximum information possible. The advantage is the relief from
cognitive strain as limited inference is required. The only strain is on memory to keep track of the hypothesis that have been tested and which require further testing.

A student with the Conservative Focussing strategy finds a positive instance and chooses instances that alter one attribute at a time. By choosing a particular instance as focus the person decreases the complexity and abstractness of the task of keeping of information he has encountered. Hence there is relatively more cognitive economy.

In the Focus Gambling strategy one uses a positive instance as a focus and changes more than one attribute at a time. The strategy makes use of fewer test choices. But there may be equal chances of requiring more test choices and therefore the name focus gambling. There is more risk involved.

Social System

The model has a moderate structure. The teacher assumes a major role initially in choosing the concept, selecting and organising or sequencing data. The teacher controls action but with subsequent phases student interaction is encouraged. In the reception oriented model, the structure moves from high to moderate. In the selection oriented model it is relatively structured with students assuming more initiative for inductive process.

Principles of Reaction

The model emphasises teacher support during the flow of the lesson with due regard to hypothetical nature of discussion. Pupils should be helped in creating a dialogue in which students test their hypotheses against each other. The teacher should focus pupils' attention on specific features of examples and finally assist the pupils in discussing and evaluating their thinking strategies. The teacher should encourage analysis of the merits of various strategies rather than attempting to seek the one best strategy for
all people in all situations.

Support System

Well organised reference material is the most essential support required for this model. Carefully selected and organised materials and data in the form of discrete units easily serve as examples.

Effects of the Model

The Concept Attainment Model accomplishes several instructional goals depending on the emphasis of the particular lesson.

Understanding the nature of concepts, specific concepts, improved concept building strategies and inductive reasoning ability etc. are the instructional effects of the model.

The nurturant effects come from experiencing the environment created by the model. These effects are sensitivity to logical reasoning in communication, tolerance of ambiguity (but appreciation of logic) and awareness of alternative perspectives.
Nature of the Concept

Improved Concept Building Strategies

Specific Concepts

Inductive Reasoning

Awareness of Alternative Perspective

Tolerance of Ambiguity

Sensitivity to Logical Reasoning in Communication
### 3.1.3 INQUIRY TRAINING MODEL

**Family:** Information Processing Models  
**Major Theorist:** Richard Suchman

In this model, the students are actively involved in finding solution to problems and thus this teaching strategy is classified as an Inquiry Model.

The Inquiry Model has a number of steps which include:
1) identification of a problem.
2) hypothesising a possible solution to the problem.
3) gathering data to test hypothesis.
4) revising the hypothesis and
5) repeating steps three and four until a hypothesis which accounts for all the data is found.
The most important feature is that in this model the problem is posed by the teacher and is carefully designed to motivate the student. The questions should be posed in such a way that they can be answered ‘Yes’ or ‘No’. This rule has two plus points: “it requires more precise thinking on the part of students, and it prevents them from putting the burden of thinking on the teacher through openended questions”. (Weil and Joyce, 1978 : 132) Such man model is more process oriented.

The general goal of inquiry training is to help students develop the intellectual discipline and skills necessary to raise questions and search out answers stemming from their curiosity.

Planning for Activities

Identification of goals appropriate for inquiry activities is the first process. There is a close interaction between content and process in Suchman Model. When the students are forming an explanation, which is the content goal, they are developing their process skills.

Inquiry training begins with a puzzling situation and the students are motivated to pursue meaning it. The understanding assumption of the model is that individuals, when puzzled, need to explore the data surrounding the puzzle and put these data together in new ways.

Like Bruner, Ausubel and Taba, Suchman believes that students can become more and more conscious of the process of inquiry.

After identifying the goals, the next task is to develop a problem which will be the focal point of activity. The teacher has to consider many things while designing problems. First, the event must pose a problem to the students which they can focus upon data gathering and hypothesis testing. Second is, that of student motivation. When
problems are structured they become motivated. They become curious and this curiosity creates added interest in finding an explanation to the problem.

The more discrepant a problem is, the more motivating it may be. But, any event that requires an explanation serves as a starting point. The event must focus the student on a particular problem rather than a set of problems.

**Implementing Suchman Inquiry Activities**

The Inquiry Training Model as shaped by Joyce and Weil has a definite syntax. There are five phases in an inquiry activity.

**Phase I**: Encounter with the Problem.
- explain inquiry procedure
- present discrepant event

**Phase II**: Data Gathering - Varification
- verify the nature of objects, events
- time and properties

**Phase III**: Data Gathering - Experimentation
- isolate relevant variables.
- hypothesis and test
- find causal relationships

**Phase IV**: Formulation of an Explanation
- Simple linear causation
- theory of properties
- analogy
- application
Phase V: Analysis of the Inquiry Process

Recapitulation of the steps of the model analysis of the strategies of inquiry.

During the first phase of the model, the teacher explains the inquiry procedures in brief and presents the discrepant event. The teacher explains the inquiry procedure and the rules of the game. As the students are exposed to a number of inquiry sessions, this step is omitted.

The following rules have been formulated by Weil and Joyce (1978)

1. Questions which are asked to verify the data should be framed in such a way that they can elicit ‘Yes’ or ‘No’ answer from teacher.

2. Questions should be specific and to the point. There should be no double baralled questions. Only one question should be asked at a time.

3. To test a guess or hypothesis experimentation questions which elicit ‘Yes’ or ‘No’ answers should be used.

4. Questions which theories or imply an explanation to the problem should not be asked.

The inquiry session actually begins with the presentation of a discrepant event. The distinguishing feature of discrepancy is that it involves an illogical phenomenon, that conflicts with the notions of reality. Anything that is mysterious unexpected or unknown suits for a discrepant event. Suchman believes that individuals have a natural tendency to inquire. Hence he deliberately selects episodes that have sufficiently suprising outcome to make it difficult to encounter. The learners cannot remain indifferent to the encounter. The learners cannot dismiss the solutions as obvious. They have to work to explain the situation and the product of that work may be a new insight into the phenomenon, new concepts, new theories.
When students have noted the discrepancy in the puzzling event they proceed to ask questions keeping the rules of the game in mind. This is the second phase of the model - the data gathering - verification. Verification is the process whereby students gather information about an event they see or experience. Verification questions are those which verify the facts related to the situation - the nature and identity of the subject, the events and conditions surrounding the puzzling event, the property of the object etc. These questions attempt to verify 'what is'.

Four types of questions may be asked by the students to verify the data.
1. Object questions - verify the nature of the objects involved in the problem situation.
2. Event questions - verify the occurrence and nature of an action
3. Condition questions - verify the state of objects or events at a particular time.
4. Property questions - verify the generalised behaviour of the object under specified conditions.

As students become aware of the properties of the data, hypotheses come to their minds which guide further inquiry. This is the third phase of the model which involves experimentation, using the verified data about objects; events conditions and properties. They select new data, reorganise the existing data to see what would happen if things were done differently. Experimentation is usually done verbally through the questions which begin with the clause 'if' or 'suppose'.

The second and third phases of the model require active participation in scientific inquiry both on the part of the teacher and the pupils. The pupil does the inquiry and the teacher guides it. The following points should be kept in mind while guiding pupils to inquire:
1. Ensure that the questions are phrased in such a way so as to elicit Yes/No response
2. Ask pupils to be specific with their questions

3. Direct pupils' inquiry towards object, event condition and property questions

4. Invite experimentation questions

5. Ask the pupils to rephrase the invalid questions

6. Encourage interaction among the pupils

7. Record systematically on the chalk board, the questions of pupils and the teachers' response

8. Provide a free intellectual environment without evaluating pupils' questions

9. Review the questions and responses to help the student to keep track of the process.

After developing several causal relationships and testing them with the help of experimentation questions, students may ultimately arrive at the fourth phase of the model - formulating and explaining the theory. A theory may be built at four different levels.

1. Simple Linear Causation - At this level students state that 'X' causes 'Y'. Where 'X' and 'Y' are related to cause and effect.

2. Theory of Properties - By analysing the generalised property of objects of concern, students build a higher level of theory. In other words, based on the property questions students find an answer why 'X' causes 'Y'.

3. Drawing Analogies - An analogy is a partial likeness or agreement between two things. It is a comparison made with reference to the theory formulated. Drawing analogies helps in better understanding of the theory formulated.

4. Citing Application - The fourth level of theory building is citing applications. How a theory can be applied to different situations is stated by the students. Two types of applications may be cited.
1. Applications which are already known

2. Probable application

    While giving applications students actually think in the lines of scientists and inventors.

    It is quite easy to identify simple linear causation theory during an inquiry training session. By verification and experimentation questions students can easily be guided to find out that 'X' causes 'Y'. However building the theory of properties by finding how and why 'X' causes 'Y' needs a complex approach. Apart from the teacher guiding the pupils to think about properties that are causing this particular relationship, he may need to provide reference material in the form of books, journals, experimental kits etc.

    The Inquiry session ends with the analysis of the Inquiry process, which constitutes the final phase. There are two stages in this phase.

1. Recapitulation of the steps of the model

2. Analysis of the strategies of inquiry

    Recapitulation of the steps is necessary in the first few lessons for the pupils to learn and remember the procedure. When pupils are familiar with the steps of the inquiry, this stage may be omitted.

    The second stage viz; analysis of the inquiry procedure is an important step from the point of view of the development of inquiry strategies among students. During this phase the content or explanation of the discrepant event is not important but the process by which students arrive at the explanation of the event is important. Therefore this model is more process oriented than product oriented. Due to the inclusion of this phase, inquiry becomes a conscious and a systematic process to the inquirer.
This step determines the questions that were most effective, the lines of questioning that were productive and those that were not, or the type of information the students needed and did not obtain. Hence this phase is essential if we are to make the inquiry process a conscious one and systematically try to improve it.

**Principles of Reaction**

The Inquiry Training Model is unique in the sense that the principles of reaction in this model are quite different from those in other Models of Teaching.

The most important reactions of the teacher take place during the second and third phase. The teacher has to help the students to inquire, but not do the inquiry for them. The teacher can if necessary keep the inquiry moving by making new information available to the group and by focussing on particular problem events or by raising questions. During the last phase the teacher's task is to keep the inquiry directed towards the process of investigation itself.

**Social System (Role of the teacher and the students)**

The teacher selects or designs the puzzling situations and presents it to the students. However during the inquiry session teacher and students, both participated as equals. As the students learn the principles of inquiry the teacher guides them to use the resource material and performs experiments and conducts discussions with other students.

**Support System**

The support that can be used in this model comprises a set of confronting materials, a teacher who understands the intellectual process and strategies of inquiry, and other resource material in the form of books, films, self instructional material, maps, diagrams etc. to verify the data, form hypothesis and build the theory of properties.
Instructional and Nurturant effects

The major outcomes of the models are:

development of scientific process skills viz., observing, collecting and
organising data, identifying and controlling variables, making and testing
hypothesis, formulating explanations and drawing inference.

Strategies for creative inquiry.

Besides these effects, the model facilitates spirit of creative inquiry and
logical thinking. It makes the pupils active autonomous learners. They become more
proficient in verbal expression as well as in listening to others. The model also develops
an attitude that all knowledge is tentative.
3.1.4 ADVANCE ORGANIZER MODEL OF TEACHING

Family : Information Processing Models

Major Theorist : David P Ausubel

Theory of AOM

The Advance Organiser Model is built around the work of David P Ausubel's theory of meaningful verbal learning. This theory deals with some concerns like how knowledge is organised, how the mind works to process new information, and how these ideas about curriculum and learning can be applied by teachers. His goal of learning is the acquisition of subject matter. He stands in contrast with those who advocate discovery methods of teaching, open education and experience based learning.

Goals and Assumptions

Ausubel's primary concern is to help teachers convey large amounts of information as meaningful as possible. His theory is applicable to situations where the teacher plays the role of a lecturer. His purpose is to help students to acquire subject matter. The learners job is to receive ideas and to internalise it.

AOM is designed to strengthen the cognitive structure of the students. By cognitive structure Ausubel means "a person's knowledge of a particular subject matter at any given time and how well organised, clear and stable it is" (Ausubel, 1963 : 27)

Characteristics of Reception Learning

Ausubel denies the criticism that has been brought against reception learning. It has been accused of leading to rote memorization, fostering intellectual passivity rather than curiosity. Ausubel opines that meaningful verbal learning is not an easy task. Mere internalisation of the information is not its goal.
Meaningful learning implies that what the learner has learned is intellectually, linked and understood in the context of the previously learned. In this opinion, a meaningful learning set implies that the learner must be ready to comprehend and relate what is being presented, rather than to memorise its verbation.

Since the learner has to 'do nothing with' the presented material in reception learning, it is assumed that reception learning is a passive one. But the learner has to be quite active in this type of learning. They must relate the new material to existing knowledge judging which concept or proposition to catalogue the new knowledge under. Ausubel talks about the learner struggling with the material looking at it from different angles, reconciling it with similar or contradictory information and finally translating it into his own frame of reference. Ausubel assumes that for meaningful verbal learning to occur the learner has to play an active role. The teaching model for reception learning must be designed in such a way as to facilitate these type of active mental operations. An Advance Organizer Model is a deductive Information Processing Model. In this model, an organizing statement called advance organizer is presented at the beginning of the lesson.

Ausubel describes advance organizers as "introductory material that is presented ahead of the learning task and at a higher level of abstraction and inclusiveness than the learning task itself. Its purpose is to explain, integrate and inter-relate the material in the learning task with previously learned material."

(Ausubel, 1963 : 148)

Advance organizer is a technique proposed by Ausubel for aiding learning and retrieval of information.

This advance organizer acts as a connection between the material to be learned and the learner's cognitive structure. By cognitive structure Ausubel means "a
person's knowledge of a particular subject matter at any given time and how well organized, clear and stable it is". (Ausubel, 1963: 27)

Overview of the Ausubel Model

An advance organizer can take any of the following forms namely, 1. A concept definition, 2. An analogy and 3. A generalization.

After the presentation of the organizer, the content is developed. For this, the organizer is broken into subordinate concepts, or components and these are presented in a hierarchical form of structural outline.

For developing the structural outline in a hierarchical form, the technique of progressive differentiation is used, which is the process of breaking down broad ideas into narrow, less inclusive ones. This process includes the consideration of similarities and differences between concepts or ideas. Through the process of integrative reconciliation the differences or inconsistencies in the new material are resolved. The desired outcome of the process of integrative reconciliation is a unified body of knowledge in which relationships are noted and differences or anomalies recognized.

According to Ausubel's theory, meaningful verbal presentation helps the student in acquisition and retention of large bodies of subject matter and easy learning.

Subsumption:

"For learning to be meaningful, the information should be frequently linked or anchored to relevant aspects of an individual's existing structure. This process of linking new information to pre-existing segments of cognitive structure is referred to as subsumption". (Ausubel, 1963: 58-59)
Subsumptive ideas possess enough explanatory power to render otherwise arbitrary factual detail potentially meaningful. Another characteristic is that they organize related new facts around a common theme, thereby integrating the component elements of new knowledge both with each other and with existing knowledge.

The characteristics of the Advance Organizer Model may be listed as follows: 1. the statement of an advance organizer, 2. the formation of a structural hierarchy, 3. the process of progressive reconciliation.

Planning for Ausubel Activity

Considering the above theoretical aspects, planning includes identifying the goals, hierarchical structuring of content and formation of advance organizer.

"The model can be used to teach both concepts and generalizations. It can be used for long-range planning as well as a teaching model to teach content within a lesson. The goals for an Ausubel lesson depend mainly upon the background of the learner. According to Ausubel, whether a material is meaningful depends on the learner and the material, not the method of presentation" (Weil and Joyce, 1978: 83-84)

Ausubel is of the view that each of the academic disciplines has a structure of concepts that are organized hierarchically. Several methods are used to form the structure of content. They are, 1. analysis of concepts into subordinate, co-ordinate and superordinate relationships, 2. organizing the content through the use of interrelated generalizations. Ausubel maintains that new ideas can be usefully learned and retained only to the extent that they can be related to already available concepts or propositions that provide ideational anchors.

Formulation of advance organizer is the final task in planning the model. The important functions of an advance organizer are, 1. it links the content of the lesson to the learner's cognitive structure and 2. it helps to organize for the learner the material
which is to be learned. The advance organizer acts as a subsumer. As explained in the overview of the model, an advance organizer can take any one of the forms namely. 1. a concept definition, 2. a generalization, 3. an analogy.

When the material to be taught is new or unfamiliar to the student, definitions are valuable organizers of the content. This definition has to contain the concept, superordinate concept and characteristics of the concept. If concepts are defined in terms of superordinate concepts, the linking of new concept to concept which already exist in the learner’s cognitive structure becomes easy. Illustration of concrete experiences and review of previously learned material may serve as valuable reinforcers.

Generalizations are useful to summarise large amount of information. Hence they can be effectively used as advanced organizers. But the concepts used in them must be familiar to students.

Analogy is the most effective type of advance organizer. Analogies can be clearly designed and stated. Hence they are more appealing and motivating to students than definitions and generalizations.

Implementing Activities

The implementing stage follows the planning stage. The model is expository because the students are exposed to new knowledge through the activities of the model. The teacher acts as the primary source of information and the learner receives this information. The teacher has to maintain an interactive environment in which the students are encouraged to participate and interact freely.

Syntax of the Advance Organiser Model of Teaching

There are three phases of activity in the Advance Organiser Model.
Phase 1: Presentation of Advance Organiser

The activities of this phase are:

Clarify aims of lesson, present organiser and prompt awareness of relevant knowledge and experience in learner's background.

Phase 2: Presentation of Learning Task or Material

The activities in this phase are: make logical order of learning material explicit to student, maintain attention and make organisation explicit.

Phase 3: Strengthening Cognitive Organisation

The activities in this phase are: use principles of integrative reconciliation, promote active reception learning, elicit critical approach to subject matter and clarify.

Progressive Differentiation

This is the process by which ideas are broken down or expanded. Based on the background of the students, the differentiation process can be operated. Interaction with the students is an essential fact. Progressive differentiation can be used to break a generalisation down into less inclusive and more specific generalisations.

Integrative Reconciliation

According to Marsha Weil and Bruce Joyce, integrative reconciliation implies that, "new ideas should be consciously reconciled with and integrated with previously learned content" (Weil and Joyce, 1978: 206-207)

In this also, the teacher-student interaction through questioning and clarification is important. The exploration of similarities and differences in related ideas is an important tool for integrative reconciliation.
Various Components in the Application of the Model

The model consists of theory and practical training. To translate a theory into practical teaching form, a set of four concepts, syntax, principles of reaction, social system and support system are employed.

Syntax describes the model as a flow of actions. It is described in terms of sequences of events called phases.

Principles of reaction guide the teachers’ response to the learner, they tell the teacher how to regard the learner and respond to what he or she does.

Social system provides a description of student and teacher roles and relationships and the kinds of norms that are encouraged. In the models selected for the study, the teacher acts as a reflector or a facilitator of group activity, a counsellor of individuals and the source of input, the organizer of the situation.

Support system refers to additional requirements beyond the usual skills, capacities and technical facilities necessary to implement a model.
The aforesaid description regarding the theoretical construct of Information Processing Models especially CAM, ITM and AOM is intended to make an awareness regarding the work done by experts in the field under study. Bruce Joyce and Marsha Weil experimentally verified the theoretical aspects in the 1980's itself. The investigator tried herself to make it practicable through Chemistry teaching in the secondary and the higher secondary classes of Kerala. Moreover lesson transcripts were prepared based on the guidelines suggested by Joyce and Weil and an integrated approach of using the different models (CAM, ITM & AOM) was incorporated throughout instruction.