Chapter-II

MODELS OF TEACHING
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2.1 INTRODUCTION

Teaching is an activity for transmission of knowledge, skills and the like is underway since time immemorial in one form or the other. Though with passage of time, objectives and form have changed but one thing is definite that it was never based on any principle or theory for long. Looking at the theories with us, it can be stated in terms of learning only. Teaching may be called the facilitation of learning. Students have multidimensional personalities and differing learning styles with numerous individual differences. There need to be different teaching strategies to match them, which could be possible only if we have strong theoretical base for teaching methodology or strategy.

For the last one-decade educationists and psychologists have been striving hard to evolve some well developed theories of teaching but so far no final theory of teaching has been formulated. If a teacher is provided with a good theory of teaching, he has a successful topology to help him evolve good models in classroom to captivate the interest and attention of pupils. However, recently some researchers have come up with some principles (though no well developed theories) that could serve as guiding principles for creating teaching environment or help in teaching learning process. These are known as Models of Teaching. They are tentative theories, which have analogy and evaluated by utility.

Though relevance of models of teaching has been stated in preceding
chapter that establishes their need and utility, this chapter includes theory base of
some of the relevant information processing models of teaching and other context.

2.2 INSTRUCTIONAL STRATEGIES AND THEORIES OF LEARNING

Singh (1990) in his paper, Teaching Methodology - Changing Orientation, states that teaching seems to stem from the capacity to teach differing learners and to create rich and multi-dimensional environment for them. Taneja (1989) in his paper, 'Romance of Teaching' has rightly stated that the wearer only knows where the shoe pinches. National Policy on Education (1986) envisaged teachers to devise appropriate methods of communication and activities relevant to the needs and capacities of the concern of the community. The teachers need to collect information from multifarious resources, integrate these, and then utilize in a gainful manner. The teacher may be required to process the information as received from primary sources to the level of the students. Theories of learning are like the softwares and teaching strategies as hardwares. A teacher with moral fibre and intellectual caliber can metamorphosis the rising generations only if he uses appropriate strategies.

If we analyze the teacher training programmes and their curriculum till now along with the classroom teaching therein, we find that they all emphasize the theoretical knowledge and conditions of learning.

Smith (1961) comments that, "teaching cannot be treated as mirror image of learning and teaching is a different process from learning".

But with existing knowledge it is difficult to develop theories of teaching. Theories of learning only describe the process of learning that is happening after the fact. Theory of teaching does not imply that theories of learning and development are irrelevant to the theory of teaching. Teaching and learning are two sides of a coin; both being interdependent on each other. Instructions are predispositions towards learning. The theory of instruction should specify the ways for achieving instructional goals that are based on specific patterns regarding use of
mind. Strategies of teaching attempt to structure knowledge in a way that the students easily grasp it. The sequence in which material is presented to a learner is the teaching strategy that facilitates learning. Research indicates that the understanding of a random phenomenon requires the use of certain concrete logical operations well within the reach of a young child. It is difficult to believe that general heuristic roles—such as the use of analogy, the appeal of symmetry, the examination of limiting conditions when used frequently will be nothing but a support to intuitive thinking. The practice of teaching has been limited because of lack of refined knowledge of goals, roles, designs and strategies of instruction.

According to Eggen (1979), “The educational goals have been divided into cognitive, affective and psychomotor domains. Cognitive goals address the development of the students intellect; affective goals are concerned with emotional and social growth; the psycho-motor goals are aimed at acquisition of manipulative and movement skills. Cognitive goals are important in information processing, the affective goals in development of attitudes while psychomotor goals in development of mental processes. Thus, all the three need to be taken into account while deciding strategies of teaching”.

It is controversial to say whether teaching is an art or a science and as such not much inquest could be attempted into its theories. Moreover, it was a common belief that satisfactory theories of learning have a good base for a teacher to act upon. But one would agree with Gage (1979) that we must try to develop a scientific basis of art of teaching.

Smith (1961) has also opined that, “there is a difference between the process of teaching and process of learning”.

No doubt some implications for teaching have been drawn from theories of learning but these theories are inadequate. Further, theories of learning are descriptive while teaching strategies or theories of teaching are prescriptive because the latter sets forth rules for effective teaching strategy.
The theory of teaching also provides a yardstick of evaluating a particular way of teaching.

Gage (1963) professes two kinds of theories of teaching. "The first one explains why teachers behave as they do in teaching and second explains how the behaviour of a teacher can influence learning of pupils".

The common implication of these facts is that the teachers should use different strategies matching the objectives of teaching and pupils' learning styles and personality dimensions. It is true that theories of teaching are not available as yet, but there are a number of teaching strategies, which have been developed by the researchers to realize specific instructional goals. These strategies have been developed on the assertion that there is no single best way to teach; as such different instructional strategies are required to realize different instructional goals. Moreover, it is now increasingly felt that teaching can be studied objectively and successfully, as instructional approaches and therefore, strategies could be identified and taught.

According to Joyce and others (1991), "To provide all round development, one needs to design suitable instructional strategies which help our students grow emotionally, physically, socially and intellectually. We need to know how to modify their behaviour so that they function effectively in changing society. We need to engage ourselves in changing professional roles".

Although a great deal of work has been done about how humans and pupils learn; there still exists a big gap between theoretical knowledge and actual teaching practice in the school. A teaching strategy is, however, not a substitute for teaching skills. They are rather complementary. A teacher having selected appropriate teaching strategy will still be required to make use of proper teaching skills. Models of teaching as teaching strategies need to be incorporated in one's teaching practice. It helps in enhancement of educability of human beings, helping in effective transmission. Teaching strategies based on cognitive psychology delve into the mental.
2.2.1 The Instructional Framework

Figure 2.1, the Instructional Framework, identifies and illustrates the inter-relationship among instructional approaches that, properly used, are acknowledged to be consistent with sound educational practice.

**Fig. 2.1**

Instructional Framework, identifies and illustrates the inter-relationship among instructional approaches
The approaches are referenced to the goals of education and apply to the objectives of the various curricula. The figure also illustrates the levels of approaches in instruction ranging from an instructional model, a broad approach, to an instructional skill, which represents a specific teaching behaviour or technique. Within each level the potential exists for developing both the science and the art of teaching (Internet). Information is given in the above diagram.

2.3 TEACHING AND INFORMATION PROCESSING

In the present fast growing age, lot of information has to be collected from multifarious sources, integrated, and then processed in a gainful manner not only within self but also to the next generations. Teachers have been shouldered with the responsibility of processing it through a formal system to the level of the students.

Max Wertheimer was the first to investigate, “the ways one tends to superimpose upon what one sees or hears. He suggested that information processing is a matter of perceptual organization imposed upon stimuli so that new patterns can be seen. These are involved in human learning and performance”.

Hess (1963) states on the basis of his research that, “there is a reason to believe that the potentialities of human mind are genetically determined but don't unfold naturally and inevitably; it requires active participation of a stimulating environment in order to attain normal development. Abstractions and concept formation have been regarded extremely important to research and teaching but it has not been matched by the rigour of procedures used to study them”.

Gagne (1965) has named information processing as a language available for expressing the strategy for inference. It has been accepted as a process to direct thoughts that can be conceived as a linear sequence of operations actually carried out by the subject according to a system. It may be ability to structure the problem frame to differentiation of relevant cues and integrate them accurately, structuring, handling information and feedback which the teacher institutes further effect the flow of cues. In information processing visual symbols are to be converted
into meaningful phrases in mind.

From developmentalists’ view, the information processing approach offers a methodology for precisely specifying the changes in organismic states and systems or strategies that have been practising and modifying for a long time.

Morine Dershimer and others (1990) in their study on ten teachers in a sub-urban elementary school indicated considerable success in stability of information processing styles. Studies of remembrance, problem solving, thinking, and mental operations have much in common. They all need information processing using same basic strategy, i.e. it is easy to add different types of information to the database.

Through the teaching of information processing, capabilities of the learners are facilitated and ability to master information is enhanced. Teachers handle information coming from outside, organize data, enable the learner to raise problems, generate concepts and solutions to the problems with the use of verbal and non-verbal symbols.

Elements of information processing in teaching are five-fold:

- Flow of cues
- Interpretation
- Perception of cues
- Processing and
- Responding.

The teacher is a powerful agent in determining the processing of information by reducing the amount the natural behaviour of children, instituting the instructional patterns, building a social system and regulating the instructional process.

According to Simon, there are hundred of systems that have been adopted or developed to permit us to record and categorize teacher-student behaviour in a variety of ways.
Garner (1974) emphasized both roles of stimulus variations and functions of cognitive structure in determining the kind of information selected and integrated.

Shiffrin (1976) emphasizes that capacity to process the information is multifaceted.

Hunt (1986) suggests three abilities - ability to match patterns efficiently, ability to match and maintain or manipulate information to guide controlled behaviour and ability to make use of priming to increase the efficiency of production, selection or the like.

Information processing as such is termed as experimental psychology. Greatest emphasis has thus been laid on information processing power of academic disciplines in a formal teaching system. Hence, from the foregoing discussion it can be inferred that:

a) Information processing affects all the cognitive as well as affective and psycho-motor processes.

b) Information processing is an important concern, component, and requirement of pedagogy.

c) Theories of learning have a direct bearing on information processing.

d) Information processing can be enhanced.

e) Information processing can be studied.

f) Information processing can be manipulated and taught through formal education.

2.4 MODELS OF TEACHING

Models of teaching are a midway approach between teaching method and teaching skill approach, i.e. it is the teaching process approach. There appear to be exerting a certain definable way of working with the students that helps them to
grow more than any other way would. The teacher has an identifiable focus and frame of reference, when using the models of teaching approach. They are useful for teaching children, planning, and organizing the teaching activities, shaping the courses of studies, formulating the theories of teaching and the like.

A model of teaching provides guidelines for designing educational activities and environment. Models of teaching are derived from personals, group dynamics, academic and psychological information processing stances, behaviour modification etc. Models of teaching have given functional and structural guidelines to design instructions or instructional material. They are dynamically interactive with social and cognitive purpose with the learning theory underlying procedures, with available support technology and with personal and intellectual characteristics of the learners. They have a frame and focus of reference to rationalize them and classify learning outcomes into distinctive categories. Through models of teaching one can specify the learning situations. They help the teachers to increases the capacity to reach more children and create richer and more diverse environment for them.

Different meanings have been assigned by different educationists to be term "Model of Teaching". Models of teaching are, however, prescriptive teaching strategies (Eggen, et.al., 1979). They differ from general approaches to teaching in the way that they are designed to realize specific instructional objectives.

Dececco (1968) has made a distinction between teaching models and a theory of teaching, stating that models do not have a rigour of tested theories. They are consciously and systematically design to accommodate all-important variables. Models may eventually give rise to empirically tested theories.

According to Hunt (1970), "How can we build a model for optimum growth which enables teachers and others to match the learning environment to the characteristics of the individual?" This is nothing but a model of teaching.

According to Taneja (1989), "A model of teaching is a term, an imitation, condition, category, prototype representation considered as a standard of
excellence to be envied, emulated and accentuated, of course, in teaching”.

A model of teaching is not a substitute for teaching skills. It is rather complementary to the latter. Many models have resulted from attempts to improve the society including the desire to reform it radically, may be, accidentally or deliberately.

According to Joyce, Weil and Showers (1991), “A model of teaching seeks the systematical exploration of interaction among educational purposes, pedagogical strategies, curricular designs or materials and social and psychological theories. Motto of models of teaching is to teach by creating environments”.

According to Passi (1991), A model of teaching is characterized by well defined and verifiable theory, specification of intended and unintended objectives, pedagogical syntax expressed in terms of well-sequenced steps, explicitly described reactions of teachers and description of classroom support system.

According to Brady (1985):

1. The models are guides to the preparation and implementation of teaching and not highly developed theories. They are, as DeCecco (1968) suggests, forerunners to probable theories.

2. No single model is regarded superior to others. No single model can realize the multiplicity or school and subject objectives.

3. The models are not highly discrete, i.e. there is no definite boundary between each one.

4. A through knowledge of all models leads to a greater flexibility and efficiency.

The invention of models of teaching as such is only in its infancy. Still we know very little about how to help youngsters grow in myriad kinds of ways and we know even less about developing teaching models that will reach youngsters. There are two extremes of the continuum from teacher dominated to pupil centered on
which different models can be located. Identifying the models on continuum helps the teacher to identify a particular way or a particular model with a wider scheme.

Doyle (1979) suggested that the common denominator of all the models of teaching is that each attempts to achieve a deliberate instructional goal based on a specific belief about the nature of a child and most importantly, each suggests a sequence of general participant actions to facilitate learning to produce pupil co-operation in activities.

2.4.1 Families of Models

Different researchers to the evolution of models of teaching have adopted different approaches as——

Robert Glaser (1962) developed a basic teaching model with four components applicable to all classes—

- Instructional objectives
- Entering behaviour
- Instructional procedure
- Performance evolution

Dececco (1970) has described three historical and four psychological models. In historical models he has tried to show a relationship between traditional concepts of teaching and basic teaching models; while in psychological models of teaching it is considered that they are best substitute for a theory of teaching.

- Historical models are: Socrates teaching model, classical humanistic model and personal development model.
- Psychological models are: basic teaching model, computer based teaching model, teaching model of school learning and interaction model of teaching.
Israel Shefter (1970) has discussed three philosophical models of teaching as:

- Impression model
- Insight model
- The rule model

Similarly Hadden (1970) has described four models of teaching in behavioural analysis of teaching, diagnostic teaching, etc. These are:

- Taba's model of teaching
- Turner's model of teaching
- A model of variation in teacher orientation
- Fox-Lippitt's teaching model

Mosstons has developed seven models on a continuum in his book, "From Command to Discovery". These are:

- Command style
- The task style
- Reciprocal style
- Individual programme (teachers' design)
- Guided discovery model
- Problem solving model
- Individual programme (Pupils' design)

Lapp, Bender, Ellenwood and John (1975) believe that the multiplicity of teaching learning styles can be validly subsumed by four models:

- The classical model
- The technological model
- The personalized model
• The interaction model

Stallings (1977) places her five models on a continuum. Viz., exploratory model, the group process model, the developmental cognitive model, the fundamental model and the programmed model.

Eggen, Kauchak and Harder (1979) discussed six information processing models as:

• General Inductive Model
• Concept Attainment Model
• Taba's Inductive Thinking Model
• General Deductive Model
• Ausubel's Advanced Organizer Model
• Suchman's Inquiry Training Model

Brady (1985) discusses five models of teaching as:

• exposition model
• behaviour mode
• cognitive development model
• interaction model
• transaction model

The most extensive and comprehensive work or examination of teaching is that of Joyce and Weil (1990) who have identified 20 models categorized in four basic interaction families as well as a number of models for thinking about models. These four families of models are defined as follows.

(a) **Information Processing Models**

This model emphasizes the acquisition mastery, and processing of information. The cognitive functioning of the student is the focus.
(c) **Social Interaction Models**

This model emphasizes the personal and societal relationships among people. The focus is on improving the student's ability to relate to others, to engage in democratic processes, and to work productively in society.

**Table 2.3- Social Interaction Models**

<table>
<thead>
<tr>
<th>Model</th>
<th>Major Theorist</th>
<th>Mission or Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Investigation</td>
<td>Herbert Thelen, John Dewey</td>
<td>Development of skills for participation in democratic social process through combine emphasis on inter personal (group) skills and academic inquiry skills. Aspects of personal development are important outgrowths of this model.</td>
</tr>
<tr>
<td>Social Inquiry</td>
<td>Byron Massialas, Benjamin Cox</td>
<td>Social problem solving, primarily through academic inquiry and logical reasoning.</td>
</tr>
<tr>
<td>Laboratory Method</td>
<td>Nation Training Laboratory (NTL), Bethel, Maine</td>
<td>Development of inter personal and group Skills and, through this, personal awareness and flexibility.</td>
</tr>
<tr>
<td>Jurisprudential</td>
<td>Donald Oliver, James P. Shaver</td>
<td>Designed primarily to teach the jurisprudential Frame of reference as a way of thinking about and resolving social issues.</td>
</tr>
<tr>
<td>Role Playing</td>
<td>Fannie Shaftel, George Shaftel</td>
<td>Designed to induce students to inquire into personal and social values, with their own behaviour and values becoming the source of their inquiry.</td>
</tr>
<tr>
<td>Model</td>
<td>Major Theorist</td>
<td>Mission or Goal</td>
</tr>
<tr>
<td>------------------------</td>
<td>---------------------------</td>
<td>---------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Social Simulation</td>
<td>Sarene Boocock, Harold Guetzkow</td>
<td>Designed to help students experience various social processes and realities and To examine their own reactions to them, also to acquire concepts and decision-making skills are important outgrowths of this model.</td>
</tr>
</tbody>
</table>

(d) **Behavioural Models**

The behavioural model emphasizes changing the visible behaviour of the learner to be consistent with his or her own self-concept. As a result of its basis in the stimulus control/reinforcement theories, the behavioural model of instruction stresses that learning tasks should be broken into a series of small sequenced tasks and behaviours.

**Table 2.4- Behavioural Models**

<table>
<thead>
<tr>
<th>Model</th>
<th>Major Theorist</th>
<th>Mission Or Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contingency Management</td>
<td>B. F. Skinner</td>
<td>Facts, concepts, skills</td>
</tr>
<tr>
<td>Self-Control</td>
<td>B. F. Skinner</td>
<td>Social behavior/skills</td>
</tr>
<tr>
<td>Relaxation</td>
<td>Rimm and Masters, Wolpe</td>
<td>Personal goals (reduction of stress, anxiety)</td>
</tr>
<tr>
<td>Stress Reduction</td>
<td>Rimm and Masters, Wolpe</td>
<td>Substitution of relaxation for anxiety in social situation.</td>
</tr>
<tr>
<td>Assertive Training</td>
<td>Wolpe, Lazarus, Salter</td>
<td>Direct, spontaneous expression of feeling in Social situation.</td>
</tr>
<tr>
<td>Desensitization</td>
<td>Wolpe</td>
<td></td>
</tr>
<tr>
<td>Direct Training</td>
<td>Gagne, Smith and Smith</td>
<td>Pattern of behavior, skills</td>
</tr>
</tbody>
</table>
2.4.2 Components of a Model

According to Joyce (1990) each model of teaching has a theory and a practical training. To translate a theory into practical form, there are four concepts called the components or the fundamental elements of a teaching model. These are:

- **Syntax:** The syntax of the model describes the model in actions. For example, if teachers were to use the model as the basis for their strategy, what kind of activities would they use? How would they begin? What would happen next? It also describe as a sequence of events (phases). It involves a description or structure of activities.

- **Social System:** The social system describes student and teacher roles; relationships and the kind of norms that are encouraged. Thus, three things are included in it:
  
  (a) Student-Teacher roles
  
  (b) Hierarchical relationships and
  
  (c) Norms to be encouraged or pupil behaviour to be rewarded.

- **Principles of Reactions:** Principles of reaction tell the teacher how to regard the learner and how to respond to what the learner does. Principles of reactions provide the teacher with rules on how they should react to the students and select model appropriate to what the learners do.

- **Support System:** It refers to the additional support the teacher may need to ensure success. Support system includes two sources:
  
  (a) Role specification for the teacher and facilitators
  
  (b) Requirements of the substances, i.e., experts' advice, and formal requirements necessary to support the model.
Besides these four components some people have included Focus or Goals also as an element or component of a model of teaching. It refers to the objective of teaching, i.e. aspects of environment important for a student.

2.5 INFORMATION PROCESSING MODELS

Since two information-processing models have been studied in this research through experimentation, it is desirable to discuss the family of these two models here. As is evident from instructional strategies and theories of learning (2.2), information processing has been primary concern of pedagogy and an important dimension of human development. As such Joyce and Weil (1990) identified seven models under the second large family known as information processing family or information processing models. They introduced the idea of information processing models as a discrete grouping and defined it as the ways people handle stimuli from the environment, organize data, sense problems and solve them. It provides understanding, knowledge about new information or facts and stimuli for students to solve problems.

Information processing models are designed in such a way that information processing capacity of the learners is facilitated and learner’s ability to master information is enhanced. The teaching facilities for developing creative thinking within, academic discipline are also increased. One of the major characteristics of information processing models is to development of the ability to solve problems by applying productive thinking.

Thus, the development of pupils' intellectual skills or acquisitions of knowledge by them are the goals of information processing models. Through these, global view of some entity becomes possible by using concepts and information. In these models emphasis is on intellectual development-the means by which pupils obtain, process and retain knowledge. Information processing models depend upon activities concerning contents as well as skills. Some information processing models are designed to develop inductive mental processes and reasoning like Hilda Tabo Inductive Thinking Model while some are concerned with acquisition and retention.
concepts like Bruner’s Concept Attainment Model. Particular interest of the student and environment for his optimal growth are important in it. Retention and effective information processing are outcomes. The information processing models emphasize the way the students process information.

These have come from:

(a) Developmental studies of intellectual capacity of human beings
(b) Conceptualization of the mental processes

As the present study has been conducted using two information processing models, namely, Concept Attainment Model and Inductive Thinking Model. These two models are discussed in details here.

2.6 CONCEPT ATTAINMENT MODEL

Concept Attainment is an indirect instructional strategy that uses a structured inquiry process. It is based on the work of Jerome Bruner. In Concept Attainment, students figure out the attributes of a group or category that has already been formed by the teacher. To do so, students compare and contrast examples that contain the attributes of the concept with examples that do not contain those attributes. They, then, separate them into two groups. Concept Attainment, then, is the search for and identification of attributes that can be used to distinguish examples of a given group or category from non-examples.

Concept Attainment is designed to clarify ideas and to introduce aspects of content. It engages students into formulating a concept through the use of illustrations, word cards, or specimens called examples. Students who catch onto the idea before others are able to resolve the concept and then are invited to suggest their own examples, while other students are still trying to form the concept. For this reason, concept attainment is well suited to classroom use because all thinking abilities can be challenged throughout the activity. With experience, children become skilled at identifying relationships in the word cards or specimens. With carefully
chance examples, it is possible to use concept attainment to teach almost any concept in all subjects.

2.6.1 Advantages

- Helps to make connections between what students know and what they will be learning.
- Learn how to examine a concept from a number of perspectives.
- Learn how to sort out relevant information.
- Extends their knowledge of a concept by classifying more than one example of that concept.
- Students go beyond merely associating a key term with a definition; concept is learned more thoroughly and retention is improved.

Importance of concepts was understood in 1960 with the invention of games, films, and other such aids. Bruner, Goodnow and Austin (1966) found categorizing and sets of concepts, as the product of some kind of thought processes and means of acquiring any concept is essentially the same. Concept Attainment Model is thus based on the works of Bruner and Coworkers on the basis of, "A Study of Thinking". It is based on researches conducted by them to see how children learnt concepts, understood and mastered environment. It enables the students to describe similarities and relationships among things of the environment.

According to this model, "In order to cope up with the environment that we engage together mentally, the objects which have real differences but which classify together on the basis of what they have in common. Students are given Concept Attainment exercises; they analyze strategies for attainment of concepts; analyze concepts in written material and finally practice it". This focuses on the description of a process by which learners discriminate the attributes of things, persons, and events and place them into categories thereby developing inductive thinking and reasoning. Attending and discriminating are essential operations in
Concept Attainment.

Bruner described the concept as having five essential elements:

(i)   Name
(ii)  Examples and Non-examples
(iii) Attributes (essential and non-essential)
(iv)  Attribute-Values
(v)   The Rule

A person is known to have attained concept when he is able to name that concept, identify examples and non-examples, and define the concept on the basis of its attributes. In general it is possible to recall more items that are acoustically different from one another than items that are acoustically similar.

The model begins with the students provided with samples of information, some of which represents a concept and other that does not. They are informed about the kinds of attributes that make up the concept. They are provided with more examples until every one in the group thinks that he knows the concept. Then the group discusses the relationship between the attributes, concepts and thinking processes. Each of the following passage is labeled Yes (Positive) or No (negative) depending upon whether it represents the concept. Gradually, we receive more information which enables the students to eliminate some possibilities and think of some new ones. This search can help to throw light on the nature of the process of categorizing events. Bruner and his associates have distinguished between two kinds of strategies or learning conditions as the selection oriented and reception oriented. In the former, the examples are not marked positive or negative and the individual selects or enquires; whereas in the latter one the teacher presents the examples in a pre-arranged manner (marked positive or negative).

Eggen and others (1979) find this model similar to general inductive model in the type of reasoning used; it is specifically designed to teach only one form of content/concepts. They have planned concept attainment activity as:

i) Identification of goals
ii) Selection of exemplars  
iii) Sequencing of exemplars  
iv) Medium of presenting exemplars

The types of attributes significant for concept attainment are defining attributes and critical attributes. Generally, identification of anything is not inferred from single attribute but is possible from a constellation of attributes in particular relation to one another.

Joyce and Weil (1982) divides the syntax of Concept Attainment exercises into four phases:

(a) Playing concept attainment games  
(b) Analyzing strategies  
(c) Analyzing concepts in reports, conversation and written material  
(d) Practising them

2.6.2 Steps of Strategies of Concept Attainment Model

Concept attainment focuses on understanding what characteristics or attributes may be useful for distinguishing between members and non-members of a grouping or class. The method is based on the work of Bruner. In this situation, the student does not fully understand a concept. Developing a comprehensive definition for the concept involves the following key elements.

The five key elements necessary to define a concept are: names, examples, attributes, attribute values and rules. The concept name is the term given to a particular group of objects or events. Examples are instances of the concept. Characteristics of the object or event are referred to as attributes. Those common characteristics, which are essential to place an object in a grouping, are known as critical attributes. Attribute value refers to the range within which a characteristic exemplifies the concept. For example, lemons exist in a variety of shades of yellow but if the example is too close to orange, it does not qualify for the concept "lemon" but may well be an example of the concept "orange". A rule gives a summary,
generalization, or definition, which specifies the critical attributes of the given concept. A discussion of three processes for attaining understanding of a concept follows. Two of these processes fall within the inductive approach. The third process is described from a deductive approach.

2.6.3 Inductive Approach

The first process focuses on examining examples and non-examples. As each example of the concept is examined and its attributes are noted, students form a hypothesis (rule) about the critical attributes of the concept. Each successive example or non-example reinforces the hypothesis or alters it to make it more exact. Eventually, students develop a rule for distinguishing examples from non-examples.

**Selection-Oriented Concept Attainment Model:**

<table>
<thead>
<tr>
<th>SYNTAX</th>
<th>Phase Two:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase One:</td>
<td>Testing Attainment of the Concept</td>
</tr>
<tr>
<td>Presentation of Data and Identification of Attributes</td>
<td>Students identify additional unlabeled examples as yes or no.</td>
</tr>
<tr>
<td>Teacher presents unlabeled examples. Students inquire which examples, including their own, are positive ones. Students generate and test hypothesis.</td>
<td>Students generate examples.</td>
</tr>
<tr>
<td>Phase Three:</td>
<td>Teacher confirms hypothesis: names concept and restates definition according to essential attributes.</td>
</tr>
<tr>
<td>Analysis of Thinking Strategies</td>
<td>Students describe thoughts. Students discuss role of hypothesis and attributes. Students discuss type and number of hypotheses.</td>
</tr>
</tbody>
</table>
The second process involves selecting an item from an unlabelled group and questioning an authority to determine if it is an example or not. Through examining the attributes of the examples, a hypothesis is made. Students select additional items in order to test and refine the hypothesis. With each selection, students ask "yes-no" questions of the authority. This process results in a rule for identifying the concept.

In the first example, students were using a reception process of concept attainment in which the items were labeled as examples and non-examples. Students became familiar with the basic elements of the concept and used these, to form the "rule".

Reception-Oriented Concept Attainment Model:

<table>
<thead>
<tr>
<th>SYNTAX</th>
<th>Phase Two:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phase One:</strong></td>
<td><strong>Testing Attainment of Concept</strong></td>
</tr>
<tr>
<td>Presentation of Data and Identification of Concept</td>
<td></td>
</tr>
<tr>
<td>Teacher presents labeled examples.</td>
<td>Students identify additional unlabeled examples as yes or no.</td>
</tr>
<tr>
<td>Students compare attributes in positive and negative examples.</td>
<td>Teacher confirms students' hypothesis, names concept, and restates definition according to essential attributes.</td>
</tr>
<tr>
<td>Students generate and test hypothesis.</td>
<td>Students generate examples.</td>
</tr>
<tr>
<td>Students state a definition according to the essential attributes.</td>
<td></td>
</tr>
</tbody>
</table>

**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 second example, which uses a selection process, unlabelled samples were presented and students had to determine if they were examples or non-examples through questioning, selecting more examples, testing the hypothesis and formulating a rule.

Both processes described previously illustrate an inductive approach to concept attainment. Examples and non-examples are introduced and students discover critical attributes, which in turn lead to the discovery of a rule or definition of the concept, which includes the critical attributes and their relationships.

2.6.4 Role of Teacher

The teacher plays a key role in providing structure to the Concept Attainment Model and facilitating students' understanding of the concept. The teacher determines the concept to be taught and its relationship to the learning objectives of the lesson. Example selection is a critical component for success. Initial examples must strongly represent the concept's critical attributes. Later examples and non-examples can gradually become less clear-cut as students' perception and understanding of the critical attributes increases.

Prior to the lesson, a list of attributes of the concept is prepared. Materials (e.g., pictures, objects, audio tapes, descriptive phrases, etc.) are carefully selected and organized to serve as examples and non-examples of the concept. Alternating examples with non-examples in the initial phase of the presentation helps students to compare the similarities among examples to the differences with non-examples.

The teacher is supportive of students' hypotheses and helps them to test one hypothesis while focusing their attention on the critical attributes of the examples being presented or selected. In a similar fashion, the teacher assists the students in discussing and evaluating the thought processes and thinking strategies, which they employed.
2.6.5 Deductive Approach

A third process could be employed to attain the concept. The teacher introduces the concept and draws attention to the critical attributes and their relationship(s) to each other. Examples and non-examples highlight both critical and non-critical attributes. Students are given an opportunity to test their understanding of the concept by examining unlabelled items and explaining the choices made.

This final process of concept attainment is a deductive approach moving from the general rule to specific examples. Steps generally followed in this approach are:

1. The teacher presents the concept label and the rule or definition of the concept.

2. Examples and non-examples of the concept are presented and the critical and non-critical attributes of each are discussed.

3. The critical attributes of the concept and their relationship(s) to one another are reviewed in terms of the concept rule.

4. Students test their attainment of the concept by examining unlabelled examples and identifying them as representing or not representing the concept.

In contrast to the inductive approach, the deductive approach tends to be closed and direct. Being teacher centered, it can be an efficient way to introduce large numbers of facts and concrete concepts. The deductive approach can be used to show relationships between several previously acquired concepts and what is about to be taught.

These previously acquired concepts are best attained following an inductive approach. Research (Joyce and Weil, 1986) indicates that inductive processes of concept formation and attainment increase students’ retention of
information by enabling them to develop mental structures which allow them to "hold" the information better than structures which are provided for them. In addition, the inductive approach to concept attainment can help students in developing observational and analytical abilities.

The teaching situation in this model is moderately structured. The teacher has to control all actions but discussion within phases of teaching is free. However, teacher has to motivate the students and remove their doubts. The concepts in this model should be pre-arranged and data matter should be presented as discrete units. The students should know the sources of material.

The purpose of Concept Attainment Model has been identified three fold:

i) To teach the students about the nature of concepts to help them understand how objects are distinguished by attributes and placed in categories.

ii) To teach the students to be more effective in attainment of concepts.

iii) To teach specific concepts.

Concept Attainment Model could be used with pupils at all levels-pre-primary, primary, secondary and senior secondary stages and in all disciplines. This helps in inductive reasoning, sensitivity to logical reasoning and tolerance of ambiguity.

2.6.6 Instructional and Nurturant Effects

The Concept Attainment strategies can accomplish several instructional goals, depending on the emphasis of the particular lesson. They are design for instruction on specific concepts and on the nature of concepts.
They also provide practice in inductive reasoning and opportunities for altering and improving students’ concept building strategies. Finally, especially with abstract concepts, the strategies nature an awareness of alternative perspectives, sensitivity to logical reasoning in communication and a tolerance of ambiguity (Fig. 2.2).
2.7 INDUCTIVE THINKING MODEL

Inductive reasoning is a branch of logic. In a valid inductive argument, the conclusion (consequent) is believed to be true on the basis of its antecedents. For example, when all swans are observed to be white, a student may easily reach the conclusion that all swans are indeed white. A generalization is made based on the evidence gathered. However, when a black swan is observed, the generalization must be thrown out based upon the new data (antecedents). Do you recall that the black swan is native to Australia? Well, it is! Before the great voyages of discovery, the black swan was never observed in Europe and England, and it remained unknown to westerners until Australia was discovered and explored. That swans could be black would have been a false conclusion by anyone other than the indigenous people of the land down under before the exploration of the Australian continent.

Inductive Thinking Model has been developed by Hilda Taba (1967) on the basis of conceptions of mental processes and theory of building. The main focus of this model is on developing mental abilities and emphasizing concept formation involving cognitive tasks. To quote Hilda Taba, "The subject matter has to be seen as consisting of three levels of knowledge; each of which served special function in curricular organization, and thus, specific plans are needed for selecting and organizing the learning experiences through which the students could achieve several different objectives, such as discovering important ideas, mastering relevant skills and developing attitudes; attention and the like to the kind of teaching strategy required by a successful pursuit of these objectives".

Her approach to designing of teaching strategies to develop creativity and autonomous thinking has a wide range of applicability. Recent studies have shown that thinking can be learnt developmentally. Teaching strategy that helps the students to higher level of thinking involves what questions were asked, what the teacher told or sought and at what point in the proceedings.

Hilda Taba believed that students make generalizations only after data are organized. She believed that students could be led toward making generalizations
through concept development and concept attainment strategies. In A Teacher's Handbook to Elementary Social Studies, Hilda Taba describes generalizing as a higher order of thinking when compared to forming concepts.

Generalizations like concepts, are the end products of a process of an individual's abstracting from a group of items of his experience those elements of characteristics the items share, and expressing his recognition of this commonality in a way that is convincing to others. The two major differences between concepts and generalizations are, first of all, that in generalizations the verbal form of the process is expressed as a sentence rather than a word or phrase as in the case of concepts, and second, that generalizations are here taken as representing a higher level of thinking than concepts in that they are a statement of relationships among two or more of these concepts (1971, p. 72).

Taba's Inductive Thinking Model requires the students to predict consequences, explain unfamiliar data, or hypothesize and then, attempts to create inductive thinking in them. This requires them to explain predictions or hypotheses verify or identify conditions that would verify predictions. However, carefully squeezed content and suggested learning experiences form the basis of information to proceed inductively. In any inductive thinking lesson three cognitive tasks strictly follow the sequence-concept formation, interpretation of data and application of principles.

According to Joyce and Weil, Hilda Taba utilized three main assumptions in developing her teaching model (Joyce & Weil, 2000, p. 131).

1. Thinking can be taught.
2. Thinking is an active transaction between the individual and data.
3. Processes of thought evolve by a sequence that is "lawful".

Taba developed three effective strategies in the Inductive Thinking Model that enable students to form concepts, interpret data and apply principles.
1. Concept Formation
   i) Enumeration and listing
   ii) Grouping
   iii) Labeling, Categorizing

   Students gather data, group it, and categorize it. (The database in Hats of to History serves as the vehicle for this strategy. Teachers may feel it necessary to create alternate field names for the database after students research the project).

2. Interpretation of Data
   i) Identify dimensions and critical relationships
   ii) Explain dimensions and relationships
   iii) Make inferences

   Students identify critical relationships and make inferences based on their exploration of the relationships.

3. Application of Principles
   i) Predicting consequences, explaining unfamiliar phenomena, hypothesizing
   ii) Explaining and/or supporting the predictions and hypotheses
   iii) Verifying predictions

   Students predict and form a hypothesis, explain their hypothesis and use data to verify their position.

   Another important belief of Taba is that learning is incremental and thereby learning experiences should be in small steps. These steps should match the child's ability to assimilate and accommodate information. Atmosphere conducive to learning, co-operative and democratic should persist and teaching activities have to be arranged in a logical sequence in advance with eliciting questions.

   Though the primary aim of the model is development of inductive and academic processes, academic reasoning, or theory building, but these capacities are
useful for personal or social goals as well. Her model helps the students improve their ability to categorize; use categories and explore. The model increases the scope of process skills development by involving students in making generalizations, explanations, and predictions.

2.7.1 Instructional and Nurturant Effects

The Inductive Thinking Model is designed to instruct students in concept formation and, simultaneously, to teach concepts. It nurtures attention to logic, to language and the meaning of words, and to the nature of knowledge (Fig. 2.3).

Fig. -2.3

**Instructional and Nurturant Effects - Inductive Thinking Model**

- Attention to Logic
- Sensitivity To Language
- Awareness of the Nature of Knowledge
- Concept-Formation Processes
- Specific Concepts
- Nurturant Effects
- Instructional Effects
The model is an effective mean for teaching content in the form of generalizations. This may even be helpful in the development of scientific temper or attitude as the phases of this model involve scientific method. These phases are useful for transaction of Science curriculum as well.