CHAPTER - I

1.1 INTRODUCTION

“Education is the process of living through a continuous reconstruction of experiences. It is the development of all those capacities in the individual which will enable him to control his environment and fulfill his potentialities.” (John Dewey, 1950). In the words of Redden (1954) “Education is the deliberate and systematic influence, exerted by the mature person upon the immature through instruction, discipline and harmonious development of physical, intellectual, aesthetic, social and spiritual powers of the human being, according to individual and social need and directed towards the union of educant with his creator as the final end.”

It is necessary to look briefly into the concept of education, as it existed in Western world and in India to develop a better understanding of education and specific topic of research in this thesis. In the Western civilization both Hellenic & Christian tradition contained within itself two different doctrines about human nature. Greek view saw man as rational animal and Christian belief saw man as child of god. Greek thinkers emphasized on men’s duality of sensuous nature and reason. Christianity added another dualism that penetrated deeper into natural and super natural nature of man. Ultimate aim of man is to serve god and enjoy everlasting life and bliss. Aims of education
were defined accordingly. Different western thinkers saw education differently. For example Socrates saw it as tool to bring ideas of universal validity. Aristotle saw it as creation of sound mind in a sound body thus emphasizing on development of various human faculties. Milton looked at education as enabling tool for man to acquire skills to perform various official duties in times of peace & war. Ulich Robert saw education as interaction among and between people and with the objective world. Thus all western thinkers looked at education as a means for man to acquire certain qualities of mind and perform its role in the society at large.

Closer home the existence of idea of education is established from the very fact that word “Shiksha” is derived from Sanskrit verbal root “Shas”. Sanskrit was the language of educated elite in those times. The word “Shas” means ‘to discipline’, ‘to teach’, ‘to instruct’, or ‘to control’. Similarly word “Vidya” is also derived from Sanskrit verbal root “Vid” which means ‘to know’. The term ‘Vidya’ really means ‘knowledge’. In India disciplining the mind and acquisition of knowledge was emphasized. The concept of education in India had a structural bias as right to education was considered to be sole preserve of upper castes until emergence of a more egalitarian social order with infusion of western ideas during the colonial period. Thus educated classes namely Brahmins & Kshatriyas were traditionally supposed to practice the art of statecraft through ages. Other castes down the social ladder played different roles in the society by acquiring skills through family tradition. Learning through family tradition was also a form of education far removed from the formal system of education that existed during the pre medieval period.
During ancient period an international university existed at Taxila inviting students from all around the world. During the post Alexander period Persian influence was visible in cultural life, Arts/Painting, Sculpture; Architecture. Buddhism brought its own influence on education in India culminating into Nalanda University which existed for 650 years to be destroyed by Bakhtyar Khilzi in about 100 AD. This was followed by evolution of madarsa system during medieval period and modern education brought by British rulers, while the objective of madarsa system was to spread the Islamic way of life among youth. The British system of education was driven by the need to train manpower to sub serve the interests of colonial rule. At different times one or more of above different systems co existed. It is evident from above historic facts that education played different roles at different times depending on political dispensation of society at large.

Societies existed in a framework of political institutions, which shifted from aristocratic to democratic form. Agrarian and commercial economies evolved into industrial. Development of science & technology brought about intellectual turn over of ideas. Education is a continuing activity in a society and its aims and methods depend on the nature of society in which it takes place. Hence most perennial dimension of education is social one pointing towards intimate relationship between society & education.

Everyone is born as a member of community that exists with some of its members being unaware of its organization or purpose. It is the impact of education that brings out the development
of social consciousness. It is this consciousness that makes members of a community into potential members of a society that is united by common set of aims and values. In order to achieve these aims & values education plays a double role. It attempts to develop personality of educant and then prepares him/her for membership of the society. Thus education plays dual role of individual personality development and that of adjusting individual to human environment, which is dynamic in nature. The process of imparting of education to young member of a community has been mostly through a system of formal education and school is its modern incarnation.

Education is a bipolar process where teacher is the former pole, the pupil is the opposite pole, knowledge emanating from the teacher to the pupil connects the two and the instrument is the mutual discussion. In the process of education teacher plays significant role in achieving educational goal. The teacher lights the path for the development of basic skills, understanding, work habits, value judgment and adequate personal adjustment of pupils. Wightman (1970) stated that “Warmth exhibited by a teacher was found to have positive relationship to scholastic achievement”. An effective teacher impresses the pupil and changes the pupil’s behavior through his way of teaching. According to Green (1971), “Teaching is the task of a teacher which is performed for the development of a child”. Pedagogy is not a profession but a mission. Missionary zeal, as opposed to mercenary task, imbibes a spirits of fellow feeling, sympathy, love, cooperativeness etc. towards the individual or the group wherein the missionary undertakes the job. According to Milton, “Teaching is not a ‘giving’ matter as is generally understood by layman but giving and taking affair or pedagogically speaking a teaching-learning process,
wherein the teacher not only teaches but learns also, as teaching and learning are complementary process”. Learning to learn is not just a slogan. It denotes a specific pedagogic approach that experiences the requirements of the learner. If the teacher is to adopt and restructure the learning experiences to meet the observations, interests and capabilities of the learners, his approach to teaching should be in relation to objectives of teaching, nature of learner and nature of content. According to Joyce & Weil (1985, 2000) teaching is a process by which teacher and students create a shared environment including sets of values and beliefs, which in turn color their views of reality.

From the philosophical basis of education, we get the aims of education. Every philosopher formulates his own philosophy. The naturalists emphasize the child-centered method of teaching. They recommend proper motivation and effective use of illustrative aids to capture and sustain child’s interest in the lesson. The idealists believe that teaching is essentially an impact of the teacher’s personality on pupils. They recommend discussion method, role learning and a meditation in a cordial atmosphere. The pupil is expected to obey his teacher and have full faith in him. The pragmatists advocate that teaching is possible only in a social medium. So they recommend project and problem solving method of teaching in which pupils are engaged in a useful activity of their own choice and interest.

From the Psychological basis of education we learn the means to attain those aims that are set by philosophical basis of education. Educational Psychology revolves around the learner, the learning process and the learning situation. Thus the main focus of teaching is to facilitate learning. Learning is generally regarded as
change in behavior. It is affected by many factors e.g. pupils’ intelligence, age, social background and interest etc. Although each student learns up to his capacities but these capacities probably enhanced with the help of teaching. It must be designed in such a way that appropriate learning conditions can be developed and desirable changes can be brought in learners. Teaching cannot be improved without studying the nature and factors of learning.

The concept of relationship of teaching and learning is an aid to understand the nature of theories of teaching. Recent work of Piaget, Bruner and Ausubel has also made significant contribution in the field. Gage (1963) explained that the relative neglect of theories of teaching has probably taken place because it may be in the minds of researchers that if there are satisfactory theories of learning, then the teacher can act upon these theories without developing a separate theory of teaching. Teaching is thus viewed as mirror image of learning. And now it is conceptualized that there is difference between the process of teaching and learning. Gage (1972) made a distinction between the process of learning and the process of teaching. He mentioned that theories of learning deal with the ways in which an organism learns while theories of teaching deal with the ways in which a person influences an organism to learn. Bruner (1966) also explained the distinction between theories of learning and theories of teaching. He mentioned that theories of learning and development are descriptive in nature. A theory of teaching, on the other hand is prescriptive. It is prescriptive in the sense that it sets forth the rules concerning the most effective ways of helping children to achieve knowledge and skills. The theory also provides yardstick for evaluating in particular way of teaching. A theory of teaching must attempt to set
forth the best means of maximizing learning on the part of children. Kerlinger (1965) defined the term theory of teaching as “A set of inter related constructs, definitions, propositions which present a systematic view of teaching by specifying relations among variables with the purpose of explaining and predicting”. According to Bruner (1966) a theory of instruction has four major features, Firstly a theory of instruction should specify the experiences, which should implant effectively in an individual pre disposition towards learning. Secondly, a theory of teaching should specify the ways in which body of knowledge should be structured so that it is readily grasped by the learners. Thirdly, the theory should specify the most effective sequences in which the materials to be learned by the learners should be presented. Finally, the teacher should specify the nature and pacing of reward and punishment in the process of teaching and learning.

According to Boyle (1979) teaching is both an act and enterprise. The enterprise of teaching is widely dispersed throughout the society. The acts of teaching are institutionally bound. There are many acts of teaching. They include the logical acts of teaching: informing, explaining, describing, exemplifying, motivating, evaluating, diagnosing, selecting and prescribing. The researchers are yet to evolve a theory that encompasses all the above acts of teaching. In the absence of theories of teaching teacher behavior and teaching style are guided by a number of teaching strategies.

The concept of teaching strategy is comparatively a newer one. It seems to be the result of the shift of research in education from laboratory to classroom. It emphasizes restoration of balance between content and process and ingredients of learning by
analyzing the structure of contents and classifying the function of different levels of content in curricular for the teaching – learning. According to I.K.Davis “Strategies are broad methods of teaching”. B.O.Smith says, “The term ‘strategy’ refers to pattern of acts that serve to attain certain outcomes and to guard against certain others”. A strategy is a purposefully conceived and determined plan of action. A strategy is the teachers approach to use information, selecting resources and defining the role of the students. B.B.Strasser (1964) defines teaching strategy as “A generalized plan for a lesson which includes structure, desired learner behavior in terms of goals of instruction, and an outline of tactics necessary to implement the strategy”. In the view of Stones and Morris (1970) “Teaching strategies is a generalized plan for a lesson which includes structure, desired learner behavior in terms of goal of instruction and an outline of planned tactics necessary to implement the strategy. The lesson strategy is part of a larger development scheme”. Two aspects are involved in this definition of strategy. Firstly, a generalized plan for the presentation of a lesson. Secondly, desired learned behavior in terms of goals of instruction. Teaching strategy is a skillful planning of a working system by which objective can be achieved conveniently. Strategies are never the same. They change according to changing situations. Teaching strategy means the determination of some policy by planning before presenting the contents with the help of which students’ force is faced and the teaching objectives are achieved and it seeks to establish the relationship between teaching and learning in view of achieving the objectives. Teaching strategies have been regarded as broad ways of instruction.
In 1962 Alfred D Chandler proposed that “Strategy” be defined as: The determination of basic long-term goals and objectives of an enterprise, and the adaptation of courses of action and allocation of resources for carrying out these goals. This definition of strategy was afterwards defined by Kenneth and Andrews (1965), Igor Ansoft (1965) and others who brought the idea of strategy as a process instead of a fixed formula like the policy making. Thus the concept of strategy by implication emphasizes identification of objectives, taking actions (process), proving needed support and achieving the objectives. It has been emphasized by several writers that there cannot be one single way of teaching to achieve all the instructional objectives. Objectives of teaching have been classified into three domains – cognitive, affective and psycho-motor. Special efforts have to be made to achieve each of these types of objectives. Not only that, even all-cognitive objectives cannot be successfully achieved in the same way. For example the strategy fit for comprehension level teaching may not be suitable for analyzing level of teaching. Explanations and illustrations may serve the purpose of developing the comprehension in the students. But for developing the ability to analyze and apply the teacher have to resort to some form of inductive or discovery strategy of teaching. Multiplicity of teaching objectives, thus, has resulted into multiplicity of strategies, methods and techniques of teaching. This however does not mean that there is no one to one correspondence between strategies of teaching and objectives. One strategy of teaching is not the case, the objective can be achieved in a number of ways.

The question of adopting appropriate strategies for providing learning experiences and organizing teacher pupil activities
is crucial for effective use of curricular content and achievement of curricular objectives. While dealing with curriculum organization, the curriculum designer should treat teaching learning strategies as an essential component of curricular cycle and while transacting the curriculum, the curriculum practitioner should be consistently conscious about careful selection of appropriate strategies. It would be imperative that, in spite of the mastery over the content on the part of the teacher, he /she should be appropriately oriented with regard to the importance and various types of instructional strategies and the principles that should govern their selection and administration. Function of strategies include ensuring that certain learning will be acquired in as brief a time as possible, inducing students to engage in exchange of ideas, minimizing the number wrong responses as the students attempt to learn a concept, principle etc. and ensuring the attainment of certain content objectives. Strategies should develop desire to do work with the highest measure of efficiency of which one is capable. Strategy should develop capacity for clear thinking. Strategies should expand the range of student interest.

Teaching strategies have been developed on the assertion that a single and best way to teach does not exist and as such different teaching strategies are required to realize different instructional goals. Pupils with multi-dimensional personality have different learning styles. Hence an effective teacher should be able to adopt different strategies of teaching keeping the objectives of teaching, pupils learning style and their personality dimension in mind. With the help of learning theories, an effective teacher should create rich and interactive environment for students. This lead to variety of approaches to design instructions along with teaching learning
situation to achieve specific instructional objectives. The functional and structural guidelines to design instructional material and environment came forward as Models of Teaching.

Models of teaching are prescriptive teaching strategies. Teaching strategies can be Teaching Models. Strategy can be defined as techniques helpful in attaining pre-established goals. In teaching strategies, there is a planned sequence of actions. The appropriateness of teaching strategies determined by the proper synchronization of educational objectives & nature of subject matter & learner specific. Models of teaching differ from general teaching strategies as they are designed to reach specific goals. When a teacher sets goal and adopts a particular strategy in order to achieve educational objectives, here we can say that the teacher is using model approach. Model approach to teaching was developed by Joyce Bruce and Weil (1972). The concept of 'Models of Teaching' seeks to systematically expose the interaction among educational purposes, pedagogical strategies, particular designs and materials.

A teaching Model can be considered as a type of blue print for teaching. They differ from general approaches of teaching in that they are designed to realize specific instructional objectives (Eggen et al. 1979). General approaches of teaching are considered to be applicable to all teaching situations. However, models of teaching are not applicable to all situations. They are rather prescriptive teaching strategies to realize specific instructional goals. Models of teaching are structured, logical consistent, cohesive and logically described alternative pattern of teaching. (Joyce & Weil, 1985). Each model of teaching is developed in its theoretical terms. Its specific procedures are presented in detail, which are more practically oriented to teachers (Schalfer, 1985).
Dececco (1968) made a distinction between teaching models and a theory of teaching. Models do not have rigor of tested theories. Some useful models/teaching strategies eventually give way to empirically tested theories. A teaching strategy is not a substitute for teaching skills. They are rather complimentary. A teacher after having selected an appropriate teaching strategy to match the identified instructional goal is required to make use of requisite teaching skills, which are essential in the use of selected model of teaching. He also distinguishes between teaching models and method. A teaching model is good tool of teaching in which components are inter related and arranged in a sequence where as method is mode of accomplishing an end. It is concerned with the teaching technique for implementing model. Broudy (1963) has stated that “Method refers to the formal structure of the sequence of acts commonly denoted by instruction. The term method covers both strategies and tactics of teaching and involves the choice of what is to be taught, and in which order is it to be presented”. Teaching models are instructional designs. Erickson, Maslow and Rozer (Counselors and Therapist), Ausubal, Bruner, Skinner (Learning Theorist), Hunt, Kolberg and Piaget (Developmental Psychologist), Broudy, Dewey and James (Philosophers) etc. are some of the persons whose theories and researches have contributed to the development of models.

A model of teaching, according to Joyce and Weil (1980) “is a plan or pattern of teaching that can be used to shape curricula, to design instructional materials and to guide instructions in classroom and other settings.” These models are based on practice, empirical
work, theories of learning and speculations about the meaning of theories and researches done by others.

According to Sansanwal & Singh (1990), “A model of teaching is a blue print where theory based well sequenced, replicable steps are given for the creation of certain instructional effects in learners”. Model of teaching has specified a learning outcomes and in observable terms. What the students will perform after completing an instructional sequence is specified in detail. A model specifies the criterion of acceptable performance, which is expected from students. The models of teaching deliberate the behavioral outcomes, which the learner would demonstrate after completing specific instructional sequence. Since the researchers have not paid attention towards the teaching aspect very few models of teaching have been evolved.

Stallings (1977) developed five models – exploratory model, group process model, cognitive development model, programmed model and the fundamental model. Eggen, Kauchak and Harder (1979) have discussed six information-processing models – general inductive model, concept attainment model, Taba’s inductive process model, general deductive model, Ausubel model and Suchman’s enquiry model.

Joyce and Weil (1997) have identified twenty-four models of teaching, which are classified into four families – Information Processing Models, Personal Models, Social Interaction Models and Behavior Modification Models. These are described in the following paragraphs.
Information Processing Model may be defined as the ways people handle stimuli from the environment, organize data, sense problems etc. The goals of information processing models are to help individuals to acquire knowledge through an analysis of data from the world around us. They aim at intellectual growth of the individual. These models are – Inductive Thinking Model, Inquiry training Model, Concept Attainment Model, Cognitive Growth Model, Biological Science Inquiry Model, Advance Organizer Model, Memory and Group Investigation.

Social Interaction Models emphasize the development of capabilities for interpersonal relationships. They lay stress on the development of skills, which help individuals to engage in democratic processes. The Models of teaching in this category are – Social Inquiry, Laboratory Model, Jurisprudential Inquiry Model, Role Playing and Social Simulation.

The goals of personal models are to develop the capacity for personal development in terms of creativity, self-concept, self-understanding, and creative problem solving. These models are – Synectics, Awareness Training, Nondirective teaching, Conceptual systems etc.

Behavioral Modification Models have evolved from endeavours of researchers to develop efficient system for sequencing learning tasks and shaping behaviors by manipulating reinforcement. Exponents of reinforcement theory, such a skinner (1957) have developed these models and operant conditioning as central mechanism. The Models of this family are – Stress reduction, Assertive
Training, Desensitization, Relaxation, Self-control, Contingency Management etc.

The above-mentioned classifications of models of teaching developed by different theorists do have some common characteristics, though there are differences in emphasizing the development of individuality. Further each theorist postulates a model, which is concerned with developing pupil competencies and changing observable behaviors of pupils.

The sample synoptic view of these four categories is given below in Table 1.1

**TABLE-1.1 FAMILIES OF MODELS OF TEACHING**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Category of Model</th>
<th>Name of the Model</th>
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<tbody>
<tr>
<td>1.</td>
<td>Information Processing Model</td>
<td>1. Inquiry Training Model</td>
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<td></td>
<td></td>
<td>2. Inductive Thinking Model</td>
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<td>3. Concept Attainment Model</td>
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<td></td>
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<td>4. Cognitive Growth Model</td>
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<td></td>
<td></td>
<td>5. Advance Organizer Model</td>
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<td></td>
<td></td>
<td>6. Scientific Inquiry Model</td>
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<td></td>
<td></td>
<td>7. Memory Model</td>
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<tr>
<td>Personal Models</td>
<td>Personal Models</td>
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<td>-----------------------------------------</td>
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<td></td>
</tr>
<tr>
<td>Behavior Modification Models</td>
<td></td>
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</tr>
</tbody>
</table>

| 1.  | Programmed Instruction Model          | 2.  | Social Inquiry Model |
|     |                                         | 3.  | Lab Model            |
|     |                                         | 4.  | Jurisprudential Model |
|     |                                         | 5.  | Training Model       |
|     |                                         | 6.  | Role Playing Model   |
|     |                                         | 7.  | Value Discussion Model |
|     |                                         | 8.  | Social Simulation Model |

| 1. Non-directive teaching               | 2.  | Contingency Management Model |
| 2. Awareness Training                  | 3.  | Assertive Training Model     |
| 3. Synectics                           | 4.  | Anxiety Reduction Model      |
|                                         | 5.  | Simulation Model             |
|                                         | 6.  | Relaxation Model             |

**Information Processing Model of Teaching**
The models of this family share orientation towards the information processing capability of students and the ways of improving their ability to master information. Some Information Processing Models are concerned with the ability of the learner to solve problems, and thus emphasize productive thinking. Others are concerned with general intellectual ability. A large number of Models emphasizes concepts and information development from the academic disciplines. These models are concerned with social relationship and development of integrated and functional self. The route, however, is through intellectual functioning.

Seven Models of teaching have been grouped under Information Processing Models. Each has a distinct goal. Table 1.2 gives the name of each Model with its goals and name of the theorist on whose work, the Model was developed.

<table>
<thead>
<tr>
<th>S.NO</th>
<th>MODEL</th>
<th>MAJOR THEORIST</th>
<th>MISSION / GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Inquiry Training Model</td>
<td>Richard Suchman</td>
<td>Designed Primarily for the development of inductive mental process and academic reasoning or theory building, but these capacities are useful for personal and social goals as well.</td>
</tr>
<tr>
<td>2.</td>
<td>Inductive Thinking model</td>
<td>Hilda Taba</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Concept Attainment Model</td>
<td>Jerome Bruner</td>
<td>Designed Primarily for the development of inductive mental process and academic reasoning or theory building, but these capacities are useful for personal and social goals as well.</td>
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<td>4.</td>
<td>Cognitive Growth Model</td>
<td>Jean Piaget</td>
<td>Designed Primarily to develop inductive reasoning but also for concept model development and analysis</td>
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<td></td>
<td>Irving Sigel</td>
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<tr>
<td>5.</td>
<td>Advance Organizer model</td>
<td>David Ausubel</td>
<td>Designed to increase general Intellectual development, especially, logical reasoning but can be applied to social and moral development.</td>
</tr>
<tr>
<td>6.</td>
<td>Scientific Inquiry</td>
<td>Joseph J. Schwab</td>
<td>Designed to increase the efficiency of</td>
</tr>
</tbody>
</table>
### 7. Memory model

<table>
<thead>
<tr>
<th>Model</th>
<th>Harry Lorayne</th>
<th>Jorry Lucas</th>
<th>information processing capacities or absorb in related bodies of knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Designed to teach the research system of a discipline but also expected to have affect in other.</td>
<td>Designed to increase capacity to memorize.</td>
<td></td>
</tr>
</tbody>
</table>

Each model of teaching consists of the following fundamental elements –

**1. Focus** – Focus is the central aspect of a teaching model. For what the model stands is the theme of the focus. All of the teaching models are meant for achieving some specific goal or objectives of teaching in relation to the environment of the learner. Therefore, objectives of teaching and aspects of environment generally constitute the focus of the model.

**2. Syntax** – The term syntax or facing of the model refers to the description of the model in action. Each model consists of several
phases and activities which have to be arranged in a specified sequence quite unique to a particular model. The syntax helps the teacher to use the model. It tells him how he should begin and proceed further.

3. **Principles of Reaction** – While using the model how should a teacher regard and respond to the activities of the students is a concern of the element. These responses should be quite appropriate and selected. Every model through its principles of reaction provide the teacher with particular and unique rules of thumb by which “tune in” the student and select appropriate responses to what the student does (Weil & Joyce, 1978).

4. **Social System** – The fourth element refers to a description of the following –

   A. Interactive roles and relationships between the teacher and students.
   B. The kinds of norms that are encouraged and student behaviour, which is rewarded.

Models differ from each other with regard to the description of the above-mentioned aspects. In some models, the teacher is the centre of activity or activities are somewhat equally distributed between teacher and students while in others the students (A few or the whole group) occupy the central place. The leadership role of the teacher comprising the location of authority and the amount of control over that emerges from the process of interaction also varies from model to model. Similarly the way in which student’s behaviour is rewarded also differs from model to model.
5. **The Support System** – This element of model refers to the additional requirements beyond the usual human skills or capacities from the teachers and the facilities or schedules available in an ordinary class room. Such type of additional support may demand some special skills, knowledge and capacity from the teacher or some special aid material facilities like films, self instructional system, visit to some place, a flexible schedule and a particular organizational climate suiting to the requirements of a particular model. It is needless to emphasize that the support system of a model contributes towards the success of a model by generating a desirable classroom environment.

6. **Application** – The last element of a model describes its application aspect. Some models are meant for short lessons, some for the large and some for both. They also differ in terms of the goal achievements – conative, cognitive or affective – and subsequently prove suitable for one or the other type of teaching. Therefore each model through its element of application context tries to describe the feasibility of its use in varying context achieving specific educational goals and demanding specific work environment.

The effectiveness of Models in Concept learning process has been established time and again. Through education, pupils must be prepared to face the challenges and to keep pace with the advancement of science and technology. Generally, pupils memorize the content and reproduce the same to pass the examination. In such an environment creative thinking interest in inquiry activities and other skills for example problem-solving skills, co-operative skills cannot be
developed among them. To motivate students to learn and to develop skills like mentioned above Concept Attainment Model is the right model to choose. Concept Attainment Model of teaching provides scientific knowledge as well as inculcates enquiry skills. Therefore researcher has planned to study the effectiveness of Concept Attainment Model in teaching of Biology. To give an organized body of content in a meaningful way keeping in mind the cognitive map of the learner simple ideas are presented first to the students followed by complex ideas so that proper learning can take place in sequential and integrated manner. In this way, habit of precise thinking and interest in enquiry can be developed among the learners. The researcher selected Concept Mapping Model to test its effectiveness in teaching of Biology. Both the models have long term effects for example interest in inquiry are common researcher has planned to study the relative effectiveness of Concept Mapping Model and Concept Attainment Model in the class room situation. Various investigators have studied the effectiveness of Concept Attainment Model in the different subjects outside India. Feldman Jacob (2003), Carlson Johnson, Kastl R. (1992), Danielle (1991), Klausmeir (1992). In India, the effect of Concept Attainment Model Advance Organizer Model and traditional method on conceptual learning efficiency and retension in relations to divergent thinking was investigated by Jaimini (1990). Naresh (1995) studied the effectiveness of Concept Attainment Model and compare it with Inquiry Training Model. There is hardly any study seen in which the relative effectiveness of Concept Mapping Model and Concept Attainment Model has been studied.
The views of Novak and Gowin (1984) and Jerome Bruner should be studied to appreciate the difference between Concept Mapping Model & Concept Attainment Model.

Novak and Gowin (1984) developed an offshoot from Ausubel’s theory of meaningful verbal learning i.e. Concept Mapping. It is a technique of hierarchically arranging the concepts in a deductive manner with the broader concepts placed at the top followed by the less inclusive concepts to facilitate meaningful learning.

Jerome Bruner and his associates (1980) developed Concept Attainment Model. It is an approach of teaching based on thinking process used by learner to learn concepts.

1.2 Concept Mapping

It is found that Concept mapping is a learning Model that facilitates meaningful Learning.

1.3 Meaningful Learning

That learning is said to be meaningful which enables the learner to relate the newly acquired knowledge with the previously learnt knowledge. It enables the learner to apply the new knowledge to other situations. It helps the pupils to retain the concepts for a long time. It is found that students who employ meaningful learning can retain knowledge for a long span of time than the students who learn by rote. Meaningful learning depends upon how the learning material is organized and how it is processed by mind. On the other hand, rote learning takes place when new knowledge is arbitrarily incorporated
into the cognitive structure. It is seen that the students who learn by rate are able to recall the new information but they can't apply it in other situations.

1.4 Concepts

According to Novak & Gowin, (1984, 2000) "Concepts are perceived regularities or relationships within a group of objects or events & are designated by some sign or A Concept is a group stimuli, which have common characteristics or symbol". These stimuli may be objects, events or persons. It is a form of data or form of content that results from a categorization of a number of observations. Concepts are named by using labels or terms. The concept name is the label attached to the mental construct & that name is used for the purpose of communication.

1.5 Concept - Maps

Concept maps is a two dimensional body of knowledge. Construction fosters meaningful learning and positive attitude towards the school & subjects. Concept map is a map showing the interrelationships among concepts. Thus a concept map is a convenient & concise representation of conceptual framework about any type of knowledge & can hence be defined as an 'interlocking' network of "newly & previously acquired knowledge" of the learners. In concept maps, concepts are arranged in descending hierarchy, i.e., the most general concepts are placed at the top followed by the specific ones, thereby, giving the whole concept-map the look of a pyramid. In a concept map, concepts are linked with one another and these linkages are made through "words" & "phrases". Concept maps depict an understanding of the relationship between concepts and enhance
meaningful learning. Meaningful learning depends upon how the subject matter is organized. If the content is organized systematically, the meaningful learning takes place. In a concept map, as discussed above, concepts are arranged in a systematic manner. In it, concepts are hierarchically arranged in a deductive manner with the broader concepts placed at the top followed by the less inclusive concepts. This systematic relationship existing among concepts fosters meaningful learning.

According to Novak (1977), concepts do not exist in isolation but depend upon one another for meaning. Concepts, in a concept map, are well connected through links; and these links are powerful connections forming a 'web' of relevant concepts, thereby enhancing their stability in the cognitive structure rather than just connecting general concepts to specific ones; and it also connects previously learned concepts to newly acquired ones. This leads to meaningful learning of concepts & hence enhanced performance on concept learning outcome. This pattern leads to both the quantitative and qualitative increase in the learner's knowledge. In a concept map, the more effective interrelationship among concepts is drawn, the more meaningful learning takes place.

According to Novak (1977), the Concept Mapping is helpful in organizing concepts into well-connected & meaningful entities. Ault (1985) has given the following steps involved in the Concept Mapping Model:

1. First to select a topic. The topic may be an important text,
passage or any laboratory background material.
2. After selecting a topic, main concepts involving in the passage are underlined.
3. Then these selected concepts are ranked from the most abstract and inclusive to most concrete & specific.
4. Then, clustering the concepts according to two criteria concepts that function at similar levels of abstraction & concepts that interrelate closely.
5. In the fifth step, the concepts are arranged in a two-dimensional array analogous to a road map. Each concept is in effect a potential destination for understanding. Its root is defined by other concepts in the neighboring territory.
6. Then, the concepts are linked with the help of lines; and each line is labeled in prepositional form.

1.6 Advantages of Concept Maps

Concept Mapping is very useful for Concept –learning and concept acquisition. From the above discussion, we find that concept maps are very helpful for learners, teachers as well as for curriculum developers. Some of the advantages of concept maps are given below:

1.6.1 Advantages for Learners.

Concept maps are helpful for learners in:

a) The meaningful acquisition of concepts
b) Retaining concepts for a long span of time because construction of a concept map requires a repetitive thinking process about relations among concepts.

c) Summarizing materials when preparing for examinations.

d) Revising the content.

e) Highlighting main concepts & understanding relationships among them.

f) Identifying gaps in their knowledge and hence, commencing them about the continuity of subject matter.

g) Enabling the students to relate newly acquired material to the previously learned material.

h) Enabling the students to apply new information in solving new problems.

i) Reducing burden on working memory because this technique does not emphasize on loading the contents in the minds of the learners.

j) Consolidating the previous learnt material.

k) Developing problem-solving ability: Clarifying misconceptions because a concept map requires a repetitive thinking process about relations among concepts.

l) Increasing achievement of the students because this technique enhances meaningful learning.

m) Concept Mapping Model has a diminishing effect on intervening variables like anxiety, boredom, fatigue etc.

n) Concept Mapping has been proved to be an effective tool, which the students can use to analyze an activity in terms of procedure or content.
0) Encouraging students to construct the most plausible relationships among various concepts.

p) Motivating the learners to take active participation in the whole teaching-learning process.

q) Allowing the learners to exchange views so as to achieve shared meaning.

r) Drawing attention of the low ability students, thereby, increasing their achievement level. Low ability students are likely to benefit more from Concept Mapping since low verbal ability students may also be affected by the distracting features of the laboratory. Concept Mapping may provide them with the means to attend to important information in the activity.

s) Promoting reflective thinking associated with pushing & pulling of concepts, putting them together and separating them again.

t) Identifying connections between concepts.

u) Gaining an integrated view of the subject matter.

1.6.2 Advantages for Teachers

Concept Maps are also helpful for teachers in many ways:

a) Concept Maps are helpful for teachers in designing lesson sequences that allow one proposition to follow naturally from the other and hence, encouraging meaningful learning.

b) Helpful in identifying sub-concepts, arranging them hierarchically & establishing valid inter-relationships among them.

b) Helpful in getting an integrated view of the content.
d) Helpful in defining an instructional goal by indicating the specific objectives to be gained.

e) A concept map serves as an effective tool for showing students alternative framework.

f) By revising concept maps, teachers can develop a more highly integrated understanding of how their curriculum was structured and how meaningfully concepts were related.

g) Concept maps are very helpful for teachers in providing necessary guidance & initial framework with the help of this model. The teacher ‘can design class & homework questions that require the students to reflect on existing & novel situations. This gives them ample opportunity to apply the acquired knowledge.

h) Helpful for the teacher detecting and removing the misconceptions of the students because when the students construct concept maps, the teacher gets an idea of their misconceptions; & once these misconceptions are diagnosed, the teacher can work to do away with them.

1.6.3 Advantages for Curriculum Development

Concept Maps are also very helpful for curriculum developers & evaluators in many ways:

a) Since a concept map depicts a very clear & systematic relationship among various concepts, so it is very helpful for a curriculum developer in planning a unit or course by relating various concepts within a unit format.

b) The changes shown regarding hierarchical structure, integrated reconciliation, & progressive differentiation have implications for the
effective implementation of the curriculum in the school.

c) Concept Mapping Model allows for the improvement in both the process & product of curriculum development.

d) Helpful in revising the existing curriculum in both process and product.

e) Helpful in planning interdisciplinary instruction by developing a conceptually coherent programme that integrates concepts from different areas.

Posner & Rudnitsky (1986) also suggest the use of concept maps as a part of curriculum development process. Leachy (1986) uses concept maps to develop guides to literature. According to Driver & Oldham (1986) concept maps show current trend in curriculum & that the concept maps mirror the constructivist definition of curriculum as a set of learning experiences which enable the learners to develop their understanding.

Novak & Gowin (1984) also suggest utilizing concept maps in curriculum development.

1.6.4 Advantages for Evaluation / Assessment

M.K.Karkam, J. Joel. & Joenes et al (1994) used concept Maps as a research and evaluation tool. In the assessment of the conceptual comprehension of the students, concept maps serve as evaluative devices. Here, conceptual comprehension refers to the ability to grasp the meaning of
the concepts. In order to test the comprehensive ability of the students, the teacher can give the students various concepts & ask them to arrange the concepts, hierarchically in a deductive manner in order to construct a concept map. Scoring can be done with the help of following criteria: a) Validity of propositions & relationships connecting the concepts. b) Correctness of the hierarchical level. c) The validity of cross-links. d) Extent of latitudinal & longitudinal branching. e) Appropriateness of general & specific examples.

1.6.5 Advantages in complex laboratory conditions

Since there is a deep connection between theoretical concepts & experimental observations, concept maps may serve as criteria in complex laboratory environment. As concept maps depict hierarchical relationship among various concepts some unknown linkages may be found out among various concepts. Concept Maps may also be used to relate concepts to the main theme. It is very helpful in identifying cognitive conceptions. As Concept Maps show a very clear relationship among various concepts, so they may prove very helpful in revealing certain misconceptions.

1.7 CONCEPT ATTAINMENT MODEL

Concept attainment model was designed by Bruce Joyce and Weil Marsha on the basis of the work of J. S. Bruner. It is meant for teaching different levels and types of concepts. The CAM facilitates the conceptual type of learning in contrast with rote learning. There are three variations of CAM, the first one is Reception CAM which is more direct in teaching students the elements of a concept. A second variation is the selection CAM which permits students to apply the conceptual activity more actively by using their
own initiation and control. The third variation is unorganized CAM, where the learner transfers concept theory and attainment activity to a real life setting.

1.8 Bruner’s view about concept learning:

Bruner has described the processes by which people acquire concept on the basis of researcher in the book “a Study of Thinking”. All types of concept learning depend upon nature of concepts which Bruner has given as “Theory of concepts” and also described the thinking strategies used by learners in order to acquire concepts.

1.8.1 Theory of Concept –

Bruner sees any concept as having five elements-

a) Name
b) Example (positive and negative)
c) Attributes (essential and non essential)
d) Attributes value and
e) Rule

a) Name:

The name is a term given to a category for example fruit, plant and chair are all name given to category.

b) Example:
The second element ‘example’ referred to instances of a given concept. These instances which possess a concept are called positive examples and others are called negative examples.

c) **Attributes:**

Third element of the theory of concept is attributing. Attributes are the common characteristics that cause to place example in the same category. Bruner differentiated attributes of the concept in the following types – Those attributes are essential ones which play a role in distinguishing examples from non-examples. The attributes that are often associated with the concept but does not play a role in distinguishing example from non-example are called non-essential attributes.

d) **Attribute Value:**

The acceptable value range of an essential attribute of a concept is called attribute value. For example purple is out of the acceptable value range of color of ‘apple’.

e) **Rule:**

The sixth important element of a concept is a rule. It is a definition or a statement specifying the essential attribute of concept. A rule normally evolves at the end of the concept attainment process.

1.8.2 Objectives of CAM-
The CAM produces two types of effects, the instructional effects and nurturing effects. The major instructional objectives of CAM are:

a) To teach specific concept  
b) To understand the nature of concept  
c) To create awareness about thinking strategy and improve concept building strategies  
d) To provide practice in inductive reasoning.

With abstract type of concept certain nurturing effects are also produced by the model. These are:

a) An awareness of alternative perspectives  
b) A sensitivity to logical reasoning in communication and  
c) Tolerance of ambiguity

1.8.3 Syntax of CAM

The syntax of this model describes the model in action, it describes the sequence of the activities (phases) which teachers have to do by using the model.

1. Phase one - Presentation of data and identification of concept

It involves presenting data to the learner each unit of data is a separate example or non-example of the concept.

The examples are presented in a pre-arranged order and labeled ‘Yes’ or ‘No’. The learners are informed that there is an idea or concept that all the positive examples have in common, learners are
asked to compare and justify the attributes of the different example. Their task is to develop a hypothesis about the concept.

2. Phase two – Testing Attainment of Concept

The students test their attainment of the concept first by correctly identifying additional unlabelled examples of the concept and there by generating their own examples.

3. Phase three – The Analysis of Thinking Strategies

In this phase students begin to analyze the strategies by which they attain concept. The learners can describe their patterns, whether they focused on attribute or concept, whether they did so one at a time or several at once, and what happened when their hypothesis was not confirmed. Did they change strategy; gradually they can compare the effectiveness of different strategies.

1.9 Need of the study

Through education, pupils must be prepared to keep pace with the advancement of science technology as existing traditional method of teaching doesn’t develop creative thinking, interest inquiry activities among pupils. Looking into the practical situation, the researcher felt that there is need to use such a teaching model, which can motivate students to learn. Concept Attainment Model lays stress
on understanding concept. Through this model independent thinking, interest inquiry, problem-solving skill can be developed among students, which is the dire need of the present. Concept Mapping is a novel teaching model, which lays stress on arranging the concept in a deductive manner. Through this model interest in inquiry, problem-solving skill can be developed among the pupils. Since some long term effects of both the models, for example interest in inquiry related to concept, are common. Researcher has planned to study the relative effectiveness of Concept Mapping Model and Concept Attainment Model in classroom situation.

**RATIONALE OF THE STUDY:**

Educational institutions play an important role in the all around development of the students. Striving for academic excellence is the dire need of every pupil today. To meet this need we should improve our teaching strategies. Various models like Advance Organizer Model, Biological Science Inquiry Model, Concept Attainment Model, Concept Mapping Model affect the achievement of the students. Out of these Concept Mapping Model and Concept Attainment Model affect adversely the academic achievement of students in Biology. The models in the present study develop creative thinking, interest in inquiry activities among pupils and the effect will be seen on adolescents, the age of stress, strain and full of energy. Researcher felt that for giving proper direction to their energy Concept Mapping Model and Concept Attainment Model was used for teaching of Biology. Through these models problem solving skill, independent thinking can be developed. Keeping the time limit and resources limitations are in mind the researcher choose the students of ninth grade.
1.10.0 The Problem

“EFFECTIVENESS OF CONCEPT MAPPING MODEL AND CONCEPT ATTAINMENT MODEL IN BIOLOGY TEACHING AT NINTH GRADE”

1.11.0 DEFINITION OF KEY TERMS:

The following key terms have been used in the problem.

Effectiveness

It refers to the effect of particular treatment given to a learner, which produces a significant change in pupils’ behavior in terms of their achievement.

Concept Mapping Model

An approach of teaching based on Ausubels’ theory of meaningful verbal learning to teach students.

As this study compares the relative effectiveness of Concept Mapping Model, Concept Attainment Model, there is need to
evolve well defined phases, so as to bring the same functional and operational level as Model.

Four well-defined phases of Concept Mapping were evolved after rigorous discussions with experts in the subject and technique of drawing concept maps. Once at the same structural and functional level, the two strategies can be compared for their effectiveness.

**PHASE I - Presentation of Abstraction**

First, the students are presented with a definition or a generalization. Since a generalization arises from common characteristics of various concepts, the students are asked to identify various concepts and sub-concepts and to enlist them and they are asked to provide new and unique examples to judge their understanding of these concepts.

**PHASES II: Propositional Phase**

The teacher guides the learners to arrange the concepts hierarchically in a deductive manner, with the broader concepts placed at the top followed by less inclusive concepts.
These various concepts are linked by lines and these lines are supplemented by words/phrases, which indicate meaningful relationship among various concepts. Thus the whole concept map is viewed as a network of concepts.

**PHASE III: Application**

Then the students apply their knowledge by citing new examples and reflecting on the present examples.

**PHASE IV: Closure**

Closure is a point at which the students come to the formal conclusions of the lessons. At the closing stage, the students summarize major ideas involved in the process.

**Concept Attainment Model**

An approach of teaching based on thinking process used by individual to learn concepts. In the present study, the investigator tries to explore the effectiveness of the Concept Attainment Model developed by Bruner. The model is found challenging, because it promoting high level of interaction between students and teacher. It develops among students the thinking skills like observation, comparing, generalization. This Model has the following phases:
1. **Phase one - Presentation of data and identification of concept**

   It involves presenting data to the learner each unit of data is a separate example or non-example of the concept.

   The examples are presented in a pre-arranged order and labeled ‘Yes’ or ‘No’. The learners are informed that there is an idea or concept that all the positive examples have in common, Learners are asked to compare and justify the attributes of the different example. Their task is to develop a hypothesis about the concept.

2. **Phase two – Testing Attainment of Concept**

   The students test their attainment of the concept first by correctly identifying additional unlabelled examples of the concept and their by generating their own examples.

3. **Phase three – The Analysis of Thinking Strategies**

   In this phase students begin to analyze the strategies by which they attain concept. The learners can describe their patterns, whether they focused on attribute or concept, whether they did so one
at a time or several at once, and what happened when their hypothesis was not confirmed. Did they change strategy; gradually they can compare the effectiveness of different strategies.

1.12 OBJECTIVES OF THE STUDY:

1. To study the effectiveness of Concept Mapping Model in terms of meaningful acquisition of concepts.
2. To study the effectiveness of Concept Attainment Model in terms of meaningful acquisition of concepts
3. To study the relative effectiveness of Concept Mapping and Concept Attainment Model in comparison to Traditional Method.

1.13 HYPOTHESES:

The following hypotheses will be formulated –
H 01 - There is no significant difference between achievement scores of pupils’ taught through Concept Mapping Model and taught through Traditional method.

H 02 - There is no significant difference between achievement scores of pupils’ taught through Concept Attainment Model and taught through Traditional method.

H 03 - There is no significant difference between achievement scores of pupils’ taught through Concept Mapping Model and taught through Concept Attainment Model.

1.14 DELIMITATIONS OF THE STUDY:

Keeping in view the constraints of time and resources, certain delimitations need to be imposed for conducting the study. Following were the delimitations of the present study:

1. The study was delimited to the subject of Biology.
2. The experiment was limited to eighteen concepts in Biology
3. The experiment was conducted on Ninth Grade students only.
4. The study was confined to Concept Attainment Model and Concept Mapping Model only.
5. Only Achievement test was selected as criteria of effectiveness of Model.
6. The experiment was carried out only in the schools of NOIDA.