CHAPTER I

THE PROBLEM AND ITS BACKGROUND

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THE PROBLEM AND ITS BACKGROUND

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 fulfil his potentialities"


Education is a creative force and as such its responsibility is not only to incorporate corresponding changes in its curriculum and operational procedures, but it should also accept responsibility to contribute to the emergence of needed changes and new discoveries and inventions. This would require frequent diagnosis of the educational system. As a matter of fact it is hard to conceive of society developing without a renewal in educational system. The problem that we face in visualizing the future of educational system is that the future is made up of and is the resultant of change. This recognition that the determinant of society, present and future, is change, is one major gain indeed.

Teaching is the oldest, most indispensable and inevitable of all the professions in the world. In India teaching has been a recognized and revered profession since the dawn of history. In the process of
education, teacher plays significant role in achieving educational goals. According to Gage (1963), teaching is "an act of interpersonal influence aimed at changing the behaviour potential of another person". Mitra (1970) described teaching as a series of acts carried out by a teacher and guided by formulation of teaching task in a formalised instructional situation.

The process of teaching is as old as man on earth; it has been carried out by human beings and even animals also teach their younger generations for the successful adjustment with the nature. The process has undergone several changes with the rapid expansion of knowledge in every sphere of our life. Now it is a most complex meshing among conscious activities events and thoughts between teacher and taught. A number of researches have been conducted on teaching-learning processes throughout the world. New methods, techniques and models have been developed in the western countries. We may also be benefited by these innovations, if we faithfully adopt them in our classroom communications.

The world is now at the beginning of the second scientific industrial revolution of automation and cybernetics, which is likely to be in full swing before the close of century. It is difficult to visualise the changes it will make in the man's life. One thing, however, is certain unless proper steps are taken right from now, the gap between developing countries and the industrialized countries following the second revolution may become too wide to be bridged.

(Indian Education Commission, 1966)
The whole of the civilized world today is dependent upon the inventions of the scientists and the skills of the technologists. Modern advances in science have changed the life of man and give him a new civilization. They have placed in his hand tremendous powers enabling him to control the forces of nature and change his environment to suit his needs. These powers have affected his social relationship by bringing men closer together and making them more dependent on each other than they were previously. Distances have been annihilated.

The rapid development of science is revolutionizing the conditions of life and society. Its impact is now felt in every walk of our life. Not only are the means of productions and industries dependent on science but developments in medicine, agriculture, animal husbandry and practices of public health and sanitation are based on applications of science. Inventions and discoveries of science are making the lives of modern citizen healthier and happier. Whether one wants or not, science has become a part of the fabric of everyday life. Scientific literacy is thus, become an integral part of general education whatever it may be.

As pointed out in National Policy Resolution (1986) "Life in the coming decades is likely to bring new tensions together with unprecedented opportunities. To enable people to benefit in the new environment will require new designs of human resource development. The coming generation should have the ability to internalise new ideas constantly and creatively. They have to be combined with a strong commitment to human values and to social justice. All this
implies better education." (Resolution, 1986, P.3). Such education has to be provided through our formal educational system and institutions.

With the rapid expansion of knowledge in science subjects, now it is a challenge to science teachers of today to evolve new teaching strategies that may help the students to acquire more scientific concepts within the shortest period of time and in a better way. Thus, it is very important for the sake of scientific and technological advancement of the country as well as for the modernization of the society.

Sensing this need the National Policy Resolution (1986) visualised that science education will be strengthened so as to develop in the child well defined abilities and values such as the spirit of inquiry, creativity, objectivity, the courage to question and an aesthetic sensibility. It also emphasised that, "Science education programmes will be designed to enable the learner to acquire problem-solving and decision-making skills and to discover the relationship of science with health, agriculture, industry and other aspects of daily life".

In this world of science where things are changing fast, proper development of scientific attitude is most essential. Science education, therefore, should aim at the inculcation of such attitudes or mind-sets through proper methods and techniques of teaching. Unfortunately, science education in India is still oral in character. Aims and objectives of science education when spelled out in detail look grand on paper. Most of them vaporise during implementation.
Science teaching is based on the prescribed textbooks only. The methods generally followed are dull, dry and unpsychological. In this context, Kothari Commission (1964-66) aptly remarked, “If science is poorly taught and badly learnt, it is little more than burdening the mind with dead information and it could degenerate even into a new superstition.”

It is generally accepted that the goal of teaching science is to develop an inquiring mind and a scientific approach to problems. To reach this goal of teaching science, there are several aims to be achieved. Some of these aims are meant to develop skills of observing and exploring, ordering, observations, logical thinking, interpreting findings critically, posing questions and devising experiments to answer them. Scientists apply these skills in their research activities to unravel the secrets of life and nature.

“The aim of teaching science at this stage is primarily directed towards problem solving and decision-making through the learning of key concepts which cut across all the disciplines of science. The content of science should be organised on the basis of two guidelines, namely contemporary science and the learning ability of the pupil. It should reflect that science is a continuing human endeavour and that it is international in character and method” (POA,1992).

The study of sciences, more so in biological sciences, is saturated with the problems of ecological imbalances caused by irrational exploitation of natural resources leading in turn to more problems of health care, housing provision of basic amenities for the growing
population. Hence, it is obligatory that learning system has to be restructured and developed that the students may acquire such analytical, problem-solving capabilities which would help them to analyse the problems and arrive at the solutions by themselves. The instructional methods adopted earlier stressed memorisation of factual details with a minimum emphasis on biological concepts which serve to organise the known facts and to provide the functional knowledge of the living systems. But still today, our educational system remains the same. Millions and millions of children of this country are showing no satisfying results in their depth of knowledge due to several reasons. There is more emphasis on the factual learning, rote learning is done to yield good results in examination, unhealthy competition, shortage of good teachers and the teaching techniques, low teaching competence, etc.

If this is so then one cannot ignore learning of key concepts of science by students of primary and upper primary classes. Therefore, if the idea of key concepts in science is developed amongst the beginner, then it would facilitate teaching of the subject at the secondary and senior secondary levels. Teaching of concepts is one of the most desirable and applicable method of teaching, which can bring pupil's thinking to a standard where he will be able to communicate, classify and solve his problems according to the standards of culture.

Once the student grasps the fundamentals of any idea, he is in a position to recognize wherein the equations are to be solved, even if it is a new one but has a familiar theme. Whether the student
knows the names of these operations is less important for the transfer, when he has to use them. The teacher creates or rather awakens students to the motives that they already possess. If students are made aware of motivation within them, they get inclined to solve their problems and learning is intensified.

Observing, guessing, testing, discovering, thinking about what happened, retaining the results for later use, the child in his natural responses to his environment, is living the fundamental activities of the scientific method. Children's early learnings about the nature of their world provide them with the foundation of concrete experience that is essential to later learning. Not only do their learning procedures constitute the basic method of science but their findings as a result of these procedures constitute the basic materials of the physical, biological, and social sciences.

Science teaching is not very effective because the focus is mainly on its substantive structure. The syntactic structure is almost neglected. As a result of it many concepts are not clear to the students even at a higher level. They have very vague knowledge of the essential attributes comprising these concepts. Unless the essential, non-essential, and noisy attributes are identified and discriminated learning is verbal and mechanical rather than conceptual. It is a challenging task for the teacher to select suitable examples and to stimulate students to identify and discriminate the different attributes.

Teachers are required to engage in several professional roles, often simultaneously, to carry out the multiple responsibilities of personal
growth of students, their social development and their mastery of academic subjects. They are counsellors, facilitators, instructional managers, curriculum designers, academic instructors, evaluator of instruction and disciplinarians. To perform these roles, professional teachers and educators draw on a variety of Models of Teaching. A model of teaching consists of guidelines for designing educational activities and environments (Passi, 1986). Models of teaching are meant for creating environments. They provide specifications for constructing learning situations.

According to Joyce and others (1991) "To provide all round development, one needs to design suitable instructional strategies which help our students grow emotionally, physically, socially and intellectually. We need to know how to modify their behaviour so that they function effectively in changing society. We need to engage ourselves in changing professional roles." Although a great deal of work has been done about how humans and pupils learn; there still exists a big gap between theoretical knowledge and actual teaching practice in the school. A teaching strategy is, however, not a substitute for teaching skills. They are rather complementary. A teacher having selected appropriate teaching strategy will still be required to make use of proper teaching skills. Models of teaching as teaching strategies need to be incorporated in one's teaching practice. It helps in enhancement of educability of human beings, helping in effective transmission. Teaching strategies based on cognitive psychology delve into the mental process.
1.2 Teaching and Information Processing

In the fast growing world today, we collect lot of information from multifarious sources, integrated and the processed in a useful manner. Teachers have been entrusted with the responsibility of processing it through a formal system to the level of the students. Hess (1963) states on the basis of his research that there is a reason to believe that the potentialities of human mind are genetically determined but don't unfold naturally and inevitably; it requires active participation of a stimulating environment in order to attain normal development.

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

Morine Dershimer and others (1990) in a study on ten teachers in a sub-urban elementary school indicated considerable success in stability of information processing styles. Studies of rememberance, problem solving, thinking and mental operations have much in common. They all need information processing using same basic strategy, i.e. it is easy to add different types of information to the data-base.
The teaching of information processing facilitate the capabilities of learners and ability to master information is enhanced. Teachers handle information coming from outside, organise data, enable the learner to raise problems, generate concepts and solutions to the problems with the use of verbal and non-verbal symbols. Elements of information processing in teaching are five-fold: flow of cues, interpretation, perception of cues, processing and responding. The teacher is a powerful agent in determining the processing of information by reducing the amount of natural behaviour of children, instituting the instructional patterns, building a social system and regulating the instructional process. Garner (1974) emphasised the both roles of stimulus variations and functions of cognitive structure in determining the kind of information selected and integrated. Shiffrin (1976) emphasised that the capacity to process the information is multifaceted. Hunt (1986) suggests three abilities—ability to match patterns efficient, ability to match and maintain or manipulate information to guide controlled behaviour and ability to make use of priming to increase the efficiency of production, selection or the like. Information processing as such be termed as experimental psychology. Greatest emphasis has thus been laid on information processing power of academic disciplines in a formal teaching system.

1.3 Models of teaching

Models of teaching are the innovative practices which have drawn the attention of educational researchers and teachers since last few years. Models of teaching are the prescriptive teaching strategies.
They differ from general approaches of teaching in that they are designed to realise 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 realise specific instructional goals. Models of teaching are structured, logically consistent, cohesive and logically described alternative patterns 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 practical oriented to teachers (Schalfer, 1985).

DeCecco (1968) made a distinction between teaching models and a theory of teaching. Models do not have the rigour of tested theories. Some useful models/teaching strategies eventually give way to empirically tested theories.

A teaching model is a good tool of teaching in which components are interrelated and arranged in a sequence where as method is a mode of accomplishing an end. It is concerned with teaching techniques for implementing model. Brady (1983) 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 it is to be presented.” Models help the teachers to increase the capacity to reach more children and create richer and more diverse environment for them. Joyce and Weil (1991) defined model of teaching as a plan or pattern that can
be used to shape the curriculum, to design instructional material and to guide instruction in a classroom and other settings. They are consciously and systematically designed to accommodate all important variables. Taneja (1989) considers model as a term, an imitation, condition, category, prototype representation considered as a standard of excellence to be envied, emulated and accentuated, of course, in teaching.

Many models have resulted from attempts to improve the society including the desire to reform it radically, may be, accidentally or deliberately. A model of teaching seeks the systematical exploration of interaction among educational purposes, pedagogical strategies, curricular designs or materials and social and psychological theories (Joyce, Weil and Showers, 1991). The main goal of the models of teaching is to teach by creating environments. A model of teaching is characterised by well defined and verifiable theory, specification of intended and unintended objectives, pedagogical syntax expressed in terms of well sequenced steps, explicitly described reactions of teachers and description of classroom support system (Passi, 1991). Models of teaching as applied to both curricular and instructional planning provide a unifying way of looking at the curriculum and teaching. According to Brady (1985);

1. The models are guides to the preparation and implementation of teaching and not highly developed theories. They are, as Dececco (1968) suggests, forerunners to probable theories.
2. The models are not highly discrete, i.e. there is no definite boundary between each one.

3. No single model is regarded superior to others. No single model can realise the multiplicity of school and subject objectives.

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

According to Sansanwal and 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.” A model of teaching is not as haphazard combination of facts but on the other hand, it is a systematic procedure to modify the behaviours of learners.

1.4 Families of Models

Since the models of teaching was a neglected area and the researchers were not concerned with their importance in teaching, very few models of teaching/teaching strategies have been evolved. Some of them are mentioned below:

Israel Shefter (1970) has discussed three philosophical models of teaching as; impression model, insight model and the rule model. Similarly Hadden (1970) has described four models of teaching in behavioural analysis of teaching, diagnostic teaching, etc. These are: Taba’s model of teaching, Turner’s model of teaching, a model of variation in teacher orientation and the Fox-Lippitt’s teaching model.
Mosstons (1972) has discussed seven models in his book "From Command to Discovery." These are Command Style, Task Style, Reciprocal Style, Individual Programme (Teacher's Design), Guided Discovery Model, Problem Solving Model, and Individual Programme (Pupil's Design).

Lapp, Bender, Ellenwood and John (1975) have discussed four models—Classical Model, Technological Model, Personalized model and the Interaction Model in their book "Teaching and Learning—Philosophical Psychological and Curricular Applications." They believe that the multiplicity of teaching learning styles can be validly subsumed into these four models.


Eggen, Kauchak and Harder (1979) discussed six information processing models as—general inductive model, concept attainment model, Taba's inductive thinking model, general deductive model, Ausubel's model and Suchman's inquiry training model. Brady (1985) discusses five models of teaching as—exposition model, behaviour model, cognitive development model, interaction model, and transaction model.

Joyce and Weil have conducted a long search for useful models of teaching. From a list of many educational models developed by persons engaged in different types of activities on the basis of
practice, empirical theories and research done by others, they selected 23 models. These are described as constituents of a basic educational repertoire. Joyce and well have grouped these models into four families-information processing models, personal models, social interaction models and behavioural models. The sample synoptic view of these four categories is given below.

1.4 Families of Models of Teaching

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<tr>
<th>S.No</th>
<th>Category of Model</th>
<th>Examples of 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. Concept Attainment Model</td>
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<td></td>
<td></td>
<td>3. Advance Organiser</td>
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<td>2.</td>
<td>Personal Model</td>
<td>1. Non-directive teaching</td>
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<td></td>
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<td>2. Awareness training</td>
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<td>3. Synectics</td>
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<td>2. Social Inquiry</td>
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<td>3. Role Playing</td>
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<td>2. Self-Control</td>
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<td>3. Assertiveness Training</td>
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Information Processing may be defined as the ways people handle stimuli from the environment, organise data, sense problems, etc. The main goal of information processing models are to help individuals to acquire knowledge through an analysis of data from the world around us. Their major aim is the intellectual growth of the individual. These models of teaching are-Inductive Thinking Model, Inquiry
Training Model, Concept Attainment Model, Cognitive Growth Model, Biological Science Inquiry Model, Advance Organiser Model, Memory and Group Investigation.

Social interaction models emphasise the development of capabilities for interpersonal relationships. They lay stress on the development of skills which help individuals to engage in democratic processes, and to work productively in the society. The models of teaching in this category are-Social Inquiry, Laboratory Method, Jurisprudential Inquiry Model, Role Playing and Social Simulation.

Personal Models 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.

Behavioural Modification Models have evolved from endeavours of researchers to develop efficient system for sequencing learning tasks and shaping behaviour by manipulating reinforcement. Exponents of reinforcement theory, such as Skinner (1957) has developed these models and operant conditioning as their central mechanism. The models of this family are stress reduction, assertive training, desensitization, relaxation, self control, contingency management etc.

1.5 Elements of a Model

According to Joyce (1990) each model of teaching has a theory and
practical training. To convert a theory into practical form, there are four elements of a model of teaching. These are:

(i) Syntax: It states the model as a flow of actions or a sequence of events. It involves a description or structure of activities.

(ii) Principles of Reactions: These are expected behaviours of the teacher or the responses of a teacher to the learner's activities.

(iii) Social system: It gives a description of the student and teacher roles; hierarchical relationships and the kind of norms that are encouraged.

(iv) Support system: The additional requirements beyond the usual human skills, capacities and technical facilities necessary to implement a model. It includes (a) role specification for the teacher and (b) requirements of the substantive nature i.e. expert's advise. Besides these four elements also i.e. focus or goals. It refers to the objectives of teaching.

1.6 Concept Attainment Model

The Concept Attainment Model developed from the work of Jerome Bruner, Jacqueline Goodnow and George Austin. Their work "The study of thinking" culminated many years of research into the processes by which people acquire concepts. There are three variations or models, of Concept Attainment namely reception, selection and unorganized material.

Concept attainment is "the search for and listing of attributes that can be used to distinguish examplars from non-examplars of various
categories". (Bruner, Goodnow and Austin, 1967, p. 233). In other words, in concept attainment the concept is determined in advance, and the task is to determine the basis of the yes and no examples. Concept formation, in contrast, is the act by which new categories are formed; it is an act of invention. Concept formation is the basis of the inductive model which requires the students to decide the basis on which they will build categories. Concept attainment requires a student to find out the attributes of a category that is already formed in another person's mind by comparing and contrasting the examples that contain the characteristics of the concept with examples that do not contain those characteristics.

To teach the basic subjects without teaching thinking simultaneously not only neglects thinking but is also inefficient. Students learn more traditional substance when mastery is generated by models that also produce intellectual growth.

Concept attainment models facilitate the type of learning referred to as conceptual learning; in contrast with the rote learning of factual information or of vocabulary. Knowing a concept means distinguishing examples from non examples, generating new examples of the concept, and articulating the attributes of the concept.

Concept teaching provides a chance to analyze the students' thinking processes and to help them develop more effective strategies. The approach can involve various degrees of student participation and student control and material of varying complexity.

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

Bruner's work has important and immediate application to teaching. First of all, by understanding the nature of a concept and of conceptual activity, teachers can better determine when students have attained a concept and when they are only using words without full conceptual understanding. Second, teachers can recognize the categorizing strategies their students are using and help them use more effective ones. Third, they can improve the quality of instructions for concept learning by using models of teaching that capitalize on the nature of the concept attainment process.

When a person is able to name that concept, identify the examplar and non-examplar and define the concept on the basis of its attributes, it is said that the person has attained the concept.

This focusses on the description of a process by which learners discriminate the attributes of things, persons, events and place them into categories thereby developing inductive thinking and reasoning. Attending and discriminating are essential operations in concept attainment. Bruner described the concept as having five essential elements: (1) Name, (2) Examples and Non-Examples, (3) Attributes (essential and non-essential), (4) Attribute-Values, (5) Rule.
Eggen and others (1979) find this model similar to general inductive model in the type of reasoning used; it is specifically designed to teach only one form of content/concepts. They have planned concept attainment actively as:

1. Identification of goals
2. Selection of examplars
3. Sequencing of examplars
4. Medium of presenting examplars

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

Joyce and Weil (1982) divide the syntax of concept attainment exercises into four phases: (a) playing concept attainment games, (b) analysing strategies, (c) analysing concepts in reports, conversation and written material (d) practising them.

To carry on the model, the students are provided with examples which are both positive and negative. We begin the process by asking the students to scrutinize the examples and to pay particular attention to the positive examplar. Then we instruct them to compare and contrast the functions of the positive and negative examplars. The positive examplars have some common characteristics or attributes which negative examplars do not have.
We ask the students to make notes about what they believe the examplars have in common. Then, we present more sets of examplars and ask them whether they still have the same idea. If not, we ask what they now think. We continue to present examplars until most of the students have an idea they think they will withstand scrutiny. At that point we ask one of the student to share his or her idea and how he or she arrived at it. Then other students share their ideas we provide some more examples.

We continue by providing some more examples and by asking the students to identify the positive examples. When they can do that, we provide them with the name of the concept and ask them to define the concept.

The final activity is to ask the students to describe their thinking as they arrived at the concepts and to share how they used the information that was given. In other words, they were asked to record every step of learning process in terms of attributes considered and hypotheses held at each encounter with the data for all CAM lessons.

As we teach the students with this method, we help them become more efficient in attaining concepts.

Concept teaching provides a chance to analyse the students thinking processes and to help them develop more effective strategies. This approach involves student participation, student control and material of varying complexity.
## Syntax of the Reception Model

<table>
<thead>
<tr>
<th>Phase One</th>
<th>Phase Two</th>
<th>Phase Three</th>
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<tbody>
<tr>
<td>Presentation of Data and Identification of Concept</td>
<td>Testing attainment of the concept</td>
<td>Analysis of Thinking strategies</td>
</tr>
<tr>
<td>Present labelled examples</td>
<td>Identify additional unlabelled examples as 'yes' or 'no'.</td>
<td>Describe thoughts.</td>
</tr>
<tr>
<td>Compare attributes in positive and negative examples.</td>
<td>Generate examples</td>
<td>Discuss the role of hypothesis and attributes. Discuss types and number of hypotheses.</td>
</tr>
<tr>
<td>Generate and test hypotheses.</td>
<td></td>
<td>Evaluate strategies.</td>
</tr>
<tr>
<td>Name the concept. State a definition according to the essential attributes.</td>
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</table>

In addition to attaining a particular concept, a second purpose of the CAM is to acquaint students with the conceptualizing process itself. This includes understanding the relationships among data examples attributes, and concepts, and the thinking patterns that are used to attain the concept.

Bruner uses the term strategy to refer 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. We use different strategies for different type of concepts and different kinds of learning material, or data. An ideal strategy is one that is most efficient in attaining the concept but has the least amount of cognitive strain resulting from memory overload, ambiguity, and so on.
The purposes of these strategies include

1. to understand the nature of concepts to help students to see that objects, ideas and events are distinguished by attributes and placed into categories;
2. to be more effective in attaining concepts, by understanding the thinking strategies being employed and by finding out the basis of the categories other people use to organise their environment;
3. to teach specific concepts; and
4. to become more aware of conceptualizing activity and to employ it at will.

Concept attainment Models facilitate the type of learning referred to as conceptual learning in contrast with the rote learning of factual information or of vocabulary. Knowing a concept means distinguishing examples from non-examples, generating new examples of the concept, and articulating the attributes of the concept Attainment Model. The purpose of concept attainment model has been identified three fold:

1. help students acquire a new concept
2. enrich and clarify their thinking on previously acquired concepts.
3. teach them the “concept of a concept” including the terminology and meaning of a concept theory and conceptual activity.
4. help them become aware of their own thinking processes and strategies.
Joyce and Weil (1972) introduced the concept of information processing as a discreet grouping and defined it as "the ways in which people handle stimuli from the environment, organise data, sense problems, generate concepts and solutions to problems and employ verbal and non-verbal symbols." (1972, P-9).

The intellectual skills or capabilities when in operation to analyse information, are processing and include the ability to make observations and through the use of inference, to generalise, to predict, and to explain events. Through these processes, the learner is able to move beyond memorisation of information to the development of more abstract and useful forms of knowledge. The knowledge that results from the processing of information is content and the particular form of this knowledge is dependent upon the type of processing which was used to from it.

The strategies employed by the people for processing information are not fixed things. They alter with the nature of the concepts being sought with the kinds of pressures that exist in the situation, with the consequences of behaviour, etc.
Bruner and his associates have identified six strategies: four selection and two reception strategies. The four selection strategies are: simultaneous scanning, successive scanning, focus gambling, and conservative focussing.

The selection Model permits students to apply the awareness of conceptual activity more actively by using their initiation and control. The successive and simultaneous scanning are based on the use of a concept – hypothesis, whereas focussing strategies utilise individual attributes. In simultaneous scanning, people use each example to determine which hypothesis to hold and which to eliminate and they hold more than one hypothesis at a time. The successive scanning strategy consists in testing a single hypothesis at a time, the typical successive scanning limits its choices to those instances that provide a direct test of its hypothesis.

Focus gambling and conservative focussing are similar, except that instead of testing a concept, the searcher tests individual attributes of a concept. Focus gamblers use a positive instance as a focus and change more than one attribute at a time; conservative focussers find a positive instance and choose instances that after one attribute at a time.

The Reception Model is more direct in teaching students the elements of a concept and their use in concept attainment. The two reception strategies are wholist (akin to focusing) and partist (akin to scanning). The wholist's strategy is to take the first positive instance of the concept and use it as a guide, comparing all the attributes of the first instance to those of subsequent instances and modifying the
hypotheses accordingly. The first instance then becomes the concept - hypothesis, and subsequent decisions depend on the attribute similarly and difference between the first instance and subsequent ones. In the partist (of part - scanning) strategy, the choice of a hypothesis is based on only part of the initial example.

Both the modes of processing of information are available to the individual. The selection of either or both modes depends on two conditions:

1. The individuals habitual mode of processing information as determined by social - cultural and genetic factors.
2. The demands of the task. Different strategies are adopted by children while acquiring various concepts.

1.7 Need and Significance of the Study

As you know that biology is a very important subject and deals with the vital issues of living beings, i.e., all plants and animals. It is an important science which holds key position in the basic understanding of all phenomenon of living beings and their applicaiton. Medicines, agriculture, ecology, anatomy, histology, etc. are studies related to this science. Thus, the students of biology has to have a very clear idea of the content of biology.

The importance of this subject in real life situations implies a greater load on the teachers shoulders because it is the school where the child is first introduced to these issues formally though at every step man is with this science as he is himself a part of the biological organisms around him. The vast knowledge and content of this
science is impossible to be dealt at any one level or class. So, the teacher should make this subject interesting and simple. At present, any school child if questioned places biology in subordinate position in his list of sciences and considered it as a boring subject because it is always taught in a boring way. The teacher talks, keeps coming up with names which pupils feel as a burden because their task for this subject is to cram the topic taught and put it on the paper. After the examinations, they need not feel the need to apply it or remember any of the things learnt.

Science teaching is not very effective because the focus is mainly on its substantive structure. The syntactic structure is almost neglected. As a result of it many concepts are not clear to the students even at a higher level. The instructional methods adopted in traditional method of teaching stressed memorisation of actual details with a minimum emphasis on biological concepts which serve to organise the known facts and to provide the functional knowledge of the living system. As pointed out by Travers that “future innovations in biology teaching should be based on an analysis of the conceptual framework of the discipline or subdiscipline to be taught and on a systematic analysis of instructional alternatives selected to maximise concept learning by the students.” (Travers, P1007–1098).

If this is so, then one cannot ignore learning of key concepts of science by students of primary and upper primary classes. Moreover, if the idea of key concepts in science is developed amongst the
beginner, then it would facilitate the teaching of the subject at the secondary and the higher secondary levels.

If science instructions to be effective, activities, materials, concepts, and thought processes have to be organised around some center which has significance for children and is valid for science.

If every child is to develop a more adequate understanding of himself and of the complex and demanding world he lives in, then it is necessary that he gain in understanding of the important concepts of science, become skillful in using the scientific method in dealing with his problems, and gain in appreciation of the attitudes of intelligent questioning, demonstrable verification, and constructive action.

Science fundamentally is a way of thinking and acting. It is not the covering of topics in the science book or memorising answers provided by the teacher. Scientific thinking is a way of seeing, defining, and dealing with problems in such a way that you can deal with them better the next time you face them.

Acquisition of knowledge about various science concepts is necessary for every student of science because this understanding paves the way for future advancement of knowledge and thinking. Now-a-days students try to memorize the information about concepts and recall it when they are asked to answer certain questions in the examination. This rote memorisation of concept attributes and values does not help in the attainment of the concept because students seldom try to handle stimuli from the environment, organise data,
sense problems, generate concepts and solutions to problems, and employ verbal or non-verbal symbols.

The need for effective science teaching cannot be overlooked but our present modes of teaching are not fully realised. And, we are in search of such teaching strategies which would help in achieving various objectives laid down for science teaching. Therefore, we need strategies which are logical and systematically structured and which provide for an objective analysis so that their efficacy can be empirically tested. The models of teaching approach is one such way of dealing with instruction.

Accordingly, the present investigation undertook a study aims at finding out the strategies adopted by the children in acquiring different science concepts and also which type of strategy is more effective in acquiring different science concepts.

1.8 The Study and its Rationale

We live in an age of science. The youth today must adjust themselves to a much more complex and chaotic world than existed a generation ago. We are living in a fast moving world in which strong forces are tending to produce rapid changes. The traditions and customs of our school order drive our youth against the forces of a rapidly changing physical environment often caused by advances of a technological nature. Because the existing traditional method of teaching in our schools is not preparing the pupils to face the challenges and to keep pace with the advancement of science and technology. The existing instructural details with a minimum emphasis
on biological concepts which serve to organize the known facts and to provide the functional knowledge of the living system.

Even today, lecture method is commonly used method of teaching in the classroom. Most of the teachers give lectures without understanding the cognitive structure of students which results in poor learning. To solve this problem of teachers, concept attainment model is a novel teaching strategy through which organised bodies of context can be taught in a meaningful bodies keeping in mind the cognitive map of learner. The researcher has therefore, selected concept attainment model to test its effectiveness in teaching of Biology.

Models of teaching have been one of the most neglected areas of educational research as limited number of studies have been attempted in this area. Buch's (1991) Fourth Survey of Research in Education has reported only six doctoral level studies and a few M. Phil. dissertations in models of teaching. Some reviews of research in this area have also been attempted like the Bigge and Hunt (1962), Strike (1975), Mayer (1975), Dececco and Crawford (1977), Joyce (1980), Barns and Clawson (1986), Malhotra (1988), Tandrei Sau (1989) and the like. Besides these a few studies have been reported in journals like Indian Educational Review. The Teacher Innovator, American Journal of Physics, American Journal of Psychology, Psycho-Lingua, Journal of Teacher Education, Dissertation International Abstracts, spl. issue on models of teaching in 'Trends in Education' (1989) etc.
In India, no study in this area has been reported prior to 1979. Researches in this area include M.Ed. or M.Phil. dissertations, doctoral level thesis and a few projects. Some universities like Banaras Hindu University, Devi Ahilya Vishwa Vidyalaya, Jamia Millia Islamia, Delhi University, Bombay University, some SCERTs and ERIC projects have contributed some useful work in last one decade but most of these researches lack depth and analyse the features at superficial level. Researches have tried several alternative models for training in teaching involving information processing, social interaction, behaviour modification, personal abilities and the like.

Gage (1963, p.133) explains the relative neglect of theories of teaching by suggesting that in minds of many researchers, if there is a satisfactory theory of learning then the teacher can act upon that theory, without developing a separate theory of teaching. Relatively little research in India has been devoted to identify the range of teaching models suitable to existing classroom conditions.

Researchers have compared concept-attainment model with other teaching strategies. An experimental study using Ausubel's and Bruner's strategy to ascertain their comparative effectiveness with traditional method for teaching of Mathematics was conducted by Chitrive (1983). The effect of Advance Organiser Model and concept studied by Mujeeb (1991). The effectiveness of Biological Science Inquiry Model was compared with Concept Attainment Model by Sushma (1987). The relative effectiveness of Concept Attainment Model, Inductive Thinking Model and Inquiry Training Model of
teaching on mental processes and attitude towards science was investigated by Gupta (1993).

It has been rightly thought that in the present day which is the information age, an information revolution cum exposition is underway, where models of teaching could keep pace and serve an important or useful purpose, specially the information processing models of teaching. Researchers must start analysing skills of specific models of teaching. There is an infelt need to select the model which could be applicable functional and workable in Indian settings. There is a need to study feasibility of models of teaching before this innovation could be adopted or adopted in schools. There is a need of proper coordination of researches in this area. The present study is a step in the direction of application of concept attainment model for development of not only cognitive but effective and psycho-motor domains also.

1.9 Statement of the Problem


1.10 Objectives of the Study

1. To study the types of information processing strategies adopted by students of 7th grade in the acquisition of science concepts.
2. To explore the influence of socio-cultural status on information processing strategies adopted by children in acquisition of science concepts.
3. To study the relation between information processing strategies and concept attainment in science,
4. To suggest ways of making science teaching more effective by inculcating appropriate information processing strategies among children.

1.11 Variables under Study
Information Processing Strategies
Socio-Cultural Status
Concept-Attainment in Science (Biology)

1.12 Hypotheses

Keeping in view the above objectives and the variables under study, the literature and the researches in the related area have been looked into to generate the hypotheses. The following null hypotheses were formulated:

1. There is no significant difference between experimental and control group in the acquisition of science concepts.
2. There is no significant difference in the information processing strategies adopted by experimental and control group in the acquisition of science concept.
3. There is no significant difference between boys and girls of experimental group in the acquisition of science concept.
1. There is no significant relationship between socio-cultural status and the levels of acquisition of science concepts.

1.13 Delimitations

The scope of the present study was specified according to the following delimitations:

1. The study is confined to only one model of teaching i.e. Concept Attainment Model.

2. The study was delimited to the subject of Biology.

3. The experiment was conducted on secondary school pupils.

4. The experiment was carried out only in one Kendriya Vidyalaya of Delhi.

5. The sample in the study consisted of only 50 students as the tool used for measuring information processing strategies was a performance test and has seven subtests.

6. Apart from the need to keep the investigation within bounds, as well as considering the scientific concepts involved in biological sciences and the strategies reviewed earlier, number of product categories was delimited to the class of students of developing age (11 to 12 yrs) group, belonging to the middle school.

7. The present study was limited to class VII students.

8. The topic 'Photosynthesis' was taught.