CHAPTER – I
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Education is the process by which an individual is encouraged and enabled to develop fully his or her potentialities. It may also serve the purpose of equipping the individual, with what is necessary to be a productive member of the society. An individual acquires and develops knowledge and skill through teaching and learning.

Traditionally, the teaching learning process comprised instructors, learners, content and learning resources. The text contained the content to be learned and it was the instructors’ responsibility to teach that content to the learner. Teaching could be interpreted as getting content from the text into the minds of the learners in such a way that they could retrieve the information when and where necessary and apply it accurately. A more contemporary view of instructions is that it is a systematic process in which every component i.e. teacher, learner, materials and learning environment is crucial for successful learning, which occurred when learners have incorporated new information into their memories that enables them to master new knowledge.

Education is the most cogent and potent instrument for the progress of any nation. Hence, the quality of education has to be improved to achieve all round development at a fast speed. It is universally acknowledged that any attempt of the improvement in the quality of education ultimately depends on the quality of instructions imparted in the classroom. Education has been playing a major role in modernization and economic development of a nation. The present era is passing through a phase of revolutionary changes imposed on society and social system by technological and scientific advancement. The purpose of education is to manage the learning of a student’s. The value of any technology used in education must, therefore, be measured by its capacity to affect learning. In a wider perspective, technology today seems to hold out
more benefits than ever before. Large scales experimentation spread over the whole world, has changed the face of teaching-learning process and has put forth a number of teaching strategies e.g. radio, television, tape recorder, computer assisted learning etc and various models of teaching. These are being increasingly used in the field of education.

To achieve its goal, the school plays an important role in the process of socialization. In modern education system, a student is not merely a passive listener but an active participant in the co-operation rather than competition. The spirit of co-operation fosters healthy social development. Education in its broadest sense refers to the ways in which people learn skills, gain knowledge and understand the world and themselves. Our present educational system is examination oriented. In schools, too much emphasis is laid on memory work and stress on students’ participation in teaching learning process is minimal. Different aspects have been taken into consideration to improve the quality of education in India and one aspect is learning by concepts. The learning of concepts is of greater importance for human beings because they think, learn and communicate with the help of concepts Vedanagum.E.G (1989). Teaching is an extremely important and complex process. Experts in the field of education all over the world are seriously thinking of a variety of approaches for learning to achieve different instructional objectives. Experiences have shown that there is no one particular way which can be said to be the only approach to achieve any instructional objectives. Therefore, it is essential to find a number of ways to create the right environment for learning. So, “A good model of teaching may be a remedy for the ills in the teaching-learning process.”

Improvements in the process of teaching have been made from time to time by the teacher also. In fact, every good teacher in the classroom always tries to prepare a model of teaching, which he wants to follow at all times. He also goes on modifying it as he gains more and more experience in classroom.
teaching. Therefore, it is essential to find a number of ways to create the right environment for learning.

Different models of teaching are designed to impart repertories while helping students learn information, ideas, academic skills, developing social skills, values and understand themselves and their environment (Joyce and Weil, 1972). A teaching model includes patterns for designing educational environment through specified ways of teaching and learning, to achieve specific goals. The scenario has increased the importance of science manifold. So teaching/learning of science at all stages of life has assumed increased importance. This process can be made efficient and economic if suitable and convenient methods of teaching-learning are employed. Hence, the study in hand endeavours to measure comparatively the efficacy of two recent models of teaching, namely, concept mapping and Bruner's concept attainment model.

1.1 TRADITIONAL TEACHING METHOD

The present day classroom instructions are based on chalk and talk. Lecturing is the heart of this method. There is no doubt that teaching can be extremely useful for imparting large amount of factual information to a larger number of people in a short time and for revising. It is also generally accepted that the large amount of information imparted through lecturing method cannot be retained by students for a long time. Lecture method leads to the habit of cramming and isolation from real life situations and this sort of situation will endure as long as teaching based is merely based on this conventional method of instruction.

Dewey's (1963) philosophy of education urged that free, self directed activity for learner be encouraged and that externally enforced controls be delimited, that learning be through firsthand experience and not be sought exclusively from textbooks and teachers.
Skinner (1954) lashes out at the lecture model of instruction and suggests its substitution with properly structured small learning steps and students advancing through the steps at their own pace. He felt that in the conventional system of instructions, the teacher teaches a set the students at the same rate which is unfavorable to the student who can pace himself faster in a course of study than a slow learner. A slow learner is not necessarily a dullard but he starts lagging behind in studies as he is unable to move at the speed of the instructor. With a properly structured self paced course, a slow learner can rise to a good level of performance.

Gimott (1972) hits out at the conventional method of teaching and observes that in these methods, the children are dependent on their teacher and this dependency breeds hostility. To reduce hostility, the opportunities should be provided for self education. The more the autonomy, the lesser is the hostility, and more the self dependence, lesser the hostility. Thus, the effective teaching takes place when students are given opportunities to participate in learning process. Teaching is a unique, rational and professional effort undertaken to help an individual to learn or acquire some knowledge, skill, attitude or interests etc. It is a triadic relation- involving the source (human or material), student and a set of activities designed and manipulated primarily to bring change in the behavior of a student.

A lot has been said about researches for and against, the present day method of instructions. In order to achieve necessary improvement, new methods of instructions must be introduced and this will meets the challenge of the changing scenario of the world. The quality of education is to be ultimately reflected through the behaviour of learners. The focus of teaching-learning processes should be shifted from teacher-centered to student-centered, keeping in view the individual students. Different researches are going on the various teaching methods which are categorized as under:-
a. Lecture Method.
b. Project Method.
c. Concentric Method.
d. Discussion Method.
e. Inductive-deductive Method.
f. Heuristic Method.

**Lecture Method:** In this method only teacher talks; the students are passive listeners and they do not take any active part. Pupils listen, get bored, yawn and sometimes go to sleep as well. The teacher acts like a chatterbox, talking and talking all the time without ascertaining whether the students are following him or not. The students are spoon-fed and their power of observation and reasoning, the exercise of which is so essential in the learning process are not stimulated.

**Project Method:** It is based on the philosophy of pragmatism. In this method, connected facts are developed round a central theme which may be any matter of scientific interest, a scientific principle or a topic of immediate interest to the pupils.

**Concentric Method:** It mainly deals with an organization of the teaching material and evolving out a scheme of work rather than actual teaching. In fact, it is a system of spreading the whole course (covering all branches of science) over a number of years.

**Discussion Method:** Certain topics in science, which are in explicable to be through demonstrations or other techniques, can be made understandable through well-planned discussion. In this method, teacher tells the students well in advance about the topic and date of discussion. He gives a brief introduction about the subject matter of the topic and poses some key questions in suitable heuristic environment and makes the students think. When proper motivation is complete, the teacher encourages the students to give their views one by one.
**Inductive- deductive Method:**

In inductive method the rules are induced out of the examples. The pupil draws the rules himself from the given examples. Students are encouraged to examine them, to reach a conclusion and then to formulate a rule or definition. For example, while teaching ‘noun’, the teacher will give examples and then help the pupils to frame a definition. In deductive method, the teacher first gives rules and definitions. These are then applied to particular examples.

**Assignment Method:** Assignment method is the best suited for teaching of experimental science because, it involves a harmonious combination of training at the demonstration table and individual laboratory work.

**Heuristic Method:** In this method the teacher allows the students to learn or discover something for themselves.

Of these methods, lecture method is most commonly used. In this method information is imparted through a speech. It is one way traffic to impart information. The speakers give ideas and the listener takes them. The lecture is an exploration of knowledge of facts, principles or other information which a teacher wishes to present to his students using the posses sufficient back ground and ability to under stand the lecture. The key feature of this process is based on the human information processing. There is a huge gap between the intention of lecture and reception of information of the learner. This gap is to be bridged by the teacher. This method is purely teacher centered and does not expect any question or responses from the students. This method lays too much stress on rote memory. The rate of imparting information is too rapid and students do not have any continuity of thoughts. There is no provision for any kind of experimental work, where students can exercise their intelligence, capabilities and abilities. This method is useful merely to cover lengthy syllabus in short time and impart factual information easily.
1.2 MODELS OF TEACHING

The model of teaching was first described by the Joyce and Weil (1972). He defined a model as “A plan or pattern that can be used to shape curriculum, to design instructional material and to guide instructions in the classroom and other settings. The models are used to achieve specific educational objectives. They are just blue print of teaching activities in advance for providing necessary structure and direction to the teacher for realizing the stipulated objectives. Thus, a “Model of teaching consists of guidelines, for designing educational activities and environment. The best way to proceed in formulating a theory of teaching is to begin with what is known about learning in the laboratory and in the classroom by adopting a model derived from a theory of learning. The basic teaching model was developed by Glaser, Bigge and Hunt (1962) and they tried to present teaching learning setting on a theoretical line. It provides a simple yet fairly adequate conceptualization of the teaching process. The models of teaching describe teaching, as it ought to be and guide one’s behaviour by the example of the model.

Eggen (1979) suggests “Models are prescriptive teaching strategies designed to accomplish particular instructional goals and are classified into personal, social and intellectual domains.” The models of teaching are designated to impart repertories which help students to learn information, ideas, academic skills, value and understand themselves and environments. A model includes a rationale, a theory that justifies it and describes what is good for and why; the rationale may be accompanied by empirical evidence that it works.

Flander (1985) has described model of teaching by stating that “A model is more than a description of teaching behaviour. it is a curriculum design in which instructions as material, learning activities, specific objectives, class formation and pattern of teaching behaviour are synthesized into a coherent understandable gestalt.”
According to Bhattacharya (1994) the effectiveness of model depends upon the creativity of teachers who develop new models of teaching as per curriculum and need of the students. The models are concerned with problem solving activities and general intellectual abilities, but main aim of these models is to develop an integrated functioning for self and design to reach specific goals. Some of these models of teaching are more appropriate to achieve some objectives than to others.

1.2.1 Assumptions of Teaching Models

Teaching models are based on the following assumptions:

i. Teaching is a means of generating an environment for learning. It involves independent variable.

ii. Teaching model provides the learning experiences by creating appropriate environment for real behaviour outcome.

iii. Different types of teaching objectives are achieved by organizing teaching elements in different way.

iv. The content and skills function as the instruction through which students and teacher interact with one another. Thus it provides an opportunity to develop physical, academic and social efficiency.

Each model has been built on the basis of theory as to what learning is and how children learn with a view to achieves certain objectives. They have been classified into following families.

- The information processing family.
- The personal family.
- The behavioural family
- The social family.
Some of these models of teaching are more appropriate to achieve some objectives than to others. Some are specifically useful to help students grow in self-awareness and strength of self-concept, some are more appropriate for improving human relations in the classrooms helping student’s clarify their values. The Bruner’s model of teaching, which is selected for this study, comes under the information processing family.

1.3 MEANING OF CONCEPT

Meaning of concept is an idea or expression representing the common elements or attributes of a group or class. A concept is a generalized idea including all that is suggested to the individual by an object, symbol or a situation. Individuals differ in their level of concept formation on the basis of their age, intelligence and experience. Every concept has a structure, which is determined by the complexity of its attribute, the rules linking them, the number of attributes and the form in which the attributes are experienced and how the evolution of concepts effect intellectual development.

Ausubel (1963) explains concept as a unitary generic idea referring to a class of objects. Corroll (1964) define it as an abstraction from a series of experiences, which define a class of objects.

Klausmeier and Harris (1966) suggest simple definition of concept as the label of a set of things that have something in common. Gagne (1970) indicated that learning concept might proceed from discrimination of the sensitive characteristics of objects and events to the formulation of concepts.

Tennyson and Park (1971) have defined, “A concept is assumed to be a set of specific objects symbols or events which shared common characteristics, can be referenced by a particular name or symbol.” Kagan (1978) defines concept, which stands for a set of attributes shared by a group of objects or events and he says concept represents what is common among a set of related objects.
In the broad sense, it can be said that concept is a general idea that stands for a general class and represents the common characteristic of objects or events of this general class. Concept of teaching provides a chance to analyze the students thinking process and to help to develop more effective strategies.

1.4 CONCEPT MAPPING

Concept mapping, developed by Prof. Joseph D. Novak of Cornell University in early 1980, is a technique visually representing the structure of information how concepts, within a domain, are interrelated. It is based on Ausubel theory of meaningful learning which stresses that learning new knowledge is dependent on what is already known. According to Novak, new concepts are acquired either by discovery, which is mainly the way young children acquire their first concept and language or by reception learning, which is the way school children and adults acquire most of their meaning. Creating a concept map of a particular domain makes learning an active process rather than a passive one. Novak made important distinction between rote learning and meaningful learning which require the following conditions:-

(a) The material to be learned must be conceptually clear and presented with language & examples.

(b) The learner must possess relevant prior knowledge.

(c) The learner must choose to learn meaningfully.

Concept mapping is a technique for representing knowledge in graphs which are networks of concepts and consist of nodes (points/vertices) and links (arcs/edges). Nodes represent concepts and links represent the relations between concepts. A concept may represent the students understanding of knowledge. It is the key for structure of knowledge of academic discipline and to make vital link between external inputs and our behaviours. It can be thought of information about objects, events, and processes. Concept maps are useful for representing network of concepts where links do not only connect adjacent
Concept mapping is also gaining importance as a tool for problem solving in education. Concept mapping may be used to enhance the problem solving phases of generating alternative solutions and options. Since problem-solving in education is usually done in small groups, learning should also benefit from the communication enhancing properties of concept mapping. Concept mapping appears to be a good method to promote meaningful learning among students with different academic preparedness—a situation typically found in introductory science classes. It is not only used as a learning tool but also as a powerful evaluation tool and is effective in identifying both valid and invalid ideas held by students. It is a useful technique for teaching and learning as well as a range of other educational processes. A concept map is a graphical arrangement of key concepts to show meaningful relationship among the selectable concepts. Teachers have found concept mapping a useful technique for not only selecting the subject matter they teach but organizing and representing their selected subject matter contents. Students have similarly found concept mapping a very powerful strategy for taking notes from lectures and other reading material summarizing and synthesizing.

A concept map is a visual road map which makes explicit the way the designer thinks concepts are related. The concepts are written down according to a set of conventions, in which the concept at the top is super-ordinate to the subordinate concepts below i.e. the relationships are set out hierarchically. Words which link the concepts are written on the lines joining them, and the words are chosen according to the designer's understanding of both the concepts and their relationship.

1.4.1 Purpose of Concept Mapping

Concept mapping is a type of knowledge representation. Jonassen & Grabowski (1996) stated that structural knowledge may be seen as a separate type of knowledge which provides the conceptual basis for “why”. It describes...
how prior knowledge is interconnected. Structural knowledge is most often depicted in terms of some sort of concept map that visually describes the relationships between ideas in a knowledge domain. Representing knowledge in the visual format of a concept map allows one to gain an overview of a domain of knowledge, because the nodes contain only a keyword or a short sentence, more positive interpretation is required of the reader.

Plotnick, 1977; Gaines and Shaw, 1995; Williams, 1977, concept mapping can be used for several purposes:
1. To generate ideas.
2. To design a complex structure.
3. To Aid learning by explicatively integrating new and old knowledge.
4. To assess understanding or diagnose misunderstanding.
5. To facilitate knowledge elicitation and management.
6. To analyze organizational decision making process.
7. To support reading comprehension.
8. To assess understanding or diagnose misunderstanding.
9. To develop inductive reasoning.
10. To communicate complex ideas.

1.4.2 Rationale for good concept maps
David Ausubel (1963), A context for the concept map should be defined, commonly with a stated explicit "focus question".
a. Concept labels in maps should be only one or a few words labeling a specific concept.
b. Linking lines should be labeled with one or few words, and not contain concept labels important to the map's conceptual content. They specify the proposition or principle formed by the concepts and linking words.
c. Maps should have hierarchical organization, with the most general, most inclusive concepts at the top, and progressive more specific, less inclusive concepts at lower levels
d. In general, no more than three or four sub-concepts should be linked below any given concept.

e. Specific examples of objects or events may be added to maps where appropriate, but these should clearly distinguishable from concepts.

f. Cross-links should specify significant interrelationships between two concepts in different sub-domains of knowledge shown in the map. These are best added when the map is nearing completion.

g. Concept labels should not appear more than once in a given map.

h. Resources may be added to a concept map either in concepts or on linking words.

i. Additional "global maps" may be constructed to show cross-links between concepts on super ordinate and subordinate concept maps. Detailed sections of the latter maps may be removed to add clarity to crosslink.

1.5 CONCEPT ATTAINMENT MODEL

Concept attainment model is designed to clarify ideas and to introduce aspects of content. It engages students into formulating a concept through the use of illustrations, word cards or specimens called examples. Students who catch on to the idea before others are able to resolve the concept and then are invited to suggest their own examples, while other students are still trying to form the concept. For this reason, concept attainment is well suited to classroom use because all thinking abilities can be challenged throughout the activity.

The concept attainment model has been historically linked with the work of Bruner, Good now and Austin (Weil, Marshal and Joyce Bruce, 1980) believed that the role of teacher is to create a situation in which students could learn on their own, rather than providing them packaged information to the students. This is applicable to the students of all ages. This model is designed to help students learn concepts for organizing information and to help students
become more effective at learning stage. It includes an efficient method for presenting organized information from a wide range of areas of study to students of every stage at development. It was designed primarily to develop inductive reasoning, but also for concept development and analysis.

A concept attainment method involves students learning to classify a set of objects or events in a way that scientists classify. The students will be using the categories that scientists use, and will be attempting to determine the rationale behind the categories. It refers to the activity of discovering which elements belong to the category and which do not. Categorizing reduces the complexity of environment and help students deal with ideas, that are intriguing new and complex. According to Bruner (1987) “Attainment refers to the process of finding predictive defining attributes that distinguish exemplars from non exemplars of the class one seeks to discriminate. For the task of concept attainment, the subject must have already formed some concept, which is fundamental process in the concept acquisition. Thereby, when one is able to identify distinguishing features of a given category, one is said to have “Attained a concept”. It is an excellent evolution tool to determine whether important concepts introduced earlier have been mastered. Concept attainment model helps not only to developed reasoning, but also for concept development and analysis.

1.5.1 Elements of a Concept

According to Bruner (1997), any concept has five elements:

- Name: Name is “term” given to a category e.g. Noun
- Attributes: These are common essential & non essential characteristics that cause us to place examples in the same category.
- Examples (Positive or negative): Positive examples are instances of concept, while negative examples are not.
- Attribute value: Refers to the degree to which an attribute is present in any particular example.

**Rule:** It refers to a final statement specifying the essential attributes of a concept. For example: A square is closed figure with four equal sides is a rule in specifying the essential attributes. The rule emerges at the end of the process of concept attainments.

### 1.5.2 Types of Concepts

Bruner (1956) has identified three types of concepts, namely, conjunctive- disjunctive and relational.

- Conjunctive concept: is one that defined by joint presence of the appropriate value of several attributes.

- Disjunctive concepts: this class requires the presence of some attributes and the absence of others. Disjunctive concepts are often defined by ‘either’ ‘Or’ characteristics.

- Relational concepts: Presence of attributes doesn’t make them rotational concept. They must stand in particular kind of relationship concept, each exemplar or conjunctive. A relational concept has to contain all the essential attributes, while an exemplar of disjunctive concept may contain only one.

### 1.5.3 Components of Concept Attainment Model

Each model has following six components:

**Focus:** The term focus refers to the specific goal or object of teaching in relation to the environment of learner.

**Syntax:** This part of the model involves a descriptive of structure or activities and refers to presentation aspect of teaching. It tells about the shape of activities or particular educational environment of each model, known as
phasing the model.

**Social System:** Includes description of type of students and teacher’s role, a hierarchical relationship and kind of norms which are encouraged and student’s behaviour which is rewarded. Role of teacher is to provide data to the students and guide them to actively participate. The climate of the class is generally warm, competitive and friendly.

**Principal of reaction:** These are the guidelines for teacher’s response to the learners. During the first phase, students formulate the hypothesis. In the second phase, they test it. In 3rd phase, the teacher provides idea, prompts the learners to analyze the thinking strategies of the concept.

**Support System:** Includes the requirement of human skill capacities and technical facilities necessary to employ a mode, i.e., books, cassettes, self instructional material, audio visual aids etc. This system helps to generate desirable class room environment.

**Education System:** It includes the various tests and rating scales which may be administered for learner’s achievement. Without evaluation, attainment of goals can’t be assessed.

1.5.4 **Steps for concept attainment model**

According to *Jerome Bruner, Jacqueline Good now (1956)*

The following are the steps for concept attainment model

- **Select and define a concept.** The definition should be clear and the attributes should be identifiable.
- **Select the attributes.** Attributes should only include the qualities essential to the concept.
- **Develop positive and negative examples.** Positive examples must contain all the essential attributes, yet they may contain some non-essential ones as well that gradually become eliminated. Negative
examples may contain some of, but not all, the essential attributes.

- **Introduce the process to the students.**

- **Present the examples and have students list the attributes.** Positive and Negative attributes should be listed separately. Cross out items in the positive list when a new positive example does not contain the attribute.

- **Develop a concept definition.** Students should write the definition of concept using the positive attributes.

- **Give additional examples of the concept to ensure understanding.**

- **Discuss the process with the class.** Making sure that students understand how they arrived at the definition helps them to see how concepts are formed, which they will hopefully transfer to other situations encountered in their life.

### 1.6 STYLE OF LEARNING AND THINKING

Learning is an ability to connect new information with already acquired knowledge. It involves training and overcoming fear and pain. Every individual has his unique learning styles. Some are high by visual while others are strong auditorially, yet others are kinesthetic. Learning is a continuous process which brings relatively permanent change in behavior produced by experience.

**Hill (2002)** “Learning occurs when experience causes a relatively permanent change in an individuals knowledge or behaviour. The change may be deliberate or unintentional, for better or the worse, correct or incorrect, and conscious or unconscious. According to Encyclopedia of Education (2004) “Learning is defined as a lasting change in behaviour or beliefs that results from experience.”

Every individual has his own thinking, learning and working style. Learning theory deals with the way in which a person influences an organism
to learn for creative thinking. Each one has unique way to take and retrieve information. Research shows that learning styles can help learner to achieve the potential. Millions of students around the world are failing at school level because they have learning styles that are not suited to their school styles. Knowledge of learning styles can help both educators and learners to improve their effectiveness. Learning which plays very important role in determining the behaviour of an individual. It is the basis of success in life and occupies important place in the field of education. It is through learning that man brings so many changes in his instincts. All living creatures are learners. When a child is born, his mind is just like a clean slate. As soon as he comes in contact with his environment, he starts reacting and in this process of interaction of the individual and his environment, the foundation of learning is laid down. Education brings changes in the behavior of learner which implies acquisition of knowledge, attitude and skills.

1.6.1 Elements of Learning

- **Learner:** The most vital element of the learning process is that there is a learner, who is a human being or animals. The learner possesses sense organs, through which he receives stimulation; a brain, by means of which the signals originating in his sense are, transformed in a number of complex ways, and a set of muscles, by means of which he exhibits the various performance that show what he had learned.

- **Stimulus:** The events that stimulate the learner’s senses are collectively called as a stimulus situation, where as single event is being distinguished, it is called as ‘stimuli.

- **Contents:** It is an input to learning which consists of content recovered from the learner’s memory.

- **Response:** The actions that results from these inputs and their subsequent transformations is called a ‘response’

“Styles depend upon cerebral dominance of an individual in retaining and processing different modes of information in his own style of learning and
thinking.” Style indicates the hemispheric functions of the brain and student’s learning strategy and information processing are based on the preferences of the brain area (Venkatraman 1990). Styles are propensities rather than abilities. They are the ways of directing the intellect, which an individual finds comfortable. The style of learning and thinking is as important as levels of ability and we ignore to identify and develop students’ thinking styles at their earlier and appropriate stage.

Many studies have shown that hemispheric preferences play an important role in cognition and achievement. According to O’Boyle and Hellige (1989), hemispheric asymmetry, such as degree of dominance, direction of dominance, characteristic arousal level and complementarily of functioning play an important role in individual differences in cognition.

Biggs (1978) made an effort to expand the Entwistles work to develop a new measure of learning style. He was interested in motivation underlying an approach to learning. He describes three approaches of learning namely ‘deep’, ‘surface’ and achieves that involve a concerned motive and strategy.

Jackson (2002) learning styles are personal qualities that influence student’s abilities to acquire information and to participate in learning.

1.6.2 Learning Domains

Learning has three domains

a. **Cognitive domain:** It facilitates the acquisition of knowledge and skill corresponding to knowledge.

b. **Affective domain:** It is concerned with how student’s attitude, beliefs and values are related to knowledge & skill.

c. **Motor domain:** It is concerned with learning, which is the observable consequence of cognitive and effective domains interacting with each other.

Creative thinking or divergent thinking is not ones ability but cluster of abilities like fluency, originality, flexibility and elaboration Guilford and Merrifield (1960). These abilities are not generally found in equal measures in
Ordinary people can be trained to be more creative under favorable conditions of high motivation, appropriate training and an encouraging environment which are different for each individual.

1.6.3 Hemisphericity (Right and Left):

Hemisphericity is a cerebral dominance of an individual in retaining and processing modes of information in his own style of learning and thinking (Venkataraman 1989).

### TABLE 1.1

**Specialized Information Processing Preferences Associated With Hemisphericity**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Right Hemisphere</th>
<th>Left Hemisphere</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialties</td>
<td>• Copying of designs,</td>
<td>• Language skills,</td>
</tr>
<tr>
<td></td>
<td>• Discrimination of shapes e.g. picking out a camouflaged object,</td>
<td>• Skilled movement,</td>
</tr>
<tr>
<td></td>
<td>• Understanding geometric properties,</td>
<td>• Analytical time sequence processing.</td>
</tr>
<tr>
<td></td>
<td>• Reading faces,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Music,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Global holistic processing,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Understanding of metaphors,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Expressing emotions,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Reading emotions.</td>
<td></td>
</tr>
<tr>
<td>Shared</td>
<td>• Sensations on both side of face,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Sound perceived by both ears,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Pain,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Hunger,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Position.</td>
<td></td>
</tr>
<tr>
<td>Emotions</td>
<td>Negative emotions (fearful mournful feelings).</td>
<td>Positive emotions</td>
</tr>
<tr>
<td>Neurotransmitters</td>
<td>Higher levels of nor-epinephrine</td>
<td>Higher levels of dopamine</td>
</tr>
<tr>
<td>Grey Matter-White Matter ratio</td>
<td>More white-matter (longer axons) on right</td>
<td>More grey-matter (cell bodies) on the left.</td>
</tr>
</tbody>
</table>
**Left hemisphere**

Left hemisphere has been found to be anatomically larger than right hemisphere as evidenced by neonatal studies Geschwind (1972). It is considered to be more active than the right hemisphere in most adults. It is the dominant, leading or the major hemisphere and is responsible for all the processing of language and planning, the two functions which closely distinguished man from animals. The left hemisphere seems to be the locus of logical, analytical and propositional thought. It is the centre of almost all language in formation in a linear, sequential fashion, that is to say, analysis that involved processing in formation one bit after another (Cohen 1973, Brendweinand Ornstein 1971, Bradshaw and Nettleton 1981).

**Right Hemisphere**

Right hemisphere which controls the left side of the body is called minor subordinate or mute side because it cannot verbalize what it knows. Gershwin (1970) found it to be anatomically smaller than the left hemisphere. Ruben Zen (1978) reviewed and indicated that language function is somewhat equally shared between the two hemispheres before the age of five, in a simplistic way we could say that right cerebral hemisphere remembers faces while left hemisphere remembers names Sample(1977). Different clinical and psychological studies have well established that left and right cerebral hemispheres sub-serve different cognitive functions. But most of us do not use both the hemispheres equally. We tend to lay greater emphasis on rational thinking, the ability to express one verbally, read well and generally excel in analytical thinking. On the other hand less emphasis is laid on spatial ability, artistic appreciation and creative processes more often associated with right hemisphere.

In normal people, the two hemispheres work together and share information through the corpus callous.

Pask (1976) observed that learning style is the recent way of describing difference in cognitive styles. He has used problem-solving tasks to contrast
holist and aerialist strategies of learning. The holist tends to view the task as a whole; to seek interconnections between even tenuously connected ideas, and to make avid use of illustrations and individualistic analogies. The aerialist has a narrower focus in carrying out the learning task, prefers cautious step by step procedures and relies more on detailed fact and evidence in building up an argument.

Torrance el al. (1978) assumed that left cerebral hemisphere is the locus of logical, analytical and linear propositional thought. That is, the left hemisphere seems to process information sequentially and logically. The right hemisphere seems to process information non-linearly, simultaneously handling a variety of information. The right cerebral hemisphere is the centre of visuo-spatial and oppositional thought and imagination.

Goldberg and Costa (1981) concludes that the right hemisphere has a great neuronal capacity to deal with informational complexity and ability to process many modes of information within single a cognitive task. While left hemisphere is superior in tasks which require fixation upon a single mode of representation.

Torrance and Mourad (1979) developed a rationale that teacher-directed learning tends to favour students with a left hemisphere style of learning, while self-directed learning favors right hemispheric learners.

1.7 STUDY HABITS

The study habits can best be defined as the sum total of all the habits, determined purposes and enforced practices that individuals use in order to learn. Thus, it is necessary for the students to develop the special study habits and skills. Well formed habits for effective education can be achieved through various techniques of teaching and learning. It is through education that man develops his thinking, reasoning, problem solving aptitude and also to help in the inculcation of right habits among the individuals. Habit means a confirmed way to doing things. It starts forming at conscious level but becomes automatic
due to repetition. Study habits contribute to the efficiency of learning. Many pupils are able to develop efficient study habits without receiving any special formal training. There are many factors, which may influence the study habits like study, observing school \ home environment, attitude, self confidence, proper postures and attitudes towards concentration, teaching and learning process. The problem of study is of immense importance both from the theoretical and practical points of view. Efficient learning depends upon the development of effective study habits.

Study habits play a very important role in education of a child and higher learning is entirely based on acquiring good study habits. Study habits can be classified as follows:

- ‘Good’ study habits

- ‘Bad’ study habits

According to Young (1952), Study habits play a significant part in scholarship, which affect student’s interest and motivation. General scholastic attitudes, subject matter background, motivation, study habits contribute towards good academic achievement. Success mostly depends upon certain skills, fundamental and understanding the students who has not developed these skills and are handicapped and prevented from doing the best work of which he is capable. The study habits differ from each other and are affected by factors like age, sex, qualification, attitude, and parental educational background, method of teaching and level of Intelligence.

According to crow (1969) “study” implies investigation for the mastery of facts, ideas or procedures that are yet unknown or only partially known to the individual. Any human endeavour that is directed towards the learning of new materials, the solution of a problem, the discovery of new relationship or similar purposeful activities may be considered to be “study.”
According to Encyclopedia of Education (1971) study habit is the method of study. The teacher should present to the class most effective techniques or methods of work, as proved by experience and experiments, so that students may make their own choice.

Essence (1972) opined that the term “Habit” refers to a customary pattern of behavioral, cognitive or emotional response predictable according to the conditions operating at the time of response and acquired by a process of learning or the underlying set or tendency towards that pattern of response. Habit can be study habits, play habits, work habits, sleeping habits etc.

Efficient learning depends upon the learner’s ability to schedule his time, the plan of his study, note making, the habits of concentration, mental review, over learning, massed and distributed learning and so on. It has been found that those who have good study habits excel others of equal intelligence in academic achievement Thus “Study habits” as a habit is generic than specific in terms of its importance. It has very long reaching effects deep into the life of the individuals and by cumulative and interactive effects in the society. It is a common belief that a man who does not have good study habits, how so far intelligent, capable and pushing he may be, can not be an efficient learner.

According to Good’s Dictionary of Education (1973) ‘Study habits’ is the tendency of a pupil or student to study when opportunities are given, the pupil or students way of studying whether systematic or unsystematic, efficient or inefficient etc.” Thus Study-Habits refers to acquisition of knowledge and skill through more or less permanent method of studying. Success in study comes not by training and how to study but rather by developing study procedure that the learner may have to discover. Research shows that good students differ from poor students merely in effective use of study times.

Goldenson (1984) stated that habits are persistent pattern of learned behaviour which becomes so ingrained that it is almost automatic. It develops habitual ways of thinking, feeling, perceiving, talking and walking as well as
habitual attitudes, reactions, verbal expressions and mannerism. These patterns help to structure one’s behaviours, but if they become too rigid, they hinder adaptation to new situations.

Study habits imply a sort of method of studying and every student has their own way of studying. Those who have good study habits are intelligent in achievement as compared to individual having bad study habits. It is also believed that many students who fail could succeed if they developed effective study habits and ready their programme of course in various ways. It has a very reacting effect into the life of individual cumulative as well as and interactive effect in the society.

It refers to the student’s way of studying or behaviours such as comprehension concentration, task orientation, drilling, supports, language etc. In present study, the study habits have been taken as a score obtained, by the student as measured on the study habits inventory developed and designed by Mukhtpadhyay and Sansanwal (1983,87,92), at post secondary level.

Good study habits include such like things as concentrated study, studying according to time table, regularity in preparing and learning lesson, adopting a correct sitting posture while studying, struggling hard to excel. They remain active during classes, review class room work, enter the examination with confidence, and make schedule and plan of work. Efficient learning depends upon the habits of good study and skills and is one of the objectives of the continuous teaching that improves both practical and theoretical problems.

Rojoria (1991) studied the influence of study habits and instructional material “with” and “without” advance organizers and found that there was a significant interactional effect between treatment and concentration and treatment and support on the achievement of the students.

1.7.1 Factors affecting Study habits
There are several factors; both individual and personal which influence the formation of study habits of the students. These are: effective study, attitude towards teachers, home and school environment, self confidence, proper posture etc. Besides, these factors can also be listed as follows:

i. Personal interests and aptitudes.
ii. Age and level of intelligence.
iii. The time devoted to the study.
iv. Physical conditions at the place of study.
v. The extent to which co-curricular activities interfere.
vi. Particular study mechanics employed.
vii. Competition from the peer group and philosophy the of peer groups.

Efficient learning depends upon the development of efficient study habits and skills as it is one of such the continuous objectives of teaching should be improvement of study habits.

1.7.2 Components of Study habits

The study habits inventory have been considered to be constituted of nine different kinds of study behaviors (Mukhopadhyay and Sansanwal (1992). These are:

<table>
<thead>
<tr>
<th>Components</th>
<th>Weightage</th>
<th>No of items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehension</td>
<td>28%</td>
<td>12</td>
</tr>
<tr>
<td>Concentration</td>
<td>23%</td>
<td>10</td>
</tr>
<tr>
<td>Task orientation</td>
<td>18%</td>
<td>08</td>
</tr>
<tr>
<td>Interaction</td>
<td>7%</td>
<td>03</td>
</tr>
<tr>
<td>Drilling</td>
<td>7%</td>
<td>03</td>
</tr>
<tr>
<td>Supports</td>
<td>7%</td>
<td>03</td>
</tr>
<tr>
<td>Recording</td>
<td>5%</td>
<td>02</td>
</tr>
<tr>
<td>Language</td>
<td>5%</td>
<td>02</td>
</tr>
</tbody>
</table>
1.8 EMERGENCE OF THE PROBLEM

Today, qualitative improvement of education is of great importance and it can be achieved only by improving the quality of instruction. Even though great advancement in science as well as educational technology was made in our country, the methods of teaching prevalent are not significant to meet the requirement of the students at all levels. Several studies on classroom practices reveal that even through the student’s characteristics and societal expectations have changed, our educators still employ those traditional methods and mode of instruction. Hence, it is necessary to refine and to improve the teaching methods and instructional techniques to realize the fullest potentialities of individual learner. Education for all is remarkable achievement in this country, still is largely unable to accommodate individual student learning needs and to achieve acceptable levels of individual student mastery, proficiency and expertise.

Although there are number of instructional methods, each method has its own advantages as well as limitations. But a judicious use of all different techniques and methods must be made in order to attain best results. At present it has been observed that classroom instruction has become too aversive, too negative and improperly sequenced. Thus, flexibility in instructional strategies is needed so that students can work at their own pace and participate actively in the learning process.

Rajiv (1993), Carbonaro (1997), Brown (1998), Martindale (1998) and Hamilton (2002) worked on concept attainment model of teaching. Researchers have studied the effectiveness of different instructional strategies to bring about a change in student learning abilities. In our country, large numbers of studies have been undertaken in which various strategies of teaching have been used for teaching and training of teacher educators and student teachers. Review of the research reveals that very few studies have been conducted in our country to see the effectiveness of concept mapping and concept attainment model as teaching strategies in relation to study habits and style of learning & thinking. The present study was undertaken to investigate the relative effectiveness of concept mapping and concept attainment model of teaching in acquisition of science concepts in relation to study habits and styles of learning and thinking.

1.9 STATEMENT OF THE PROBLEM

The present research study is entitled as:

RELATIVE EFFECTIVENESS OF CONCEPT MAPPING AND CONCEPT ATTAINMENT MODEL OF INSTRUCTION IN RELATION TO STUDY HABITS AND STYLE OF LEARNING AND THINKING

1.10 OBJECTIVES OF THE STUDY

The study was undertaken keeping in view the following objectives:

i) To develop lesson plans on concept mapping, concept attainment model & traditional teaching of science concepts.

ii) To construct and standardize a test to assess the acquisition of science concepts from syllabus of secondary stage.

iii) To study relative effectiveness of concept mapping, concept attainment model and traditional teaching method in the acquisition of science concepts.
iv) To study whether study habits affect differential acquisition of science concepts irrespective of teaching strategies and its interaction with separate teaching strategies.

v) To study whether differential style of learning and thinking affect achievement in science irrespective of teaching strategies and to study its interactive effect with teaching strategies.

vi) To study the interaction among teaching strategies, study habits and style of learning and thinking.

1.11 DELIMITATIONS OF THE STUDY

The present study was delimited to the following

1. Population for the present study was limited to learners studying in different schools of U.T. Chandigarh.

2. Study was delimited to two teaching strategies namely concept mapping, concept attainment model of teaching.

3. Some science concepts were taken from the Xth class CBSE syllabus.

4. Only SOLAT and study habits were taken as classifying variables.