CHAPTER II

THEORETICAL OVERVIEW

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CHAPTER II

THEORETICAL OVERVIEW

2.1 Curriculum and Instruction.

“Successful teaching is very difficult, fraught with unpredictable, practical and ethical issues. No textbook can provide the “silver bullet”—the one best way to teach—and no textbook should try” (Dembo, 1994).

Teaching is what is technically known as a polymorphous activity. We cannot hope to characterise specific teaching activities simply in terms of the activities of proving, demonstrating, telling, etc. Rather teaching must be characterised by some other way which will make it clear to us when these activities are indeed involved in teaching and when involved in, say, entertaining.

The instructional process has traditionally involved instructors, learners and textbooks. It was the instructor’s responsibility ‘to teach’ the content to the learners. Teaching could be interpreted as getting content from the text to the heads of the learners in such a way that they could retrieve the information for a test. With this model, the way to improve instruction is to improve instructor. (i.e. to require the instructor to acquire more knowledge and learn more methods for conveying it to the learner).
Teaching can be viewed as a task in which some one (the teacher) attempts to help one or more persons (the students) learn knowledge, skills, or attitudes (the subject matter). The possible shared and unique aspects of instructional development and curriculum are given in figure 2.1. Each of the components influences the form of the teaching act.
2.2 Theory of Teaching.

According to Gage (1964), a theory of teaching should answer three questions: How do teachers behave", Why do they behave as they do?, and What are the effects?. It should consider the behaviour of the teacher, the cause, the learning of students, and the effect. Further it should explain, predict and control the ways in which the behaviour of the teacher affects the learning of the students. He pointed out that teaching embrace 'far too many kinds of process, of behaviour, of activity, to be the proper subject of a single theory". A theory of teaching cannot be divorced from the fundamental principles as laid down at the roots of a country's culture and civilisation. No theory of teaching can blossom forth until and unless scientific research is conducted. Therefore, one has to build a theory of classroom behaviour of students, teachers and the method involved.

There are several theories of teaching e.g. Theory of Instruction (Gordon), Theory of teacher's behaviour (Reyons), Normative Theory of Teaching (Dewey), Positivistic Theory of Teaching (Othanel), Maleutic teaching theory, Communication theory, Moulding theory and Mutual Inquiry theory, etc.

Teaching is necessary because the pupils are relatively immature. They learn by their own activity, but their activity needs guidance. The most serious cause of ineffectiveness in teaching is the lack of a clear aim in the teaching process.
In the words of Swami Vivekandanda, "the only true teacher is he who can immediately come down to the level of the student, and transfer his soul to the student's soul and see through the student's eyes and hear through his ears and understand through his mind". A teacher has to develop spirit of enquiry among his students, a spirit so closely linked with the scientific spirit, which is the distinguishing feature of our age, knowing fully well that in doing so he invites being questioned himself.

The concept of teaching is in fact totally unintelligible without a grasp of the concept of learning. It asserts that there is no such thing as teaching without the intention to bring about learning.

2.3. **Cognitive Style and Learning**

Cognitive Style is the term used to describe the different ways in which the pupil process information, including perception, storage, transformation and utilisation of information from the environment. There are individual differences in the process of cognition. The cognitive style has three features: styles are intellectual characteristics of individual; they describe process, which are relatively stable over time; and intra individual stability is consistent across tasks having similar requirements. Cognitive styles describe differences in the ways in which children and adults think and learn. It is associated with one's personality, affective and
motivational characteristics and is considered to be relatively stable, being consistent across both time and task (Schwen, et al. 1979; Kogan 1976; Messick, et al. 1976).

The best non-cognitive style of all is the field-independence/field-dependence (FI/FD) dimension, which was developed and used extensively by Witkin (1977) and his associates. Field-dependent students were expected to prefer, and were found to be more successful in arts and humanities courses rather than the sciences. These students also preferred the more informal teaching methods adopted by field dependent teachers.

Interpreting reflectiveness as a style is difficult. Some pupils are both fast and accurate while others are slow and accurate. Effectiveness can be seen, in part, as an ability and, as part, as a personality trait (Guilford, 1980). The particular learning methods to be adopted depend upon the nature of learning materials such as length and difficulty and intellectual development of the learner.

2.3.1 Cognitive processing in the Classroom.

Cognitive processes are unobservable mental actions used to manipulate information. Cognitive processes produce cognitive products and it may be processed again, or they may be manifested in performance. For example, a student may rehearse (cognitive process) the spelling of an irregular word over and over to learn (cognitive product) to spell it correctly on a test (performance).

Cognitive processing can be applied to any kind of information. Students'
cognitive systems have the potential to process not only the various kinds of information found in educational curricula, but also information that teachers provide to students to help them achieve the educational objectives. Cognition is both an effect caused by previous events, including cognitive ones, and a cause of future events. Research on students' cognitive processing during instruction has been done mostly by studying learning from the text. These researchers have examined the effects of providing students with instructional objectives, adjunct questions and advance organizers (Gagne, 1978). Students' cognitive processing during teaching consists of reciprocal interactions among their cognitive processing system on the one hand, and the curriculum and instructional cues on the other. If students were exposed to curricular information devoid of instructional cues, that is, without instruction, they almost surely would learn something. The intent of supplementing curricula with instruction is to improve the quality of students' cognitive processing beyond their natural levels. Thus, the objective of teaching is to influence the cognitive processing students use to learn.
According to Dembo (1994) cognition can be divided mainly into three, as represented in the diagram (figure 2.2).

Figure 2.2. Cognition and its subdivisions
(Dembo, 1994)
2.3.2. Information Processing Styles

A long-term memory is made up of a large number and variety of schemata, concepts, ideas and facts against which incoming information is compared, coded and stored. Coding incoming information depends on identifying and defining characteristics, and then, analysing similarities and differences. Kogan (1976) distinguished differing styles of conceptualisation by showing children pictures of familiar objects, which had to be put into groups.

Educational goals are divided into three domains: cognitive, affective and psychomotor. Cognitive goals deal with the development of student's intellect. Growth in this area includes the acquisition of basic skills such as reading, and the ability to add and subtract, learning of facts, concepts and generalisations.

Information processing is one of the important goals within the cognitive family. It is the way the pupils gather and organise information from the environment in order to form useful pattern.

2.4. Teaching Models.

Since the beginning of formal education, attempts have been done to find out the best way to teach. Attempts on this problem have focussed on authoritarian versus democratic techniques (Anderson, 1959), discovery-oriented versus expository approaches (Keislar & Shulman, 1966), teacher versus student-
centredness (Dunkin & Biddle, 1974) and direct versus indirect approaches to teaching (Peterson & Walberg, 1979).

Joyce and Weil first formalised the notion of varying procedures for different teaching situations when 'Models of Teaching' was published in 1972. The Models Approach to teaching recognises the importance of the components of teaching (teacher, students and subject matter).

Teachers are the most important factor influencing the effect of teaching procedures. Students are the second factor influencing the choice of a teaching method. Each student responds differently to various instructional strategies (Corno & Snow, 1986). Studies indicate that practices found effective with one type of students are actually ineffective with others (Coker, Medley & Soar, 1980). A third factor influencing teacher's choice of technique is the content being taught. Referring to a particular content, the teachers' goals are related but different. To reach each of the goals in the same way would be ineffective and potentially counter productive.

No single approach to teaching is appropriate in all situations. Effective teaching requires alternative strategies to accomplish different goals. The best technique is the one, which is most effective for reaching a particular goal in a given situation. Actual selection and use of procedure occurs only if the teacher has a repertoire of techniques. The use of optimal strategies in teaching demands
knowledge of alternatives. Models are prescriptive teaching strategies designed to accomplish particular instructional goals. The use of models requires an ability to specify precise learner outcomes so that a specific model can be selected to match a particular goal. A teaching model is a type of blueprint for teaching. The model provides structure and direction to the teachers and it cannot dictate all actions taken by a teacher. A teaching model is not a substitute for teaching skills. It is a tool to help the teacher to teach more effectively by making their teaching more systematic and efficient. In other words, a teaching model is a design for teaching within which the teacher uses all skills and insights.

Although a great deal of work has been done on how pupils learn in the area of Educational Psychology, Social Psychology, Psychiatry, Anthropology, and many other disciplines, there remains a big gap between theoretical knowledge and actual teaching practices in the school. Bruce Joyce and Marsha Weil (1980) have transformed prevailing theories and theoretical knowledge into different models of teaching.

**The salient features of models of teaching are**

1. It is interactive and participatory in approach.
2. Adaptability of innovation should be research-based.
3. Implementability is experimentally tried and field-tested.
4. Persuasive power is more because of empirical evidence and
5. Teacher educator is the delivery agent.
Theoretical Overview

The improvement of teaching competencies of prospective teachers through a programme of scientific knowledge led to several innovations like behaviour modification approach, interaction analysis, and microteaching. The skills of microteaching were identified on the basis of Herbartian method of teaching. Therefore, it has partly defeated the ultimate purpose of improving teaching methods in schools. This leads to search for new methods of teaching.

A model of teaching consists of guidelines for designing educational activities and environments. These are meant for creating environments with specifications for constructing learning situations. It may help us to design instructional material and to guide instruction.

2.4.1 Functions of a Model of Teaching.

The following are the specific functions of a model of teaching or how does a model help the practising teacher in classroom teaching-learning process.

(i). Guidance.

A model of teaching serves a useful purpose of providing, in definite terms, what the teacher has to do. By using a model of teaching in a classroom situation, teaching becomes a scientific, controlled and goal directed activity. Thus a model of teaching provides guidance to the teachers as well as students to reach the goal of instruction.
(ii). Developing Curriculum.

A model of teaching helps in the development of curriculum for different classes and at different levels of education.


A model of teaching specifies in detail the different types of instructional materials, which are to be used by the teacher to bring desirable changes in the personality of the learners.

(iv). Improvement in teaching.

A model helps in teaching-learning process and improves the effectiveness of teaching.

2.4.2 Characteristics of Model of Teaching.

All models of teaching have some common identifiable characteristics as follows.

(i). Specific Procedure.

A model of teaching is a systematic procedure to modify the behaviour of learners. They are based on certain assumptions.


All models of teaching specify the learning outcomes in detail on observable student's performance i.e. what the student will perform, after completing an instructional sequence.
(iii). Specific of Environment

Every models of teaching specifies in definite terms the environmental conditions under which a student's response should be observed.


A model specifies the criteria of acceptable performance, which is expected from the students. It delineates the behavioural outcomes, which the learner would demonstrate after completing specific instructional sequence.


All models of teaching specify mechanisms that provide for students' reaction and interaction with the environment.

![Diagram of Families of Models of Teaching]

**Figure 2.3**: Families of Models of Teaching

The models of teaching have been organised into four families as given in the figure 2.3.
2.4.3. **Information Processing Models.**

There is an orientation towards the information processing capability of students and the ways by which they can improve their ability to cater information. An information processing approach to learning stress the importance of meaningful, purposeful learning versus rote memorisation of content. The aim of these models is to tap the ability of the learner to solve problems and thus to emphasise productive thinking, while some are concerned with general intellectual ability.

Each model consists of theory and practice training. In order to translate a theory into practical teaching form, a set of four concepts are relied upon. (i) Syntax (ii) Principles of Reaction (iii) Social System (iv) Support System.

Syntax describes the model as a flow of actions in terms of sequence of events, which are called phases. Each model has a distinct flow of phases. Principles of reaction are a guide to the teacher's response to the learner. The teacher tries to shape the behaviour of the students by rewarding certain student activities, and by maintaining strict neutrality towards others. Social System is a description of student and teacher rules and relationship and the kinds of norms that are encouraged. The leadership of the teacher varies from model to model. The support system refers to additional requirements beyond the usual skills, capacities and teaching facilities necessary to implement a model.
2.5. Concepts and Conceptual Understanding.

Mental images are referred to as concepts. Understanding concepts depends to a large extent on one’s experience, and therefore, it is almost impossible to learn all there is to know about many concepts. Concepts are important in teaching and learning because they constitute the basic structure of a field of knowledge. Concepts are used to form theories and generalisations in the fields of knowledge and therefore serve as the key stone to the understanding of these broad principles and laws. Programmes in Mathematics, Science, and Social Studies have organised their curricula around key concepts in those fields.

A concept is a remarkably difficult term to define, but one simple starting point is to think of a concept as a set of objects or events having common features. For example, the concept of triangle consists of all shapes that have three sides. Concept has been defined by Bruner, et al. (1956) as "a class or grouping of response, an act of categorisation, of ‘rendering equivalent’. The act of categorisation involves rendering discriminably different things equivalent, to group the objects and events and people around us into classes, to respond to them in terms of their class membership rather their uniqueness”.

Bruner and his associates (1956) studied the attainment of concepts and they defined concepts as "a network of significant inferences by which one goes beyond a set of observed critical properties exhibited by an object or event to the
class identity of the object or event in question and hence to additional inferences about other unobserved properties of the object or event".

According to Dececco (1968) “A concept is a class of stimuli which has common characteristics. These stimuli may be objects, events or persons”. Concepts form the basic elements of human knowledge. They represent in a general way, the learner’s categorisation system. Concepts have been operationalised by instructional technologists to indicate types of classifying rules (Anderson, 1983; Merrill & Tennyson, 1977) that are used to facilitate the classification or identification of instances (Klausmeier, 1980).

The word ‘concept’ is as old as humane civilisation in this planet. It has appeared in the writings of Plato, but experiment in the area of concept learning dates back to the beginning of this century only (Encyclopaedia of Britannica, 1977). Concepts can be defined as general mental notions of things or events arrived at by the process of perception, classification and discrimination, used as a basis for thought and expressed through symbolic language (International Dictionary of Education, 1977).

Klausmeier and his associates defined concepts as follows. “Concepts are mental constructs, that is part of the organised cognitive structure of the individual, a category of learning outcomes. They are learned and as they learned to higher levels may be used increasingly to generalise to new examples and to discriminate
non-examples of the concept, to understand exclusive-inclusive, hierarchical and part whole relationships, to understand cause and effect, correlation, probability and axiomatic relationship among concepts, and to solve problems involving the concept (Klausmeier and Allen, 1978).

Tennyson and Park (1980) assume concept to be “a set of specific objects, symbols or events which share common characteristics (critical attributes) and can be referenced by a particular name or symbol”.

According to Weil and Murphy (1982) concepts are the building blocks for the structures of knowledge of various academic disciplines and are critical components of an individual’s cognitive structures.

Galotti (2000) believed that concept is a mental representation of some event, object or pattern that has stored in it much of the knowledge that is typically thought to be relevant to the object, event, pattern. For example most people’s concept of ‘dog’ would include information to the effect that it is an animal, has four legs and a tail, has a reputation as man’s best friend, is a common pet and so on. Medin (1989) defined the concept as “an idea that includes all that is characteristically associated with it”.

Membership of a category is not determined by precise rule but rather by the degree to which a candidate possesses the feature characteristics of existing members, the more of these features a candidate possesses, the more likely to be a
member. In this view, concepts are “fussy” in the sense that they are not demarcated by clear boundaries.

Concepts provide the building blocks for logical thought, because by comparing concepts we are able to think and reason. The ability to form concepts is not simply to intelligent thought; it is critical to our ability to function. The ability to group similar events together in concepts allows us to impose coherence on the turbulent stream of our perceptions (Liberman, 2000).

Though concepts form one of the most important dimensions of learning and cognitive development, subsequent research has shown the multitude of other components to comprise the total realm of thinking (Gagne, 1985; Good & Brophy, 1980).

![Figure 2.4. A conceptual network of Dog (Eggen and Kauchak, 1990)]
Each person’s conceptual network around an idea is personal and idiosyncratic and reflects that person’s exposure to the content. The network of ideas surrounding a child’s concept of dog is represented in the figure 2.4.

2.5.1. The Relationship among Facts, Concepts and Generalisations

The relationship among facts, concepts and generalisations is represented by a triangle-shaped diagram. Facts, being the most numerous, are placed at the base of the triangle, concepts at midrange, and generalisations at the apex. The facts are combined into categories of related meaning to form concepts. Concepts are used to form generalisations.

Facts and specifics are more easily recalled if they are learned in relationship to some overarching concept. The concept becomes a category in which specific facts can be placed. Factual learning is achieved by associating a specific bit of

![Diagram of the relationship among facts, concepts, and generalisations](Foster, 1997)
information with the verbal symbol used to label it (figure 2.5).

2.5.2. Developing Conceptualisation Skills.

Concept development, or the process of acquiring the ability to develop concepts (conceptualisation), can be a slow process (King & Kitchner, 1994) and does not occur at all among many individuals. Research reveals that not only do many students fail to develop those concepts essential to understanding subject content but frequently teachers are unaware of the failure (Perkins & Blythe, 1994). Furthermore, often the concepts that students do hold are not the concepts teachers think their students have (Heckman, Confer & Hakim, 1994).

2.5.3. Teaching Concepts.

Concept learning is based on the ability to identify specific properties or characteristics associated with a particular concept. Conceptual teaching means teaching for meaning. Therefore, any teaching strategy selected must be one that promotes meaningful learning. We teach and learn concepts by describing them, defining them, or providing examples of them.

Foster (1977) provided different strategies for the teaching of concepts. One way to teach concepts is to use a listing-grouping-labelling sequence. In this, the following procedures were used.

1. The teacher had the children list as many items as they could think of that were associated with the concept.
2. They were then asked to group those items that seemed to belong together. This necessitated identifying common properties.
3. Then the students had to label each group.

In the second strategy experiencing-hypothesising-testing sequence is used. This is also inquiry oriented. In this, the following procedures were used.

1. The learners are provided extended, direct, first hand exploratory experiences with the concept.
2. Essential terms and sub-concepts are defined, and their meaning are developed, as the need for such definitions and meanings emerges in the learner's process of study.
3. The learners are encouraged to make statements of principles that seem to explain the main concept, based on their observations and first hand experience.
4. These statements are then tested, rejected, and/ or confirmed by observing new examples of the concept in operation.
5. The statements are refined through extended first hand experiences that expand the meaning of the main concept.
6. Students are given an opportunity to apply the concepts in a context familiar to them.

This procedure is widely used in teaching Science, Mathematics and Social Studies concepts.

The next strategy involves recognising examples and non-examples. In this procedure of concepts development, the following steps are used.
1. Identified the symbol (word) for the concept.
2. Provided the major attributes of the concept.
3. Provided an example that illustrated the specific attributes of the concept.
4. Provided a non-example of the concept.
5. Presented examples and non-examples, had the learners identify major attributes, and explained why each was or was not an example of the concept.
6. Encouraged the children to find examples and non-examples on their own, as a follow-up exercise.
7. Assessed whether or not the learners could identify examples and non-examples.

Teaching of concepts is the activity with which most teachers are concerned. The general category of concept learning embraces concepts at a level of abstractions, ranging from simple concepts, such as 'tree' or 'man', to the highly abstract bodies of concepts such as laws of Physics that determine planetary motion etc. There are certain fundamental processes that seem to be relevant at all levels of concept learning. Knowledge of these processes is indispensable to the systematic and effective teaching of concepts.

Stones (1994) presented a heuristic guide for teaching concepts. He divided the phase of teaching into three, such as Preactive, Interactive and Evaluative phases.
A. Preactive.

1. Make a pedagogical analysis of the teaching objectives to identify the key concepts involved, the subordinate concepts, specific examples, methods of presentations, learner activities and methods of evaluation of learning.

2. Ascertain learner’s prior knowledge. If this is not possible, plan for diagnosis at the interactive phase.

B. Interactive.

3. Give a preliminary idea of the nature of the new learning.

4. Explain terms to be used in labeling the new concepts and their attributes and call to mind existing concepts relevant to the new learning.

5. First provide a series of simplified exemplars with a few attributes to facilitate identification of the criterial attributes.

6. Increase the salience of criterial attributes to enable learners to discriminate readily between criterial and non-criterial attributes. Decrease the salience as learning develops.

7. Provide a series of exemplars organized to provide a complete range of criterial attributes as economically as possible.

8. Provide non-examples in juxtaposition to exemplars to enhance discrimination between criterial and non-criterial attributes.

9. Provide new exemplars and non-exemplars and ask the learners to identify the exemplars. Provide feedback for each discrimination.

10. Encourage learners to use their own language in explaining nature of the concepts.

11. Provide suitable cueing throughout to ensure that pupils gradually become independent in their ability to identify novel exemplars of the concepts.
C. Evaluative.

12. Present novel exemplars of the concepts for the pupils to identify and/ or discriminate from non-exemplars.

In the item 1, the criterial attributes of the concept being taught are identified. A thorough pedagogical analysis is likely to identify the concepts subordinate to the main learning and guide the teacher in identifying lack of understanding and its remediation.

The item 12 is the acid test of the understanding of concepts.

Harrison (1990) suggested the following steps for helping students learn major concepts.

1. Present a nominal definition of a concept and give examples.
2. Emphasis the common attributes and ask students to name further attributes.
3. Ask students to give examples.
4. Have students give totally opposite examples.
5. Have students name metaphor: to compare with and contrast to the original data.
6. Have students review contexts in which the concept takes place.
7. Describe the concept’s overt application.
8. Identify environmental factors that facilitate or hinder the concept’s application.
9. Formulate an operational definition involving the last steps of this process.
10. Discuss consequences in terms of viable solutions to a given problem.

Dececco (1988) formulated the following series of steps, which are listed below, in teaching of a concept.
1. Describe the performance expected of the student after he has learnt the concept.
2. Reduce the number of attributes to be learned in complex concepts and make important attributes dominant.
3. Provide the student with useful verbal mediators.
4. Provide positive and negative examples of the concept in terms of appropriate number and realism.
5. Present the examples in close succession or simultaneously.
6. Provide occasions for student responses and the reinforcement of these responses.
7. Assess the learning of the concept.

According to Borich (1996), both inductive and deductive methods help in concept teaching. To learn concepts, the learner will need to go beyond the acquisition of facts, rules and sequences to be able to distinguish examples from non-examples. Observing examples and non-examples, examples represent the concept being taught by including all of the attributes essential for recognising it as a member of some larger class and non-examples fail to represent. The concept being taught by purposely not including one or more of the attributes essential for recognising it as a member of some larger class. Therefore, for the teaching of concepts, the examples and non-examples that define criterial and non-criterial attributes of a concept are needed. Use of examples and non-examples provides clear discrimination between other related concepts and thus the learner's concept is expanded.
Bruner, Goodnow and Austin (1956) conducted some of the earliest work on how people attain concepts. They identified several components in that process: acquiring information necessary to isolate and learn concept, retaining the information for later use, and transforming the information to make it usable when testing ideas about new possible instances.

Some experimental evidence indicates that students can learn to identify concepts without being able to define them correctly. If thorough concept learning includes the ability to use the concept in communication, special attention should be given to learning of the definition. The teacher cannot assume that the student's ability to define the concept follows from his ability to identify the concept. Some concepts in Science, Mathematics, and other disciplines are difficult to describe in words. It is most necessary to provide special training for concept definition when that definition is particularly difficult to formulate.

Pupil can and do form and use prototypes, at least under certain conditions and with certain stimuli. Reber (1967, 1969, and 1976) conducted a series of studies bearing on the issue of whether subjects ever retain and make use of information about specific exemplars. Reber concluded that when complex underlying structure exists, pupils are better off memorising exemplars than trying to figure out what structure is, because subjects who try to guess the structure often invent incorrect rules or structures.
Brooks (1978) called these processes non-analytic concept formation drawing to contrast to analytic (logical, scientific, focused) concept formation.

Non-analytic concept formation requires that pupils pay attention to individual exemplars, storing information about and representations of them in memory. Later classification is done by comparing new instances to the representations drawing analogies between new and old. Nelson (1984) argued that much of our real-life conceptual knowledge is acquired non-analytically rather than analytically. Children are especially likely to use this mode of concept learning. Furthermore, she believed that non-analytic concept formation is likely with materials that have strong family resemblance 'structures'.

2.5.3.1 Psychological Essentialism.

Medin (1989) examined pupil's reliance on underlying nature as a basis for many concepts. He proposed a new framework that is called as psychological essentialism. Medin's idea is that classifying on the basis of perceptual or other superficial similarity may be a strategy that can be effective much of the time. Still, when the situation calls for it and if the expertise is possessed, classification on the basis of deeper principles is needed.

The teacher can help the students understand the concepts by using the following specific strategies.

1. Providing more than single example.
2. Using examples that vary in ways that are important to the concept being defined.

3. Including non-examples of the concept that nonetheless possess important dimensions of the concept.

4. Explaining why non-examples are non-examples, even though they may share some of the characteristics as examples.

2.5.4 Terminology of Concept.

Derived from Bruner’s study on concepts and how pupil attains them, there is some special terminology related with a concept. The following are the elements of a concept and have special function in all forms of conceptual learning especially concept attainment.

1. Name
2. Attributes
3. Attribute Value.
4. Exemplars
5. Rule/Definition.

(i) Name
It is merely the term given to a concept. Once a concept is established, it is named so that we can refer to it symbolically. The conceptual understanding process is not one of guessing names but to get the attributes of a concept clear.

(ii) Attributes
Attributes refer to the characteristics of a particular concept that help to distinguish instances of the concept from non-instances. These attributes may be
relevant, irrelevant or criterion related. Essential attributes are those that are critical to the domain under consideration. Exemplars of a concept have many attributes, all of which may not be essential for the concept. For example, Nations have trees and flowers also but for the concept of 'Nation', trees and flowers are not essential attributes. ‘Relevant’ attributes are common to all examples of a concept, where as ‘irrelevant’ attributes may vary among examples, i.e., are associated with certain examples of a concept, but not with other examples of the same concept (Harris & Harris, 1973)

(iii) Attribute Value

Attribute value refers to the degree to which an attribute is present in any particular example. For some types of concepts (e.g. ‘Triangle’) attribute values are not a consideration. For others (e.g. ‘Honest’) they are. That is, attribute values are the particular variation an attribute undergoes.

(iv) Exemplars

The exemplars are a subset of a collection of data or a data set. The concept is the subset or collection of samples that share one or more characteristics that are missing in others. Bruner used the term exemplars to indicate the array of all instances of the concept.

Those instances that contain all the critical attributes are called positive exemplars. The instances that do not contain all the critical attributes are called
negative exemplars. It is by comparing the positive exemplars and contrasting them with the negative ones that the concept is learned.

(v) Rule/Definition.

It is a statement specifying the essential attributes of a concept. This statement should evolve at the end of the concept attainment process.

2.5.5. Levels of Conceptual Understanding.

Researches in the field of concept learning have been conceived under two major areas (Eysenck & Wilson, 1976), namely

(i) Research on the development of basic concepts in children referred to as “concept formation studies”.

(ii) Research on the development of new concepts in adults, referred to as “concept attainment studies”.

Concept attainment is the process by which mature individuals arrive at concepts in particular instances by using already acquired cognitive skills, whereas, concept formation is the developmental process of acquiring the cognitive skills necessary to thinking and to attain concepts (Bruner, et al, 1977). Joyce & Weil (1985) have made distinction between concept attainment and concept formation. In concept attainment the concept already exists, in contrast, the concept formation is the act by which new categories are formed, it is an act of invention.
Tennyson & Park (1980) defined concept learning as “the identification of concept attributes which can be generalised to newly encountered examples and discriminate examples from non examples”.

Klausmeier and his associates conducted series of experiments since 1960 dealing with both external and internal conditions of concept learning and behavioural analysis of concepts from different areas of school learning. On the basis of the findings of these studies, Klausmeier (1971) specified mental operations required for the proposed model of Conceptual Learning and Development (CLD). Later on, the model was modified (Klausmeier and Allen, 1978). It includes four levels of concept attainment. The four levels are hierarchical in nature and involve specific cognitive operations. The different levels of concept attainment are

i. Concrete level.
ii. Identity level.
iii. Classificatory level
iv. Formal level

This can be represented in the figure: 2.6.

![Levels of Concept Attainment](Klausmeier & Allen, 1978)
2.5.5.1 **Concrete Level.**

The three operations of concrete level as Klausmeier and Allen (1978) have observed are “attending to perceptible features of an object, discriminating the object from other objects, and remembering the discriminated object”. ‘Attending’ is the primary operation in all types of learning and has been named as ‘starting’ mental operation in the process of learning. A successful ‘attending to an object’ operation leads towards discrimination of that object from other objects.

Hierarchical nature of mental operations is inter- and intra- levels of concept attainment demands storing of acquired skills and knowledge for future use. Hence, memory at concrete level stores inputs obtained through ‘attending’ operation to facilitate discrimination. Generally, the attainment of a concept at this level requires attending to the distinctive features of an object and forming a memory image, which represents the object as a unique bundle of features.

2.5.5.2 **Identity Level.**

Besides, the operations involved at concrete level, generalising objects and remembering generalisation are attained by children as new mental operations at identity level. At identity level, children have to discriminate from various forms of same object and to generalise particular form of the object as the same object. Attainment of concept at the identity level is inferred by the individual’s recognition of an object as the same one previously encountered when the object is observed in
a different situational context or from a different spatial temporal perspective, or when it is sensed in a different modality such as hearing or seeing.

Hence, children at identity level, discriminate wooden furniture or steel furniture from the furniture available in their houses. They arrive at the process of generalisations through classification. Vernon (1970) observed that attainment of concepts at identity level involves both discriminating various forms of the same object from other objects and also generalising the forms as equivalent. Generalising the identity of objects and processes across environmental contexts is the new mental operation postulated to emerge as a result of learning and maturation that makes attainment at the identity level possible. The child who recognises the book as the same one when it is removed from one room to another has attained the concept of the particular book at the identity level.

2.5.5.3. Classificatory Level.

Klausmeier and Allen (1978) observe "individuals are still at classificatory level when they correctly identify a large number of things as examples and others as non examples but can not use societally accepted defining attributes of the concept in evaluating the examples and non examples". The individual is able to classify a large number of instances but cannot accurately describe the basis of his classification, or grouping in terms of the defining attributes. Generalising that at
least two different things are equivalent is the new mental operation that makes attainment of the concept at classificatory level possible.

2.5.5.4. Formal Level.

It is the highest level in the hierarchical ladder of concept attainment. Besides the mental operations of prior levels, new operations of this level work either through inductive or through deductive (reception) processes. Formulation of hypothesis on the basis of defining attributes of the concept and the rules joining these attributes are the key mental operations in inductive process. Once, hypotheses are formulated, children remember them at evaluate one after other on the basis of examples and non-examples of the concept. Inference drawn about the concept is again evaluated on the basis of presence or absence of defining attributes of examples and non-examples of the concept. A concept is said to be attained at formal level when the individual can correctly identify the examples and non-examples of the concept, name the examples, discriminate and name the defining attributes of the concept, give a socially accepted definition of the word that represents the concept, and evaluate how examples of the concept differ from examples of other concepts.

Conclusively it can be said that conceptual understanding involves three basic cognitive behaviours.
(i) Understanding the characteristics of the given concept and association of that concept within a content area.

(ii) Applying the given concept.

(iii) Knowing when, where and why to employ a given concept.

These cognitive behaviours are best learned when acquired within meaningful contexts. That is, teaching of concepts is more than a mere presentation of information.

2.5.6 Conceptual Hierarchies.

Each concept is not formed in isolation form but rather in relation to other concepts. Smith (1975) described the process of forming new concepts as one of partitioning old categories into smaller and more specialised ones. One way of describing the relationship is in terms of superordinate, co-ordinate and subordinate concepts. It is diagrammatically represented in figure 2.7.

![Diagram of Conceptual Hierarchies]

**Figure 2.7.** Conceptual hierarchies
Through super ordinate, subordinate and co-ordinate relationships, concepts provide us with the building blocks for ordering and relating classes of events.

2.6. **The Concept Attainment Model**

The Concept Attainment Model developed by Joyce and Weil is based on Bruner's theory of Concept Attainment. Joyce and Weil discuss three variations of this model: the reception oriented model, the selection oriented model, and the unorganised material model. They are explained later (2.7).

2.6.1 **Selecting teaching Models.**

The teacher should view the models of teaching as ways of accomplishing a wide variety of objectives. No single teaching strategy can accomplish every purpose. No single model can be adequate for a teacher who specialises in teaching one subject. Each model is relevant in particular goals. For example synetics may be used to teach creative writing, non-directive methods help students to develop their own potentialities etc.

2.6.2 **Application and Utility of Teaching Models**

Teaching models have direct application and utility in making the teaching-learning process more effective. The teacher, learner and the subject matter are the main elements, which interact with one another in the teaching-learning process. The models in general emphasise one or more dimensions of teaching. This can be represented as in figure 2.8. The personal dimension involves the individual's quest
for meaning and development; the social dimension, the interpersonal aspects of teaching as well as the obligation to the larger society; and the intellectual dimension relates to the cognitive faculties of an individual.

![Diagram](image.png)

**Figure 2.8.** Dimensions of Teaching Models (Singh, 1995).

![Diagram](image.png)

**Figure 2.9.** Outcomes of Information Processing (Singh, 1995)
Models belonging to the Information Processing family aim to develop process skills along with mastery of the content. The primary processes involved in the Information Processing Models are observation and inference. The processes are used by students to generate the different content forms, with each form characterised by the process skill involved. Outcomes of the Information processing is represented by figure 2.9.

Pupils having multi-dimensional personalities having different learning styles the implication of these facts is that the teacher should use different strategies of teaching to match the objectives of teaching and the different learning styles and personalities of students (Passi, Singh and Sansanwal, 1990). Researchers like Dunn and Dunn (1979), Fischer & Fischer (1979), Ellis (1979), Joyce and Weil (1980) matched different approaches, strategies of teaching with the objectives of instruction and pupils’ learning styles. Competence in teaching stems from the capacity to reach out to differing children and to create a multidimensional environment for them. Models of teaching emerged out of the search by Joyce and Weil to find a variety of approaches and to find a variety of strategies of teaching. Thus obtained a solution to differing learning styles (Ellis, 1979).

2.7. Strategies for Learning Concepts.

According to Bruner (1977) strategy refers to the sequence of decisions people make as they encounter each instance of a concept. Strategies of thinking
are not always perceived consciously by the person using them, and they do not remain fixed. People use different strategies for different types of concepts. There are ideal strategies having the property of minimising cognitive strain that one must encounter enroute to a solution. Bruner et.al (1977) state “there are also ideal compromise strategies that serve both the purpose of cognitive economy and rapid solution”. There are six strategies to learn a concept. These six strategies are classified under two broad categories that is ‘selection’ and ‘reception’ strategies. Selection strategies are used when the teacher is free to choose concept instance (exemplars and non-exemplars) in order to test the hypothesis about concepts. With the reception strategies the learner’s major area of freedom is in the hypothesis he chooses to adopt, not in the manner in which we can choose instances to test.

In the teaching using selection strategies, the teacher presents unlabelled examples of the concept and the students inquire as to which of the presentation are the examples and non-examples. The four selection strategies can be divided into two groups scanning strategies (successive and simultaneous) and focusing strategies (conservative and gambling). The major difference between these groups is that when using scanning strategies the learner is testing hypotheses about concepts, whereas with focusing strategies the learner is concerned with concept attributes. Successive scanning consists of testing one hypothesis at a time.
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Conservative focusing requires only one attribute at a time to be altered whereas with ‘focus gambling’ more than one attribute at a time is changed.

In the ‘reception’ strategies the teacher presents examples of the concept that are labelled ‘yes’ or ‘no’. The two reception strategies are wholist and partist. For the wholist strategy, the first example is used into as one’s initial hypothesis. The original hypothesis is used to examine each successive example, and is modified according to the information contained in other examples. The partist strategy begins with the choice of hypothesis about part the initial exemplar encountered. When this hypothesis fails to confirm by the same subsequent instances, the person seeks to change it by referring back to all instances previously met, and making modifications accordingly (Bruner. et.al 1977).

According to Joyce and Weil (1980), there are three types of Concept Attainment Model based on the learning conditions and strategies.

(1) Reception Model
(2) Selection Model and
(3) Model for unorganised material.
2.7.1 Reception Model of Concept Attainment (RMCA)

2.7.1.1 Syntax

The syntax of the model describes the model in action. It describes the sequence of activities called phases. Syntax of the RMCA contains the following phases.

2.7.1.1(i) Phase one - Presentation of data and identification of concept.

This involves presenting the data to the learner. Each unit of data is a separate example/non example of the concept. The examples are presented in a pre-arranged order and labelled 'yes' or 'no'. Learners are asked to compare and justify the attributes of different examples. Students have to develop hypothesis about the concept. In the end, students are asked to name the concept and state the definition of the concept according to essential attributes.

2.7.1.1(ii) Phase two - Testing the Attainment of the Concept.

Learners test their attainment of the concept, first by correctly identifying additional unlabelled examples and then by generating their own examples. After this, the group (teacher-students) revises their choice of concept or attributes and confirms or not confirms the original hypothesis.

2.7.1.1(iii) Phase three - The Analysis of thinking strategy.

In this phase the learners analyse the strategies by which they attain the concepts. Here the learner can describe their patterns, whether they are focussed on
attribute or concept; whether they did so one at a time, or several at once etc. Gradually the students can compare the effectiveness of different strategies.

2.7.2 Selection Model of Concept Attainment (SMCA)

The syntax of Selection Model of Concept Attainment (SMCA) is as given below.

2.7.2.1.(i) Phase one - Presentation of data and identification of attributes.

The procedure begins with the presentation of several instances representing the various combinations of attributes of a concept by the teacher. The teacher then draws the attention of the students to some of the examples presented which illustrate the concept. Then the teacher introduces an instance, which illustrates the positive example of the concept. Students inquire which examples are positive based on the first positive instance given by the teacher. The students may select the examples in any order one at a time, thus generate hypothesis and test them.

2.7.2.1.(ii) Phase two - Testing the Attainment of the Concept.

In the phase two, to test student's attainment of the concept, the teacher presents unlabelled examples. Then the students categorise them as positive or negative. The teacher probes the reasons and confirms their hypotheses. When the teacher became sure that the students have attained the concept, the teacher names the concept and restates the definition according to the essential attributes.
2.7.2.1. (iii) **Phase three – The Analysis of thinking strategy.**

In this phase, the teacher analyses the thinking strategies employed by the students. The students report their pattern of thinking, test hypotheses, focus attributes or concepts and process of hypothesising with all its trials and errors.

In the selection model the students may ask about their own examples in order to attain the concept. The students also control the sequences of examples by choosing the ones they want to inquire about. In general, the selection model places the responsibility for concept attainment and attribute tracking in hands of the students.

2.7.3 **Unorganised Material Model (UNMM).**

This mode of Concept Attainment Model is much more a group discussion than an instructional exercise as in the reception and selection models. In this, role of the teacher is to facilitate group discussion. The learners attain concept from unorganised material. The procedure involves (i) locating the concept (ii) identifying attributes used (iii) discussing the adequacy and appropriateness of the attributes and (iv) comparing the examples to other passages using the same concept. The syntax of this mode of concept attainment model is quite different from those of the reception and selection models. It consists of two phases. Phase I relates to the description of the concept as it is used. Phase II relates to the evaluation of the concept. It relates to the adequacy and appropriateness of concepts being used.
2.7.4. Social System

The second element of a model of teaching is the social system. Prior to the teaching with Reception Model of Concept Attainment (RMCA), the teacher selects the concept and organises the material into positive and negative examples and sequences the examples. The pupils are required to study the attributes of positive and negative examples and hypothesise. In RMCA, the three major functions of the teacher are (1) to record (2) to prompt and (3) to present additional data.

2.7.5. Principles of Reaction.

In this, the teacher has to help the students for the process of hypothesis in the beginning and then for analysis of their concepts and thinking strategies. The teacher should encourage analysis of merits of various strategies, rather than attempting to seek the one best strategy for all pupils in all situations.

2.7.6. Support System.

Concept Attainment lessons are required to be designed in such a way that the concepts are embedded in the material, with positive and negative exemplars, which can be pointed out to the student. The student's job in this is to attain the concepts that have been previously selected by the teacher. When the students are presented with an example, they have to describe its attributes (characteristics) which can be displayed on the blackboard or otherwise.
2.8 Bruner's Cognitive Psychology- Influence in Learning and Teaching.

Jerome S. Bruner may be identified as a cognitive learning and developmental psychologist. Bruner's research has been highly eclectic and influential, not only in psychology but also in education. In his study of humane being he thinks of them as information processors, thinkers and creators. Although Bruner seems not have developed a systematic learning theory as such, a generalised theory about, and outlook concerning, learning is implicit in his various works. His principal concern has been with the means whereby people actively select, retain, and transform information, and this is essence of learning.

Bruner’s earlier writings deal primarily with concept learning; his more recent interest is largely in the area of development. Bruner’s experimental work in the formation of concepts presents a significant contribution to cognitive psychology. His attempt is the first systematic one to examine the belief that people form concepts by generating and testing hypotheses about attributes of the concept in question. And the fact that he applied a controlled, experimental approach to this cognitive problem made cognitivism more acceptable to psychologist reared in an experimental usually behaviouristic tradition.

Two central unifying themes recur in Bruner’s writing. The first is that the acquisition of knowledge, whatever its form, is an active process. The second is that
a person actively constructs his knowledge through relating incoming information to previously acquired psychological frame of reference. This frame of reference is a "system of representation" or "internal model", and permits the individual to go beyond the information given to him. Therefore, each person should be regarded as an active participant in the knowledge-getting process; he selects and transforms information, constructs hypotheses, and alters his hypotheses in light of inconsistent evidence. The kind of learning Bruner and his colleagues studied was 'Concept Attainment'.

2.8.1 Bruner's Theory of Instruction.

Bruner states that a theory of instruction should take into account (i) the nature of persons as knowers' (ii) the nature of knowledge and (iii) the nature of knowledge getting processes. He thinks that "man is not a naked ape, but a culture-clothed human being, hopelessly ineffective without the prosthesis provided by culture. The very nature of his characteristics as a species provides a guide to appropriate pedagogy, and the nature of his nervous system and its constraints provides a basis for devising reasonable inevitable principles for designing a testable pedagogy". Education should concentrate more on the unknown and the speculative, what is known as a basis for extrapolation. In regard to the knowledge-getting process, the critical question is as follows. "How do you teach something to a child, arrange a child's environment, in such a way that he can learn something
with some assurance that he will use the material that he has learned appropriately in variety of situations”.

For Bruner, a theory of instruction should have five major aspects.
1. The optimal experiences to predispose learner to learn.
2. A structuring of knowledge for optimal comprehension
3. Specification of optimal sequences of presentation of materials to be learned.
4. The role of success and failure and the nature of reward and punishment.
5. Procedures for stimulating thought in a school setting.

Bruner’s work was widely accepted, because it made study of thinking tough-minded. Studying the sequence of the choices made when learning concepts gave a way of inferring a subject’s thinking without having to ask what he was doing ‘inside’ his head. Bruner (1983) suggested that one of the limitations was that the categories used were not ‘natural kinds’, that is they did not signal meaningful difference in the behaviour of the objects outside of the laboratory settings. Put it in another way, the concepts learned did not allow anticipation of the significant properties of objects encountered outside that situation, and were meaningless in the broader lines of their subjects. In fairness, Bruner’s latest work (1986-1990) very helpfully works with Jamesian and functionalist themes, among others.

According to Bruner, concepts and principles are the keys to understanding.

He believes learners master subject matter using three modes of representing
experience: enactive, iconic, and symbolic. He feels learning is enhanced by helping students grasp the conceptual framework of a subject and by fostering intrinsic motivation. He stresses that readiness for learning consists of simpler ideas taught to children that enable them to attain more advanced ideas. Bruner emphasized the importance of spiral curriculum.

The theories reviewed in this Chapter were very much helpful for the investigator to prepare the lessons based on the model of instruction selected for the study. A thorough knowledge of theories was found sine qua non especially when the lessons were prepared to teach academically disadvantaged group of students whose mental blocks were a barrier for the development of their cognitive and reasoning skills.
References:


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