CHAPTER: 2.0

REVIEW OF THE RELATED LITERATURE

2.1 Introduction

In order to get deep understanding of the problem the investigator studied related literature pertaining to field under study. By theoretical and empirical basis of related literature the problem becomes more specified. Desai and others (1997)\(^1\) says that, "For development of research planning and solutions of problems, review of related literature is must."

Review of related researches is must for planned research as it provides gaps in research work. Researcher can know about the limitations of the present research work from the study of related work. Research is actually a voyage of discovery so one should start from whatever is known.

Sharma (1985)\(^2\) states that, “The related literature forms the foundation of present on which future work is built. If we become unable to build the base of knowledge, contributed by re-observation of literature then our work might be trifling and most probably become a copy of the past which might be already executed by others”. Thus investigator has carefully reviewed reference books, dictionaries, encyclopedia, magazines, articles, dissertations, theses and research journals. Internet surfing was also done as a part of research study. Bharda (1993)\(^3\) says that, “Every work is enlightened by proper guidance that is helpful in work study, thus it is must that the investigator has to study related literature”. Investigator has thus reviewed literature and past researches. Literature review was done based on the key aspects of the present study. In the current chapter details about which points are studied is mentioned. This chapter contains theoretical and empirical basis with brief summaries and critical review with the present study. Distinguishing characteristics of this study are also mentioned at end of chapter.

2.2 Theoretical Review of the Content

The Theoretical review of the content is must to start the research work. As per Davies (1971)\textsuperscript{4} “The aim of theoretical review of the content is to divide learning material in their factors or elements and synthesize them in their logical order.

Joshi (1994)\textsuperscript{5} suggested that, it is must to know dimensions of content and for it one should first prepare questions or make points then select references and find answers for them. Investigator has done theoretical review based on following elements.

The theoretical review of the content is done based on following factors.

2.2.1 Concepts and Conceptual learning

2.2.2 Models of Teaching

2.2.3 Concept Attainment Model of Instruction

2.2.4 Academic Achievement and its Identification

Detailed review of the above content is given as below.

2.2.1 Concepts and Conceptual Learning

A concept is remarkably difficult term to define but it is true that every concept has definite structure. Investigator has studied literature related to concepts and its learning so as to bring out clear picture of concepts and conceptual learning. Investigator studied meaning of concept, elements of concept, and various levels of concept attainment, conceptual hierarchies and teaching-learning of concepts.

2.2.1.1 Meaning of Concept

According to International Dictionary of Education (1977)\textsuperscript{6} concepts are defined as; “General mental notions of things or events arrived at by the process of perception, classification and discrimination, used as basis for thought and expressed


\textsuperscript{5} H.O.Joshi, Sambandhit Sahityani Samiksha : Abhigamo, Unpublished Seminar Paper, Education Department, Saurashtra University

through symbolic language”. Chitriv (1968)\textsuperscript{7} says that “A concept is a class of stimuli which are common characteristics. These stimuli are objects, events or persons”. Cooper and Harris (1989)\textsuperscript{8} defined concept as “An idea that includes all that is characteristically associated with it”. Bruner (1963)\textsuperscript{9} studied the attainment of concepts and they defined concepts as “A network of significant inferences by which one goes beyond a set of observed critical properties exhibited by an object or event to the class of identifying the object or event in question and hence to additional inferences about other unobserved properties of object or event”.

Concepts are set of specific objects, symbols or events which share common characteristics and has particular name. They are building blocks for thoughts as they help us to think as by comparing concepts we are able to think and reason.

\textbf{2.2.1.2 Elements of Concept}

Bruner (1956)\textsuperscript{10} has given five elements of concepts as they function for conceptual learning and finally leads to concept attainment. They are described as;

- **Name:** It is the term given to the concept. On basis of certain characteristics a concept is given a symbol or termed through which it can be recognized.

- **Attributes:** The characteristics of particular concept are called its attributes. They help to name a concept as they are essential for complete description of concept.

- **Attribute Value:** Attribute value refers to the degree to which an attribute is present in any particular example.

- **Exemplars:** Bruner used the term exemplars to indicate the array of all instances of the concept. Those instances that contain all the essential attributes are called positive exemplars. The instances that do not contain attributes are called negative exemplars. The concept is learned with help of both of these exemplars.

\textsuperscript{8} Cooper and Harris, *Integrating research: A guide for literature reviews. (2nd Ed.*), California: Sage publications.1989, p.242.
• **Rule/ Definition:** It is a statement specifying the essential attributes of a concept. Definition is derived at the end of concept attainment process based on essential attributes.

Thus all the above five elements form concept.

**2.2.1.3 Levels of Concept Attainment**

Klausmeier (1980)\(^{11}\) has given four levels of concept attainment. They are Concrete level, Identity level, Classificatory level and Formal level. They are represented in pictorial form as;

![Levels of Concept Attainment](image)

**Figure 2.1**

*Levels of Concept Attainment*

(Klausmeier and Allen, 1978)

1. **Concrete Level:** There are three operations at concrete level;
   i) Attending features of an object
   ii) Discriminating the object from other objects
   iii) Remembering the discriminated object

   In the concrete level first a concept is attended based on its distinctive features. Then an image is formed in the memory. This memory image helps to discriminate one concept from another and finally remember it.

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2. **Identity Level:** In this level children generalizes objects and remember them. At this level children have to discriminate from various forms of same object and generalize particular form of the object as same object.

3. **Classificatory Level:** They suggested that children at classificatory level identify large number of things as examples and others as non examples. Still they cannot use attribute in evaluating examples and non examples. Children are also unable to give the basis on which grouping done.

4. **Formal Level:** This is the highest level in the process of concept attainment. A concept is said to be attained at formal level. In this level pupils can identify correctly examples and non examples, they can name examples, and discriminate between them, finally can give definition of concept. This level also includes evaluation of how examples of one concept differ from other.

Thus concept attainment process consists of four levels as described above.

2.2.1.4 Conceptual Hierarchies

Concepts are always formed in relation with other concepts. They do not exist in isolation. Smith (1975)\(^\text{12}\) described the process of forming new concepts as the partitioning old big concept into smaller concepts. The relations between Super coordinate, Coordinate and Sub coordinate concepts can be described as;

**Super coordinate Concept:** Each concept is formed in relation to the other concepts. Super coordinate concept is a larger set in to which the concept fits. For example super coordinate concept of trapezoid is quadrilateral.

**Sub coordinate concept:** Sub coordinate concept is a smaller set, which fits in the concept. For example the sub coordinate concept of parallelogram is rhombus or square. Sub coordinate concepts help to frame examples.

**Coordinate Concept:** The concept, which has a coordinate relationship with the referred concept within a form of reference, is called a Coordinate concept. Coordinate concept helps to frame non-examples. To frame a Coordinate concept of a particular concept, first list the characteristics of the concept. Then frame concepts based on these dimensions. For example, consider the concept “cat”. One

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characteristic of cat is “mammal”. Then a coordinate concept of “cat” is “horse” or cow”. A coordinate concept of “parallelogram” is “trapezoid”.

2.2.1.5 Teaching and Learning of Concepts

Conceptual teaching means teaching for meaning. Hence teaching strategy selected must promote meaningful learning. In order to develop appropriate teaching strategy for conceptual learning three steps are essential;

i) Find concept from content

ii) Analyze concept

iii) Specification of objectives

The teacher first does proper content analysis to find the suitable concept to be taught to pupils. Then on basis of the concept its definition, attributes, examples and non examples are decided. Specifications of objectives are very much essential so that after the teaching learning process what would be the behavioral changes among learners can be known.

Weil and Joyce (1985)\(^{13}\) suggested general objectives as;

- Pupils learns new concept
- Pupils will specify more previously learned concepts
- Pupils will learn concept about a concept
- Pupils will activate thinking process

Klausmeier (1980)\(^{14}\) gave specifications of educational objectives of concept as follows:

1. Pupil when given name of the concept can give its example
2. Pupil when given name of the concept can give its non-example
3. Pupil when given an example for concept can name it
4. Pupil when provided essential attribute of the concept can name it
5. Pupil when given example can provide essential attribute


6. Pupil when given name of the concept can enlist its essential attributes
7. Pupil when given name of the concept can list its non essential attributes
8. Pupil can identify concept when provided its definition
9. Pupil when provided concept can define it
10. Pupil when provided concept can give its sub coordinate concept
11. Pupil when given concept can provide its coordinate concept
12. Pupil when given two concepts can establish relationship between them
13. Pupil when given appropriate relationship between two examples can find appropriate solution to the problem

According to Borich (1996), both inductive and deductive methods help in concept teaching. To learn concepts learner need to differentiate between examples and non examples. Thus essential and non essential attributes of the concept should be proper so that learners can clearly discriminate between examples and non examples. Dececco (1988) has given series of steps for teaching concepts. These steps are listed below.

1. Describe the performance expected from the student after he has learned concept.
2. Reduce the number of attributes. Make important attributes dominant.
3. Provide useful mediators to students.
4. Provide positive and negative examples simultaneously.
5. Provide scope for students to respond and use reinforcement.
6. Assess learning of concept.

Stones (1994) presented heuristic guide for teaching concepts. He divided teaching phase into three; pre active, interactive and evaluative. It is described in detail as;

A. Pre active Stage
   - Prepare pedagogical analysis of the concept

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### 2.2.2 Models of Teaching

Teaching procedures should focus on students’ ability of self learning. Teachers should use teaching techniques so as to develop pupils thinking abilities and enhance their progress. Models are teaching strategies designed to accomplish particular goal. A teaching model is a blue print for teaching it is not a substitute for teaching skill but it is a tool to help teacher for systematic and effective teaching. Bruce Joyce and Marsha Weil have transformed prevailing theories and theoretical knowledge into different models of teaching. They were the first to formalize the notion of varying procedures for different teaching situations and published it in “Models of Teaching” in the year 1972. The investigator has studied meaning, characteristic features, importance, functions, elements and family of models of teaching.

- Identify key concepts involved
- Find coordinate and sub coordinate concept
- Prepare for examples and non examples
- Ascertaining learner’s previous knowledge

**B. Interactive Stage**
- Give preliminary idea of the nature of new learning
- Explain the terms to be used while labeling new concept
- Recall the concepts learnt matching with the attributes of new concept
- Provide series of simple examples and critical attributes
- Provide non examples
- Provide series of examples and non examples together and ask learner to identify them

**C. Evaluative Stage**
- Present novel examples ask students to identify them
- Ask students to discriminate between examples and non examples
- Ask to define concept and provide examples

Thus various psychologists have provided different ways for teaching concepts.
2.2.2.1 Meaning of Models of Teaching

Models of teaching bring definite behavioral changes among pupils. Teaching Models are instructional designs that describe process of obtaining required behavioral changes among pupils in specific environment. As per Joyce and Weil (1975)\(^\text{17}\) “Model of teaching is a plan or pattern that we can use to design face to face teaching rooms or tutorial settings and to shape instructional materials”.

Each model has different design. They provide us guidelines for achieving various objectives. Different models should be used as per the requirement of necessary behavioral changes among pupils.

2.2.2.2 Features of Models of Teaching

A model of teaching provides basis for designing educational activities. Its features according to Martin (1981)\(^\text{18}\) are;

1. **Scientific Approach**: Teaching models are systematic techniques for bringing behavioral changes among pupils. They are based on specific postulates. The complete process is developed to bring appropriate changes in behavior based on one or more than one principles of behavior.

2. **Definite Learning Outcomes**: For every model its learning outcome is decided. After the learning experiences provided through model what kind of efficiency pupils will obtain is described.

3. **Specific Environment**: Every teaching model decides that learners are to be kept in particular situation.

4. **Criterion of performance**: Definite scales are decided to find whether the behavior changes occurred among pupils are according to goal of teaching model and are achieved to appropriate extent.

5. **Definite Interaction**: Interactions between teacher and learner are pre decided and according to it teaching procedure is followed.

Every model has definite features as explained above.

\(^{17}\)Joyce and Weil, op.cit.
### 2.2.2.3 Importance of Models of Teaching

Models of teaching are of great importance in teaching – learning process. Its importance according to Passi, Singh and Sansanwal (1991)\(^\text{19}\) can be given as:

- Teaching models have long term effect on learners due to it learners can learn effectively.
- Learners achieve knowledge as well as skill and gets proficiency in learning process.
- Learners learn through model of teaching: how to remember, how to find information, how to develop hypothesis, how to analyze and interpret.
- Models are useful in psycho-physical areas, athletics, and performing arts, developing mathematical and social skills.
- Models develop creativity, thinking skills, problem solving skills.
- It helps learners in individualized as well as socialized learning.

Thus models of teaching are very much important for effective learning.

### 2.2.2.4 Functions of Models of Teaching

According to Martin (1981)\(^\text{20}\) following are functions of Models of teaching.

- **Guidance**: Using model in teaching – learning process makes the process more efficient. Model of teaching guides teacher as well as student to how to reach the goal of achieving required behavioral changes.

- **Developing Curriculum**: Model of teaching helps to develop curriculum at different levels of Education. Principles of learning models are used to develop curriculum for various classes.

- **Specification of Instructional Material**: Appropriate usage of materials is very much essential during the instructional process. This can be learnt through the model used.

- **Improvement in Teaching**: Models are very much effective in teaching - learning process. They enhance the learning abilities of learners.

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\(^{20}\) Martin op.cit.
2.2.2.5 Elements of Models of Teaching

According to Joyce & Weil (1985)\(^{21}\) there are seven facets of models of teaching. They are described as:

**Goals and Postulates:** Goals and Postulates are in centre of any teaching model. The postulates include relationship between various processes, conditions and element. If goal is fixed then only it can be achieved hence for every model it is very much essential that it has appropriate goal.

**Syntax:** This element shows the procedure of model. How model is implemented - how it starts, how it works, what are its phases is explained. Here all the phases are in perfect chronological order and they should be followed.

**Social System:** Social system explains the relationship between teacher and student. In some models teacher gives group activity to students. In some model teacher acts as guide while in some she is expert. In few models activity is shared between teacher and students. Thus in some models teacher act as a source of knowledge while in other she allots some activities and students comes in centre. Models having teacher in centre are comparatively more rigid than those having pupils in centre. As the models having pupils in centre have no restrictions so they are free models.

**Principle of Responses:** For every model principle of responses are fixed. Here what kind of responses teacher has to give with reference to pupil’s activities are mentioned. In some models teacher provides feedback to pupil’s activities while in some she remains neutral. In some models teacher has to ask back questions and let pupils decide whether answers are true or false. In some models teacher provides reinforcement.

**Support System:** It explains that in a particular model including human skills, talents, technical help what else is needed. This element does not explain the model but it enlists the necessary requirements for implementing model. It consists of books, literature, films, class room arrangements etc.

**Educational Effect:** Learning outcomes that are obtained as a result of implementation of teaching model are called its educational effects. Each model is developed to achieve certain objectives. The achievement of those objectives is called its educational effect.

**Indirect Effect:** Due to learning experience through model they will also learn something more than the goal of model. Model does not work to teach those facts but they are by products of the teaching - learning process. These effects can be positive as well as negative. These effects are not intended to occur but they still occur so they are called indirect effects.

**2.2.2.6 Family of Models of Teaching**

Models of teaching are divided in main four types based on the process and outcomes. They are (1) Information Processing Models, (2) Social Interaction Models, (3) Personal Models and (4) Behavior Modification Models.

There are seven models belonging to the group of Information Processing Models and they pertain to cognitive domain. There are seven models of teaching in Social Interaction Model while there are six models of teaching in each of remaining two models of teaching ie. Personal Models and Behavior Modification Models. Present study pertains to Concept Attainment Model of Instruction from the family of Information Processing Models.

The detailed structure about models included in each of the family of models of teaching is tabulated as;
Table 2.1
Family of Models of Teaching

<table>
<thead>
<tr>
<th>Information Processing Models</th>
<th>Social Interaction Models</th>
<th>Personal Models</th>
<th>Behavior Modification Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concept Attainment Model</td>
<td>Group Investigation Model</td>
<td>Non-directive Teaching Model</td>
<td>Contingency Management Model</td>
</tr>
<tr>
<td>Inductive Thinking Model</td>
<td>Social Inquiry Model</td>
<td>Awareness Training Model</td>
<td>Self – Control Model</td>
</tr>
<tr>
<td>Inquiry Training Model</td>
<td>Laboratory Method Model</td>
<td>Synetic Model</td>
<td>Relaxation Model</td>
</tr>
<tr>
<td>Scientific Inquiry Model</td>
<td>Jurisprudential Inquiry Model</td>
<td>Conceptual System Model</td>
<td>Stress Reduction Model</td>
</tr>
<tr>
<td>Cognitive Growth Model</td>
<td>Role Playing Model</td>
<td>Classroom Meeting Model</td>
<td>Assertive Training Model</td>
</tr>
<tr>
<td>Advanced Organized Model</td>
<td>Social Simulation Model</td>
<td>Behavior Modification Model</td>
<td>Direct Training Model</td>
</tr>
<tr>
<td>Memory Model</td>
<td>Value analysis model</td>
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<td></td>
</tr>
</tbody>
</table>

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2.2.3 Concept Attainment Model of Instruction

Bruner has given special emphasis on conceptual learning. Whatever we know is based on concepts. A concept includes various thoughts, things, people or experiences. According to Dececco (1968)22 “A Concept is a class of stimuli which have common characteristics.” As per Patil and Sakhare (2011)23 Concept is a bunch of specific characteristics. Every concept has examples and non-examples. Concepts have essential attributes which helps in differentiating among examples and non-examples.

He also cited that according to Bruner, Goodnow and Austin (1956) “Concept attainment is the search for or listing of attributes that can be used to distinguish exemplars from non-exemplars of various categories.” Investigator has reviewed literature on Concept Attainment Model of Instruction which is discussed as;

2.2.3.1 Elements of Concept Attainment Model of Instruction

Every concept has examples and non-examples. Concepts have essential attributes which help in differentiating among examples and non-examples. Every concept can be defined on based of some rule that is determined form its essential attributes. Joyce and Weil (1985)24 have given various elements of Concept Attainment Model of Instruction which are shown diagrammatically in fig. 2.4 as;

![Figure 2.4](image)

**Figure 2.4**

Elements of Concept Attainment Model of Instruction

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22Dececco, op.cit.
24Joyce and Weil, op.cit.
Elements of Concept Attainment Model of Instruction can be listed as:

♦ **Goals**
1. To teach pupil concepts.
2. To develop inductive thinking abilities among pupils.
3. To provide deep understanding of concepts.

♦ **Postulates**
1. Classification is a basic thought process.
2. Classification decreases the complexity of the environment.

♦ **Steps - Phases of Concept Attainment Model of Instruction**

Instructional Models of Concept Attainment are based on early studies by Bruner (1967)\(^25\) describing the process by which learners discriminates essential features of things and group them together.

In the model outlined by Weil and Joyce (1978)\(^26\), new concepts are taught by presenting sequence of examples and non examples. In this process teacher presents this examples initially and later ask students to respond and find essential attributes so that they can give examples on their own. The syntax of the model describes its plan of action. The sequences of the activities are presented as phases.

A) **Presentation of Data & Identification of Concept**
1. Presentation of Exemplars
2. Student compares attributes in exemplars & non exemplars
3. Student generates & tests hypothesis
4. Student defines the concept

B) **Testing Attainment of the Concept**
1. Student identifies additional exemplars
2. Teacher confirms hypothesis, names concept & restates definition

C) **Analysis of Thinking Strategies**
1. Student describes thoughts
2. Student discuss type & number of hypothesis

Tennyson and Park (1980) on basis of researches carried out in field of “Reformation of Concept Attainment Model” pointed out inclusion of reception strategy in it. In this strategy if the students are having any confusion while acquiring abstract concept, the instructor can immediately adapt new presentation of

information accordingly. They also emphasised on importance of surrounding structure of concept- like concepts that are easy to understand, already known concepts, very much related concepts to the actual concept to be taught. They also stressed on hierarchical structure of concept as discussed in concept analysis. They have shown mainly four steps. In the first stage instructor analyses the concept and determines attributes. In the second stage the instructor provides examples and non examples, in third stage students find attributes and actually judges examples and non examples. In the last stage new set of examples are provided to learners. This model was found effective to increase the understanding and knowledge level of students. Keeping all view point’s investigator has constructed phases of Concept Attainment Model of Instruction as indicated in chapter-4.

♦ Role of Teacher

Teacher acts as recorder and prompter. Teacher presents examples and non examples in class in appropriate order. Then teacher collects information from students arranges it and gives back essential knowledge to pupils. Main role of teacher is to provide examples and non examples, collect information from pupils and supervise their answers. Teacher creates democratic atmosphere in the class and also provides equal opportunities to all.

♦ Principles of reaction

Following rules are to be followed by teacher in providing feedback to pupils’ responses.

1. Teacher needs to be supportive.
2. Teacher should put more emphasis on discussion.
3. Teacher should help pupils to achieve equilibrium in their thought processes.
4. Teacher should encourage students to analyze thinking strategies.

♦ Support system

Learning material and teaching aids are support system for this model.

♦ Effect of Concept Attainment Model of Instruction

◊ Instructional Effect

1) Nature of concept
2) Improved concept building strategies
3) Inductive reasoning
4) Specific concept
◊ Nurturing Effect

1) Awareness of alternative perspective
2) Tolerance of ambiguity
3) Sensitivity

2.2.3.2 Strategies of Concept Attainment Model of Instruction

The Concept Attainment Model was developed by Joyce and Weil and is based on Bruner’s theory of concept attainment. Joyce and Weil discussed variations in this model based on learning conditions and teaching strategies. There are three types of Concept Attainment Model of Instruction. They are –

1. Reception Model
2. Selection Model
3. Unorganized Material Model

According to Bruner (1977)\textsuperscript{27} strategy refers to sequence of decisions people make as they encounter each instance of concept. According to him there are six strategies to learn concept. These six strategies are divided into two “Reception Strategy” and “Selection Strategy”.

In “Selection strategy” teacher is free to choose concept instantly to test hypothesis about concept. In this strategy teacher presents unlabelled examples of the concept and students inquire as to which of them are examples and others are non examples. Here students control the sequences of examples. In general it becomes responsibility of students to attain concept while using this strategy. Four strategies used are successive, simultaneous, conservative and gambling. In “Reception strategy” teacher presents examples labeled as “Yes” or “No”. The two strategies used are whole and part. While in Unorganized Material Model learners are given whole paragraph and teacher has to provide scope for group discussion for concept attainment. Detailed syntax followed in three models is given as;

1. Reception Model of Concept Attainment (RMCA)

Phase 1. Presentation of Data and Identification of Concept

- Present data to learners

\textsuperscript{27} Bruner, op. cit.
- Examples and non examples are presented separately
- Examples and non-examples are presented in “yes” and “no” pattern respectively
- Learners are asked to compare them and enlist attributes
- Students develop hypothesis
- Students name the concept and define it.

**Phase 2. Testing the Attainment of Concept**
- Learners identify more unlabelled examples
- Pupils generate examples on their own
- After revising attributes original hypothesis is accepted or rejected

**Phase 3. Analysis of Thinking Strategy**
- Learner analyze strategies through which they attained concept
- Pupils describes the process of attaining concept

2. **Selection Model of Concept Attainment (SMCA)**

**Phase 1. Presentation of Data and Identification of Attributes**
- Several instances representing attributes of concept are presented
- Teacher draws attention to some examples pertaining to concept
- Students inquire which examples are positive based on instances provided by teacher
- Students based on examples generates hypothesis and tests it

**Phase 2. Testing Attainment of Concept**
- Teacher presents unlabelled examples; students categorize them as positive or negative
- Teacher confirms hypothesis
- Teacher names concept and restates its definition as per essential attributes

**Phase 3. Analysis of Thinking Strategy**
- Teacher analyzes thinking strategy
Students report their pattern of thinking

3. **Unorganized Material Model (UNMM)**

**Phase 1. Locating Concept**

- Students find concept from the content provided in form of paragraph

**Phase 2. Identifying Attributes**

- Based on group discussion students identify attributes from content provided

**Phase 3. Discusses Appropriateness of Attributes**

- Students through group discussion find examples from essential attributes

**Phase 4. Comparing with Other Passage**

- Students compare examples with other passage using same concept

In the present study investigator has selected Reception Model of Concept Attainment as it is the best model that can be used for effective concept learning.

### 2.2.4 Academic Achievement and its Identification

Every being is unique creation of God. We human beings ahead of other creatures are blessed more in certain abilities. We get inheritance of innate abilities and certain abilities are developed in reference to our parents, schools, teachers and socio-economic climate of family. Achievement is thus succeeding in achieving innate and acquired abilities.

Achievement is a psychological word different educationists have defined it in many ways. According to Desai (1984)\(^{28}\) “Achievement is work done in standardized sequences of educational tests at school or college level, generally work carried out in various subjects of curriculum”.

According to Ebel (1966)\(^{29}\) “Educational Achievement is acquisition of knowledge and development of ability in performing tasks”. Dictionary meaning of Achievement is an accomplishment, performance and acquirement. Achievement is

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actually synonymous to success. With respect to students their achievement mainly pertains to success in field of education. In simpler terms for pupils educational achievement lies in achieving good marks in exams. One factor that has direct relationship with achievement is intelligence. Generally achievement is acquired with intelligence. But there are certain pupils whose achievement and intelligence do not function simultaneously based on this difference in achievement and intelligence learners are classified into three categories.

2.2.4.1 Types of Academic Achievement

There are three types of academic achievers depending upon their intelligence and achievement. They are –

1. Over achiever students
2. Under achiever students
3. Normal achiever students

Underachievers are those whose academic achievement is significantly below the level expected while overachievers are those whose academic achievement is significantly high than the level expected.

Students who are not so highly intelligent but their achievement level is high are termed as over achievers. Students who are nearly similar in intelligence as well as in educational achievement are termed as normal achievers. While those students who are fairly high in intelligence but could not show similar academic achievement are termed as under achievers.

Pictorial representation can be done as;

- Over achievers ≡ Intelligence ↓ and Achievement ↑
- Normal achievers ≡ Intelligence = Achievement
- Under achievers ≡ Intelligence ↑ and Achievement ↓

According to Desai (1978)30 “A pupil is said to be under achiever, when his overall scholastic achievement is low and his innate intellectual ability is not less than normal. On the other hand over achiever’s scholastic achievement is high although his intellectual innate ability is normal or less than normal”.

Joshi (2000)\textsuperscript{31} says that “The students who perform worse than expected, that means who achieve less success than expected (below norms) are under achievers.”

McCloskey (1967)\textsuperscript{32} concluded that “Under achiever students have not developed sufficient cognitive and reasoning skills as per their intelligence to show required school progress.” According to Reena and Mercy (2009)\textsuperscript{33}, “the concept of over and underachievement takes into account the academic achievement in relation to the intellectual level of the individual”. Under achievement can be understood as the discrepancy between intelligence test scores and achievement test scores. For any intelligence level, if a person achieves below what is expected of him, he is usually called an underachiever. Underachievers are typically defined as pupils who perform significantly less well in school than would be predicted from their performance on measures of learning ability, intelligence, or in some cases, past achievement.”

After studying related literatures investigator has defined three terms as;

- “The students whose scholastic achievement is more than their intelligence are known as over achievers”.
- “The students whose scholastic achievement is same as their intelligence are known as normal achievers”.
- “The students whose scholastic achievement is less than their intelligence are known as under achievers”.

\textbf{2.2.4.2 Co relates of Achievement}

It is very important for educational system to enhance the achievement level of students. So it is must for research study to find what all factors affect academic achievement. In the present study investigator is dealing only with the scholastic achievement as the study pertains only to cognitive domain. So investigator reviewed literature related to factors affecting scholastic achievement.

\textsuperscript{32}E.F.McCloskey, Urban disadvantaged Pupils – Characteristics, environments, potentials, Portland, DR: Northwest Regional Educational Laboratory, 1967.
Minikutty (2005)\textsuperscript{34} points many researches and states that, according to Passow (1970) Socio economic status, geographic location, school system, cultural heritage, linguistic and religious minorities affect achievement. Simpson (1962) found that Socio economic status of family is responsible for difference in academic achievement. Pamela (1990) differences in career aspirations, motivation, self esteem and home environment are factors that are responsible for different academic achievement among learners. Fatmi (1986) concluded that racial and religious background affects achievement. According to Panda (1997) lack of proficiency in cognitive learning, differences in achievement aspirations and self concept affects achievement.

Anand and Padma (1987)\textsuperscript{35} states that “It has been good number of variables such as personality characteristics of learners, socio-economic status, organizational climate of school, curriculum planning etc. influences achievements and they are called correlates of achievement.

Thus from the various studies it can be concluded that there are factors like cognitive ability, self concept, intelligence, socio-economic status of family, personality, locality, gender, self esteem, motivation, racial and religious background affects achievement.

In the present study investigator has developed Concept Attainment Model of Instruction for teaching of unit “Sets” in Mathematics to students with different achievement levels. Different achievement levels among students were found with help of scores on intelligence test and marks obtained in final exam of Mathematics. Investigator also considered socio-economic status and gender of pupils while determining their achievement in Mathematics. Hence co relates of achievement for the present study were;

1. Concept Attainment Model of Instruction
2. Gender of pupils
3. Socio-economic status of families of pupils


2.2.4.3 Identification of Various Achievement Levels

There are various opinions about which type of students to consider as normal achievers and rest of them as over or under achiever students. Investigator has reviewed content based on identification of different achievers. According to Reena and Mercy (2009)\textsuperscript{36}, under achievers, normal achievers and over achievers were found using Farquhar (1963) technique. Regression lines corresponding to five regression equations were developed for standard 8,9,10,11 and 12 respectively indicated as below;

(1) $Y = 0.92X + 26.14$, for Standard VIII  
(2) $Y = 0.53X + 50.73$, for Standard IX  
(3) $Y = 0.99X + 34.88$, for Standard X  
(4) $Y = 0.34X + 36.77$, for Standard XI, and  
(5) $Y = 0.29X + 38.61$, for Standard XII

Pratibha Deo and Gupta (1972)\textsuperscript{37} studied many researches and states that, “Gowan (1960) used performance more than one standard deviation below the ability as the indication of under achievement. Goldberg (1959) picked up those with 120+ I.Q. whose grades were below 80 percent of the class standing and these were called underachievers. Holmes and Finely (1957) developed a formula, to describe the grade placement deviation as the difference between actual grade placement and the grade placement expected from chronological age $+K$ (constant). Angelio and Hall (1960) took 120+ I.Q. students who were below 2.5 on a four point scale as underachievers. DC Hann and Havighurst (1961) defined underachievers as those, in upper 10\textsuperscript{th} or quarter of their class in ability, but whose grades were average or below average. Perkins (1965) classified a student as underachiever if his average IQ was 114+ and if point corresponding to his GPA fell at least one standard of error of estimate below the regression line for his classroom. Davis (1964) gives a crude estimate of over or under achievement on an achievement test and on an appropriate aptitude or mental ability and by comparing it with the smallest significant difference at a designated level of probability the difference to be calculated in terms of stanine scores.

\textsuperscript{36} Reena and Mercy, op.cit.  
\textsuperscript{37} Pratibha Deo and Gupta, op.cit
Uchat (1989)\(^{38}\) identified under achievers as those students whose scores on intelligence were above third quartile (P\(_{75}\)) but scores on academic achievement lie below the second quartile (P\(_{50}\)), as well as students whose positions on intelligence were above second quartile (P\(_{50}\)) but scores on academic achievement fell below first quartile (P\(_{25}\)). Identification of over achievers was done in similar manner, students whose scores on intelligence fell below second quartile (P\(_{50}\)) but scores on academic achievement were above third quartile (P\(_{75}\)), as well students whose position on intelligence scores below the first quartile (P\(_{25}\)) but scores on academic achievement were above second quartile (P\(_{50}\)) . Minimum difference of one quartile between intelligence and achievement was accepted for identifying under achiever and over achiever students.

Minikutty (2005)\(^{39}\) found the academic disadvantage index using the scores of intelligence test, study habits inventory, mathematics attitude scale, home learning environment, socio-economic status scale, self concept inventory and compared it with the scores of achievement test. Those with high index as compared to scores in achievement test were considered as under achievers and vice versa while others are considered as normal achievers.

Tulani (2006)\(^{40}\) developed regression equations for knowing conjoint predictability of intelligence, emotional intelligence and creativity, problem solving ability, study habits and home environment. Through these equations various types of achievers were found.

Rajyaguru (1991)\(^{41}\) points Tehli Kohli’s comparison and classification of various statistical methods for identification of over and under achievers;

**Regression equation method:** In this method, prediction of achievement is done in relation to intelligence. If predicted scores are less than acquired scores, students are classified as over achievers. Those pupils are identified as underachievers whose predicted scores are more than acquired scores.

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\(^{39}\) A. Minikutty, op.cit.


**Percentile method**: In this method, under achievers and over achievers are identified on basis of difference of percentile rank of intelligence and achievement.

**Percentage difference method**: The scores obtained on intelligence test and achievement tests are converted to percentage. In this method over achievers and under achievers are identified on basis of difference in percentage.

**Achievement indication method**: Ratio of scores on achievement test and intelligent test are found and converted to T-score.

**Inventory and Battery**: Through objective evaluation using inventory and battery, over achievers and under achievers are found.

**Stanine method**: Scores on intelligence test and achievement test are converted to stanine scores. By calculating differences between the scores underachievers and over achievers are identified.

**Rank method**: Achievement scores are compared with aptitude scores for identification of under achievers and over achievers.

**Percentage place method**: By deciding the place of percentage obtained by students in intelligence test and in achievement test, under achievers and over achievers are identified.

**Status place variability method**: Difference between actual status and expected status is found. Students showing low status compared to expected status are called underachievers and those showing high status compared to expected status are called overachievers.

**Gradation method**: Underachievers and over achievers are identified with difference in grades.

**Ranking by teachers**: Teachers with their intimacy with students, identify them as overachievers and under achievers. This method is not scientific as lot of objectivity comes in the decision.

In the present study investigator employed technique of Regression equation method. The regression equation was computed for predicting student’s achievement. Students were identified as overachievers if the predicted scores were less than achievement scores and if predicted scores were more than achievement scores those students were identified as underachievers. Investigator prepared Standardized Unit Achievement Test in mathematics and the scores obtained on it were considered as achievement scores.
2.3 Review of the Content on Empirical Basis

The investigator had studied various researches done in past. The researches were reviewed form India as well as from foreign countries. Investigator had carried out the work of developing technology for building up concepts of the students belonging to different achievement levels. Thus the review is also presented in that context.

2.3.1 Review of the Past Researches carried out in Foreign Countries

As the researches obtained for review pertaining to present study from foreign countries were few, those researches were not subdivided in different groups. But the number of researches in India for review was more and therefore it was suitable to divide them in subgroups for getting the review very sharply. Some questions were selected for the analytical review of the past researches

Analytical review for the study of the Educational Researches was done to get the answers of the following questions.

1. What was the level of Educational Research?
2. In which year was the study carried out?
3. What were the objectives of Educational research?
4. What was the sample of study?
5. Which classes were present in the sample?
6. What about the research design?
7. How was the data collected? Which tools were used?
8. What about analyzing data? Which statistical techniques were used?
9. What were the findings of the study?
10. How many researches were related to development of Concept Attainment Model of Instruction?

Investigator reviewed foreign researches as discussed below:

Rajyaguru (1991)\textsuperscript{42} has explained various studies carried out in foreign countries pertaining to the present study as;

‘Yul, Rooter, Burdger and Thomption (1973) had studied the students of age group 9-14 years. 1143 students of the age of Nine years from Essal, 1151 students of

\textsuperscript{42}Rajyaguru, op. cit., pp. 27-46.
the age of Eleven years from Essal, 1634 students of the age of Ten years from London and 2113 students of the age of Fourteen years from Essal constituted sample. The regression equation method was used to identify underachievers. The scores of the I. Q. test were considered as predicative variables and reading achievement was considered as an evaluation variable. Samples were identified on the base of comparison between intelligence and reading achievement. The findings were: i) To define underachievement, regression equation method is the only satisfactory technique. ii) The dependency on other matters of underachievers depends on the level of underachievement. iii) Correlation co-efficient between reading and intelligence were found from 0.607 to 0.639 in various groups.

Cepai, A. C. and Killing, B. (1978) had studied about the relationship between underachievement and types of anxiety. 246 students of Christ church and intermediate school of New Zealand was included in which, 132 were boys and 114 were girls. Tool used were - Mental ability test, Achievement test of mathematics, Normal anxiety test, Test of anxiety test, Mathematics anxiety test.

Definitions of over, normal and under achiever students;

(i) Over achievers: The samples, whose predicted score in achievement test of mathematics is one standard error less than real achieved score.

(ii) Normal achievers: The samples, whose predicted achievement scores in mathematics ±1 standard error in comparison with real achieved score.

(iii) Under achievers: The samples, who’s predicted score in achievement test of mathematics is one standard error more than real achievement score.

By the scores achieved from mental ability test and mathematics achievement scores, using regression equation method, as per definition. Findings were: (1) Scores achieved by girls were higher than those achieved by the boys in simple anxiety test. (2) There was significant difference among underachievers, normal achievers and overachievers in scores of math’s anxiety test. (3) There was a significant difference between combined mean of scores of math’s anxiety test of overachievers and normal achievers and mean score of normal achievers. Underachievers were highly worried for mathematics.

Nurit, Bar-ally and Amiram Raviv (1981) had studied whether there is any development in achievement of underachievers if they are made tutors of the students of lower classes. They gave work to fifteen underachievers of fifth and sixth grade to
be a tutor of the students of second grade, who were weak in math. After working as a tutor for four months, the achievement of underachievers in mathematics was shown significantly higher.

Sixty boys were chosen from the primary school of Israel. Among them, half were from grade fifth and sixth and others were from second grade. The students, who’s IQ was 110 or more, but achievement score in mathematics was less than six grades (Minimum qualification in Israel, to pass). Primarily teachers’ opinion was used for selecting second grade sample as scanner. Statistical Methods used were Variance analysis and t-test. Findings of the study were: (1) Second grade students, to whom mathematics was taught by underachievers, had shown significant achievement in mathematics within four months. (2) Fifth and sixth standard underachievers had shown significant progress in mathematics after their work as a tutor. (3) There were no significant differences about self concept between experimental group and controlled group.

Behrense, L. T. and Vernan, P. E. (1978) had studied some matters related to the personality of underachievers and overachievers. 292 Canadian students of grade seventh in which, 155 were boys and 137 were girls. Proper representation of socio-economic areas of the city was taken in the sample.

Expected achievement was found on the basis of regression line drawn on achievement verses Intelligence. The underachievers and overachievers were identified on the basis of whose actual achievement was ± 0.8 standard deviation.

Findings were: (i) Co-efficient of correlation between evaluation variable and predictive variable in the prediction done on the basis of correlation of multi variables was 0.50 when prediction of mathematics achievement was done by adding some different sides of personality, in the place of only intelligence bases and multi variables. Correlation between predictive variable and evaluation variable was 0.57 when personality variable also considered added to the intelligence. (ii) Effects of low self-esteem and negative attitude towards co-students were seen on achievement in mathematics in the girls.

Francis (2004) studied the effect student related variables and teacher related variables on academic achievement in chemistry. Teacher related variables were gender, age, qualification and experience in field of teaching. Student related

variables were gender, study habit and mathematical ability. The main objective of the study was also to develop model for enhancing academic achievement in chemistry. Senior secondary school students and teachers were taken as sample. Tools used were i) Personal data questionnaire; ii) Study habits inventory, iii) Mathematical aptitude test and iv) Chemistry achievement test. Ex-post facto research design was used. Casual relationship between student related variables and teacher related variables under investigation was found on academic achievement in chemistry. Multiple regression analysis and path analysis was done. Major finding was that teacher’s gender had affected academic achievement of students in chemistry. Thus findings established the importance of Female teachers in teaching learning situations.

**Ebenezer (2004)** had developed Common Knowledge Construction Model for enhancing achievement in science. He did the experiment on the students of class seven. He selected the topic “Digestion and Excretion” for the same. He divided the class into two groups and used the model in one of the class. He prepared a questionnaire to collect the responses of both the groups and found that the class that was taught using Common Knowledge Construction model has learnt the concepts well and had shown enhancement in achievement. Thus the model was found effective in developing concepts and further increased achievement in science.

**Betsy Mc Coach (2009)** did a comparison of overachiever, normal achiever and underachieve students in attitude, perception and motivation. The main aim of the study was to compare the high achieving, normal achieving and under achieving adolescents on attitude towards school and teachers, goal-valuation, motivation and general academic self perception. School Assessment Survey was prepared based on these five factors and was used as tool. T-tests were done for data analysis. The study revealed that over achievers were more positive in academic self perceptions, goal evaluation, motivation and attitude.

### 2.3.2 Review of Past Researches carried out in India

By doing study of the previous researches carried the investigator can get more idea about research. Investigator has selected research studies based on following five themes. Details about it are given in tabular form as:

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45 Betsy Mc Coach, Comparison of over achievers, normal achievers and underachiever students in attitude, perception and motivation, University of Connecticut, 2009.
Table 2.2
Themes of Past Researches Studied

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Theme</th>
<th>No. of Researches</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Researches related to Comparison of Concept Attainment Model of Instruction with other Teaching Techniques</td>
<td>17</td>
</tr>
<tr>
<td>2.</td>
<td>Researches concerned with Technology for Conceptual Learning in Various Subjects</td>
<td>16</td>
</tr>
<tr>
<td>3.</td>
<td>Researches oriented to Development of Concept Attainment Model of Instruction for Teaching Mathematical Concepts to enhance Achievement</td>
<td>06</td>
</tr>
<tr>
<td>4.</td>
<td>Researches that dealt with Co-relates of Achievement</td>
<td>15</td>
</tr>
<tr>
<td>5.</td>
<td>Researches pertaining to Inter relationship between Over achiever, Normal achiever and Under achiever Students</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>68</strong></td>
</tr>
</tbody>
</table>

2.3.2.1 Researches related to Comparison of Concept Attainment Model of Instruction with other Teaching Techniques

The investigator studied following researches pertaining to comparison of Concept Attainment Model of Instruction with other methods and techniques of teaching as well as with the traditional method.

Passi, Singh and Sansanwal (1986)\textsuperscript{46} prepared pre service training techniques using Concept Attainment Model of Instruction and Inquiry training Model. The objective of the study was to prepare workshop that can be implemented at college level and evaluated on school grounds. Various units were selected from various subjects. The sample constituted of 25 institutions containing 45 teacher educators, 393 budding teachers and 2500 students. Teaching techniques were considered as independent variable. Students and student-teachers achievements were considered as dependent variables. Three steps experimental design was used. The tools used were theory checkup by Bruce-Joyce, response inventory, teaching analysis manual, test for readiness, pre and post achievement tests. Descriptive and inferential statistical

methods were used for data analysis. Findings concluded that i) Concept Attainment Model of Instruction and Inquiry Training Model had positive effect on motivation, learning ability, understanding power and desiring ability. ii) Concept Attainment model was more effective for enhancing achievement as compared to other teaching techniques. iii) Concept Attainment Model was effective in developing concepts.

Chaudhary (1989) studied effectiveness of Concept Attainment Model on teaching skills of trainees. 10 female teachers of B.Ed. College were selected as sample. Concept Attainment Model of Instruction was developed based on Bruner’s theory for teaching practical skills. Mean, S.D. and t-test were used for analyzing data. Concept Attainment Model of Instruction was found effective in enhancing skills like questioning, stimulus variation, and explanation as well as in controlling class. While in writing objectives and specification this model was equally effective with traditional method of teaching.

Aziz (1990) did the comparative study of effectiveness of Concept Attainment Model, Inductive Thinking Model and traditional method on teaching of certain concepts in chemistry. 280 students from class 9 were chosen randomly. Three groups controlled – experimental design was used. Achievement test was prepared by the investigator based on certain concepts of chemistry. ANOVA was done for data analysis. Concept Attainment Model and Inductive Thinking Model were found highly and equally effective in teaching concepts as compared to traditional method.

Singh (1990) studied the effectiveness of Inquiry Training Model, Concept Attainment Model and traditional method on teaching of Science. He also studied the relationship of intelligence and attitude on science achievement. 120 College students were selected with three groups stratified random sampling technique. Pre test – post test three groups quasi experimental design was used. Jalota’s mental ability test, attitude scale and achievement tests were used. Mean, S.D. and t-test were done with ANOVA. Results indicated that scores of the students taught using Concept Attainment Model and Inquiry Training Model were equal and higher as compared to the scores obtained by the students taught through traditional method. Attitude was

same in both cases and effective relationship was found between intelligence, attitude and achievement.

Sud (1990)\textsuperscript{50} studied the effectiveness of Concept Attainment Model and Advance Organizer Model in reference to cognitive ability, intelligence and understanding of linguistic concepts in terms of creativity. Certain concepts of Hindi from class 9 were chosen. Randomly from five schools, 288 students were selected as sample. Experimental randomized group method was used. Jalota’s Mental Ability test, Torreon’s creativity test, Whitkitson’s closed figure group test and achievement test were used as tools. Mean, median, S.D. skewness and kurtosis were found. 2x2x2x2 ANOVA was done for data analysis. Concept Attainment Model was found effective as compared to Advance Organizer Model in developing linguistic concepts. While in reference to cognitive ability, intelligence and creativity no significant effect was seen.

Jaimini (1991)\textsuperscript{51} developed Advance Organizer model and Concept Attainment Model. Students of class 9 were selected as sample. Purposive sampling technique was used and three groups were developed. Quasi experimental design was used. Three unequal controlled group design was used. Three teaching technologies used were Advance Organizer Model, Concept Attainment Model and traditional method. Raven’s progressive matrices and Mehendi’s creative thinking ability tests were used. Co-variance analysis was done for analyzing data. Concept attainment Model was found significantly more effective than Advance Organizer Model for divergent thinking ability. In terms of achievement both these models were found equally effective.

Salvi (1991)\textsuperscript{52} did comparison of traditional method with teaching using Concept Attainment Model. The objectives of the study were to find the effect of Concept Attainment Model on achieving concepts in English, developing inductive thinking ability and attitude. Students of class 9 were selected for study. 270 boys and girls were included as sample. Pre-test – Post-test only controlled group design was used.

\textsuperscript{50} Sud, “Comparison of concept Attainment Model and Advance Organizer Model on cognitive ability, intelligence and creativity”. PhD. Punjab University, 1990.
\textsuperscript{51} N Jaimini, “Effectiveness of Advance Organizer Model and Concept Attainment Model on divergent thinking ability and remembrance”, PhD. Delhi University, 1991.
\textsuperscript{52} R.C. Salvi, “Effectiveness of Concept Attainment on inductive thinking ability, achievement and attitude of class 9 student”, PhD. Gujarat University, 1991.
The tools used were: i) Self concept inventory by J.H. Shah, ii) Desai-Bhatt verbal group intelligence test, iii) Inductive thinking ability test by Sarnathsinh, iv) English attitude measuring scale by Upadhaya, v) Response inventory by Passi and Sansanwal and vi) English concept attainment test. One-way and Three-way (3x2x2) ANOVA was done for data analysis. Findings indicated that Concept Attainment model was significantly effective for enhancing conceptual learning, inductive thinking ability and achievement. Significant effect of intelligence and self-concept was seen on English concepts.

**Mahajan (1992)** studied the effect of Concept Attainment Model, Advance Organizer Model and traditional method of teaching. 45 pre-service trainees were selected as sample. Pre test – Post test one group only design was used. Achievement test was prepared by the investigator. ANOVA was done for data analysis. It was found that Concept Attainment Model was more effective compared to Advance Organizer Model and conventional method of teaching in enhancing the abilities of pre-service trainees.

**Das (1993)** developed Concept Attainment model for pre service trainees in order to enhance their theoretical learning abilities. 16 B.Ed. college students were selected as sample. The objectives of the study were to find the effect of Concept Attainment Model on trainees and to know their opinion for the same. Pre-test – post-test one group only design was used. The tools used were theory check-up test, opinionnaire and teaching analysis manual. For analyzing data co-relation was done also mean and t-values were calculated. Concept Attainment model was found more significant in enhancing learning abilities and their opinions were also found positive for the same.

**Shah (1995)** studied the effectiveness of Advanced Organizer Model and Concept Attainment Model in teaching of tenses in English Grammar. The main objective of the study was to compare effectiveness of Concept Attainment model and Advanced Organizer Model in terms of achievement. The sample of study constituted

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54 B.C.Das. “A study of effectiveness of Concept Attainment Model in terms of efficiency, training, understanding and teaching to pre-service trainers”, PhD. Devi Ahalaya Bai University: Indore, 1993.
58 girls of class 9. Achievement test in English grammar on the topic Tenses was prepared. t-tests were used for analyzing data. It was found that Advanced Organizer model was more effective compared to conventional method of teaching. Concept Attainment model was more effective compared to traditional method. While Advanced Organizer Model and Concept Attainment Model of teaching were found equally effective.

Sanjiwani (2005) did study on effectiveness of Concept Attainment Model and Inductive Thinking Model of Teaching on students' achievement in Science, scientific creativity and attitude towards Science.

The objectives of the study were to study the effectiveness of teaching through Concept Attainment Model, Inductive Thinking Model and traditional Method of teaching on improving achievement in Science, reasoning ability, scientific creativity and attitude of IX class students. Study was experimental in nature and pretest-posttest design was followed. The sample was of 377 students. Tools used for measuring the variables were reasoning ability test in Hindi by P. K. Bayati, Verbal Test of Scientific Creativity in Hindi by V.P. Sharma and J. P. Shukla, Science Attitude Scale in Hindi by Avinash Grewal and a self-prepared achievement test. Data was analyzed by using t-test and ANOVA. It was found that Concept Attainment Model of teaching and Inductive Thinking Model were equally effective as compared to traditional method in developing reasoning ability, scientific creativity and favorable attitude towards Science as well as in enhancing achievement in Science among the students of IX standard.

Mukherjee (2009) studied the effectiveness of Concept Attainment Model of Instruction in terms of achievement in Science of students belonging to class VIII. The main objective of the study was to compare the effectiveness of Concept Attainment Model of Instruction in terms of achievement. The sample was taken as high school students of government schools of Indore city. The investigator prepared Criterion reference test. Data analysis were done using percentile, mean and S.D. It

\footnote{Sanjanwani, “Effectiveness of Concept Attainment Model and Inductive Thinking Model of Teaching on students' Achievement in Science, Scientific Creativity and Attitude towards Science.” PhD., Sant Gadge Baba Amravati University, 2005.}

was concluded that Concept Attainment Model of Instruction was more effective than traditional method of teaching in terms of achievement in Science.

Ali (2011)\textsuperscript{58} did comparative study of effectiveness of Concept Attainment Model and Advance Organizer Model in teaching of English in Teacher Education Course. The objective of the study was to compare the effectiveness of Concept Attainment Model and Advance Organizer Model in terms of achievement. The sample of the study consisted of 46 students teachers. On the basis of pretest scores they were placed in two groups randomly. Each group comprised of 23 students.

This study was experimental in nature. Achievement test was prepared to find the effectiveness of teaching in achievement of student teachers. T-test was used for data analysis. Concept Attainment Model of Instruction was found more effective compared to Advanced Organizer Model in teaching English to student teachers.

Jadhav (2011)\textsuperscript{59} compared the Concept Attainment Model of Instruction with the conventional method of teaching. The main objectives of the study were to select certain concepts and prepare lesson according to Concept Attainment Model of Instruction and to check its effectiveness in terms of traditional method. Sample included students of class VIII from Sayajirao School, Satara. Pre test-Post test equivalent group design was used in the study. Achievement test was prepared by the investigator based on the concepts selected. Both the groups controlled and experimental were administered with the test. Mean and S.D. were found. Data analysis indicated that there was no difference in scores of both the groups. Hence Concept Attainment Model and conventional teaching method were equally effective in teaching certain concepts of geography.

Sindhu (2011)\textsuperscript{60} studied the effectiveness of Concept Attainment Model of Instruction in Biology. His main aim was to compare the Concept Attainment Model with traditional method. He took the sample of students of class IX from Noida. 85 students were included in controlled group and 90 students were in experimental group. Pretest - Post test experimental design was used. T-test was used for analysis.


of data. It was found that there was no effect of Concept Attainment Model in teaching of Biology to the students of class IX.

**Basapura (2012)** studied the effectiveness of Concept Attainment Model of Instruction on pupil’s achievement in science and their attitude. The sample was taken of 76 students from class ix of Bellary City. The objectives of the study were to check the effectiveness of Concept Attainment Model of Instruction in terms of achievement among students of class ix and to find their attitude towards studies when taught through Concept Attainment Model of Instruction with respect to traditional method of teaching.

Parallel pretest post test design was used. Standardized achievement test was prepared. The attitude scale prepared by Avinash Grehwal was used. Major findings of the study were that Concept Attainment Model of Instruction was more effective in terms of achievement as compared to the traditional method. Attitude among pupils that studied through Concept Attainment Model of Instruction was more positive towards studies as compared to pupils who studied through traditional method.

**Kumar (2012)** studied effectiveness of Concept Attainment Model of Instruction on achievement of concepts in Physics. The main objective of the study was to compare the adjusted mean scores of physics concept understanding of concept attainment model group and traditional method group by considering pre-physics concept understanding, gender and intelligence as a covariates. Experimental research method was adopted in the present study. The data required for the present study were collected through achievement tests (pre-test & post-test), students liking scale and Raven's standard matrices scale. For the study the stratified random sampling technique was used to select 60 students of class IX from Shri Krishna senior secondary school. The statistical techniques used were t-test and F-ratio (ANCOVA).

### 2.3.2.2 Researches concerned with Technology for Conceptual Learning in Various Subjects

Investigator studied the researches related to technologies that can be utilized for teaching of concepts. Past researches on various school subjects concerned with teaching of concepts were studied by the investigator. Various researches that

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61 J. Basapura, “Effectiveness of Concept Attainment Model of Instruction on pupil’s achievement and attitude”, M.phil. Vijayangara Shri Krishna Devraya University, Karnataka. 2012.

62 Kumar, “Comparative effectiveness of Concept Attainment Model of Instruction and Traditional method for Acquisition of Physics concepts in class IX.” PhD. Banasthali Vidyapeeth, 2012.
included variety of teaching techniques and various methodologies for conceptual learning in various subjects are discussed in detail under this heading.

Gosai (1977) selected students of class 5 for teaching them Mathematical concepts. 300 students were taken as sample that included 150 boys and girls each. The objectives of the study were to study the effect of linear programming on achievement and gender. 2x2x3 mixed factorial design was used. Six steps were created in the program. Analysis of variance was done for analyzing data. Small steps of linear programming were effective in conceptual learning especially in terms of knowledge, understanding and interpretations.

Chitriv (1983) evaluated the effect of teaching using teaching techniques according to thoughts of Asubel and Bruner in accordance with attainment of concepts. He also used conventional method of teaching to teach in one class. Six mathematical concepts were chosen from the textbook of class 11. Three equal groups design was used. One group was taught using techniques suggested by Asubel, second was taught by techniques suggested by Bruner and the third group was taught by chalk and talk method. Raven’s Progressive Matrices, Robin’s and Granny cognitive style test, criterion reference test and achievement test were used as tools. Descriptive statistics was used. T- test was also done. It was found that Bruner and Asubel’s teaching techniques were much effective than that of traditional method. Asubel and Bruner’s teaching techniques were however found equally effective.

Chand (1985) took the pupils of class 3, 4 and 6 as the sample for study. Using cluster sampling technique total 300 students were selected from rural and urban areas. Two different teaching methodologies were prepared using two different teaching thoughts. One technique was based on thoughts of Bruner and other technique was based on Piaget’s thoughts. Survey was carried out partially as well as Practical group design was used. Achievement test was prepared by investigator. The techniques were more effective on urban pupils as compared to pupils of rural area.

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63 Gosai, “Effectiveness of linear programming on algebra at primary level”, PhD. Himachal Pradesh University, 1977.
64 U.G. Chitriv, “To evaluate the effects of Bruner, Asubel and traditional method on achievement of concepts in mathematics”, PhD. Nagpur University, 1983.
Agarwal (1988)\textsuperscript{66} did the study of finding out the effectiveness of Reception oriented Concept Attainment Model in teaching of certain concepts in Science. The main objective of the study was to enhance knowledge and understanding of concepts among students using this model. Sample was selected from students of class 8. Sample included 18 girls from girl’s school. Two groups were developed. Pre-test and post-test were conducted. Man-Whitney U test was used for analyzing data. This model was found effective in developing concepts.

Bhaveja (1989)\textsuperscript{67} developed various teaching techniques to study its effectiveness on achievement of concepts. The objectives of the study were: i) To analyze Bruner’s teaching technique as the ideal technique for development of concepts. ii) To decide the place of Inductive Thinking Ability Model in the process of concept development. iii) To find the most effective technique form all the thinking techniques. Purposive sampling technique was used for selecting students form primary class. 29 boys and 70 girls were selected as sample. Experimental and controlled group design was used. Raven’s Progressive Matrices and criterion reference test were used as tools. Mean and S.D. were found and from data analysis of variance was done. Concept Attainment Model and Inductive Thinking Model were found equally effective and were better than traditional method of teaching.

Gupta (1989)\textsuperscript{68} developed the technology for teaching various concepts in geography. He selected std. 8, 9 and 10. He selected 12 units from the subject. The sample constituted 501 boys and girls. Total 12 different programs were developed. Survey was carried out and one group experimental design was used. Raven’s Progressive Matrices were used. Descriptive statistics was used. T- test was also done. Significance of various programs was seen on pupils. Boys showed significantly more attainment of concepts as compared to girls.

Shista (1990)\textsuperscript{69} tried to focus on developing series of concepts using discovery learning and traditional method. Photosynthesis topic was chosen from Science subject of class 8. Students of class 8 studying in Delhi Public School were taken as

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\textsuperscript{67} Bhaveja, “Effectiveness of Models of Teaching on attainment of concepts”, P.hD. Delhi University, 1989.
\textsuperscript{68} R. Gupta, “Constructing teaching technologies for concept attainment in Geography among children of various age groups”, P.hD. Kurukshetra University, 1989.
sample. One group Pre-test – Post-test design was used. Ravens Progressive Matrices and achievement test were used as tools. Mean, S.D. and t-value were found. Discovery learning technique was comparatively effective in developing concepts of Photosynthesis rather than traditional method.

Manocha (1991) developed lesson plans based on Bruner’s Concept Attainment Model theory. Reception oriented model and Selection oriented model were prepared for teaching of biological concepts to students of class 9. Three groups of 33, 36 and 32 students were chosen. Experimental and controlled group post test only design was used. Achievement test was prepared by investigator. Mean, S.D. and t-value were found. ANOVA was also done. Findings indicated that Selection oriented and Reception oriented Concept Attainment Model of Instruction were equally effective. They were better compared to traditional method of teaching.

Agarwal (1995) did a comparative study of conceptual understanding using Programmed Instruction and Computer Assisted Instruction in Biology. The objectives of this study were to compare the relative effectiveness of two methods of teaching Programmed Instruction (PI) and Computer Assisted Instruction (CAI) for the conceptual understanding of students in reference to intelligence, gender, socio-economic status, learning time and attitude.

The sample of the study comprised of 160 students of class IX students (boys and girls both) from ASC Central School, Bareilly. The tools used to collect the data included Branching Programs, Computer Programs, Conceptual understanding tests, PI and CAI Attitude scale, Socio-economic Status scale by Shah and Agarwal and Group tests of Intelligence developed by R.K tendon. Mean, SD, t-test and product moment correlation was also used to analyze the collected data. Both the methods PI and CAI were quite effective for teaching Biological concepts to class IX students regardless of their sex, intelligence or SES level. Neither the level of conceptual understanding nor the time taken for learning by PI group students was influenced by their sex, intelligence or SES level.

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Apte (1995)\textsuperscript{72} studied development of concept of numbers in children from different socio-economic status (SES). The objectives of study were to investigate whether the development of the concept of number can be accelerated in children at ages 4+, 5+ and 6+ after the implementation of a specially designed instructional program and investigate whether there are any differences in children between the Socio-Economic levels and within the levels with regard to the development of the concept of number after the implementation of the instructional program.

For the study an experimental method involving a 3 X 3 multi-functional randomized group design was used. Three age levels were 4+, 5+ and 6+ and the three SES levels were higher, middle and lower respectively. The instructional program was based on logical operations as proposed by Piaget and Bruner. Evaluation was based on summative and formative approach. Sample comprised of 135 students of MIT and BVB schools of Pune’s urban areas. Data were analyzed by using ANOVA and Scheffe test. According to Piaget, the development of the concept of number comes around the age of 7+. In the study it was found that the specially designed instructional program helped to accelerate the development of the number concept, i.e. by lowering the age from 6+ to 5+. All the three SES levels children have benefited from the instructional program.

Alam (1997)\textsuperscript{73} developed Inquiry Training Model and Inductive Thinking Model for development of concepts in Science. Three classes from two schools were selected. Total 336 boys and girls were included in sample. Traditional method was also implemented for teaching on one of the group. Two experimental and one controlled group design was used. Jalota’s mental ability test, Chauhan’s Socioeconomic status scale and concept attainment test were used as tools. Mean, S.D. and t-value were calculated. Inductive Thinking Ability Model was found more effective than Inquiry Training Model and traditional method. However Inquiry Training Model was more effective than traditional method.

Ayyappan (1997)\textsuperscript{74} studied concept development among higher secondary students. The objectives of the study were to identify the concepts essential for

\textsuperscript{72} Vinita Apte, “An Experimental Investigation of the Development of the Concept of Number in Children belonging to different Socio-economic status in Pune city”, PhD. (Human Development), SNDT Women’s University, 1995.

\textsuperscript{73} Alam, “Comparative effectiveness of Inductive Thinking Model and Inquiry Training Model on conceptual learning in Biology”, PhD. Jamia Malia Islamia University, 1997.

\textsuperscript{74} R.Ayyappan, “Concept development in Electronics at Higher Secondary Level”, PhD. Bharthiyar University, 1997.
understanding electronics at higher secondary level and to develop packages and compare them in terms of knowledge, understanding, application and skill. Purposive sampling technique was used for selecting the sample. Tools used in study were Achievement Test in Electronics; Reaction Scale for testing students’ reaction towards the packages and Attitude test for testing teachers’ attitude towards the training program. The data were analyzed with the help of t-test. Experimental group was found effective in terms of knowledge, understanding, application and skill.

Deshmukh (1997)\(^7\) developed teaching technologies for teaching mathematical concepts. The main objective of the study was to develop audio-visual aids, projects, games or certain techniques that could enhance concept development. Equations topic was chosen from the textbook of class 5. 103 students were selected as sample and they were divided into four groups containing 27, 26, 24 and 26 students. Effectiveness of teaching techniques was found on achievement. Flannel board, cut-outs, charts, match sticks, straws etc. were used. Four group design was used. Criterion reference test was used. Mean, S.D. and t-value were found. Findings concluded that teaching technique has effect on achievement of students. Students can learn better if any activity is carried out in class or games are played. New concepts should be introduced in some definite manner. Conceptual learning can me made effective if proper techniques are followed in the teaching process.

Solanki (1999)\(^8\) studied relationship of reasoning abilities with achievement of concepts in Mathematics of students of secondary schools. The objectives of the study were to construct and standardize the reasoning ability test and find relation of reasoning ability of the students with achievement of concepts in mathematics in relation to residing area, sex, I.Q. and caste. The sample comprised 2000 students of secondary schools in Gujarat. This sample was used for standardization of reasoning ability test and collecting the data. The factorial ANOVA was used. The reasoning ability of the students of secondary schools in Gujarat with achievement of concepts in mathematics was found to be average. The area, sex, I.Q. had significant effect on relationship of reasoning ability of the students with achievement of concepts in mathematics. Caste had no effect on the relationship.

\(^7\) Deshmukh, “To construct and check the effectiveness of various technologies for teaching Mathematical concepts”, PhD. Mumbai University, 1997.

Arora (2003) studied development of Moral reasoning in children at Concrete and Formal Operational Stages of Cognitive Development in relation to intelligence, home and school climate. The main objectives of the study were to study the development of Moral Reasoning of children at Concrete Operational Stage in relation to intelligence, home climate and school climate.

The sample consisted of 401 students of two age groups of 7 to 11 and 12 to 18. It was drawn on cluster basis from various schools of Rohtak city. The tools used in the study were: (i) Culture Fair Intelligences Test developed by R.B. Cattell Scale 2 and Scale 3; (ii) Family Relationship Inventory developed by G.P. Sherry; (iii) School Environment Inventory developed by K.S. Mishra; (iv) Standardized Moral Dilemmas developed by Raths and Kohlberg. Significant positive Relationship between Intelligence, school climate and home climate with development of Moral Reasoning in children at Concrete Operational Stage was found.

Dalal (2003) studied effect of Inductive Thinking Strategy on English Development and Concept Formation. The main objectives of the study were to study the effect of inductive thinking on concept formation, language development with respect to three strategies: (a) Concept Formation, (b) Interpretation of Data and (c) Application of Principles and to analyze thinking strategies for the same.

Sample was comprised of 587 students. Out of 587, 293 were in Experimental Group and 294 in Control Group. The “tool for teaching” was standardized by Hilda Taba and other tools used were self developed. The treatment was applied to classes IV to VIII students in the form of experimental group and control group. It was found that experimental group was superior to the controlled group in all aspects of the study.

These were the few researches that dealt with certain aspects of study.

2.3.2.3 Researches oriented to Development of Concept Attainment Model of Instruction for Teaching Mathematical Concepts to enhance Achievement

Investigator also reviewed specially the past researches that were done for teaching Mathematical concepts using Concept Attainment Model of Instruction.

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There were very few researches that were pertaining to development of Concept Attainment Model of Instruction for teaching Mathematical concepts and in turn enhancing academic achievement.

**Tavde (1991)** prepared three educational programs based on Bruner’s theory. He developed three models and compared them based on three intercultural groups. Three groups were developed from tribal, rural and urban areas. Three groups were prepared from each of these areas and total nine groups were formed. Each group contained 20 students. Symbolic, visual and action oriented techniques were used for presenting Concept Attainment Model. 3x3 factorial design was used. Pre – test and post – test were taken. Variance analysis was done. Urban group was found much effective as compared to other two.

**Vyas (1991)** developed teaching techniques using exemplars and characteristics of concepts. He intended to compare the two teaching technologies in terms of achieving concepts. The sample of 300 girls from class VIII was chosen. Comparisons of these teaching technologies with conventional teaching style were done as well as they were mutually compared. Solomon practical group design was used. Group eluded figure test was done. Findings indicated that exemplar oriented technology and characteristics oriented technologies for conceptual learning were equally effective and much more significant as compared to conventional method.

**Suvarna (1994)** did comparative study of Selection Oriented Concept Attainment Model of Instruction and Reception Oriented Concept Attainment Model of Instruction in Mathematics. The objectives of the study were to find out the relative effectiveness between experimental Groups - Selection Oriented Concept Attainment Model (SOCAM) and Reception Oriented Concept Attainment Model (ROCM) of teaching in mathematics on the criterion variables: (a) Achievement (b) Worksheet performance in (c) Verbal Creativity (d) Divergent thinking and (e) Reaction. Pretest-Posttest parallel design was followed. The sample comprised of 86 students studying in standard VII of an English medium sub urban school. These 86 students were then randomly assigned to the two experimental groups, namely, SO and RO.

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81 S.D.Suvarna, “A comparative study of Selection and Reception Oriented Concept Attainment Models of Teaching in Mathematics”, PhD., University of Bombay, 1994
Tools used for the study were: Nafele’s non-verbal test of Intelligence (NVTI), Otis self-administered test of mental Ability (OTIS), Divergent Thinking Categorizing Ability Test (DT), Torrence Test of Creative Thinking-Verbal (TTCT), Catells’ high school personality Questionnaire (HSPQ), Achievement test in Algebra and Geometry, worksheet for CAM, Reaction scale of pupils towards CAM, Achievement Test in CAM, Rating-Cum-Ranking Scale to measure the effect of the CAM, Rating-Cum-Ranking Scale to measure the Image of the Attitudinal characteristic of the CAM, Ranking Scale to measure the difficulty level of the various aspects of the CAM, Rating-cum-ranking scale to measure the surety of occurrence of the effects of the CAM. The data were analyzed with the help of ANCOVA, correlated t-test, t-test, Fiduciary limits, Kendall’s co-efficient of concordance (W) and Spearmen’s Rank correlation. No significant difference in the mean gain scores on the criterion variables, namely, gain in Achievement in Algebra-1, 2, Geometry 1 & 2, and total gain in Achievement in Algebra, and Geometry between SOCAM and ROCAM, Boys and Girls in the above groups, and interaction of Sex and Treatment in the above groups was found.

Raval (1996) did study of effectiveness of Concept Attainment Model of Instruction on teaching of unit “Triangle and Circle”. The objective of the study was to compare the effectiveness of Concept Attainment Model of Instruction and Conventional method of teaching. 56 boys and 33 girls were chosen as sample. Two groups were prepared one was taught using Concept Attainment Model of Instruction and other was taught through traditional method. Achievement test was prepared by the investigator. The test was given to both the groups after experiment and from the marks obtained t-test was done for analyzing data. It was found that Concept Attainment Model of Instruction is more effective than conventional method of teaching.

Faffal (2003) did research entitled as Technology for teaching and evaluating Mathematical concepts. The objectives of the study were to prepare lesson plans using Conceptual Instructional Design and Concept Attainment Model and secondly to compare them. He also prepared and standardized criterion reference test.

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214 boys and 220 girls were taken as sample for experimentation. While for preparing criterion reference test sample of 210 boys and girls were taken. Three units of mathematics trigonometry, geometry and statistics were taken and instructional design as well as model was developed for the same. F-tests were done for data analysis. The results revealed that compared to traditional method the Conceptual Instructional Design and Concept Attainment Model of Instruction were equally effective.

**Minikutty (2005)**\(^8^4\) prepared a Concept Attainment Model of Instruction in Mathematics. The objectives of the study were to find out achievement in Mathematics as well as cognitive ability of academically disadvantaged students. Socio-economic status and intelligence were also to be assessed of academically disadvantaged students. Sample of 505 students were taken. Concept Attainment Model of Instruction was developed for 32 concepts in Mathematics. Intact class rooms were taken for experiment and ANCOVA was used for analyzing scores. Concept Attainment Model of Instruction was found more effective compared to traditional method for teaching Mathematical concepts.

Thus there were very few researches pertaining to development of Concept Attainment Model of Instruction in Mathematics.

**2.3.2.4 Researches that dealt with Co-relates of Achievement**

This research is not only aimed at developing a teaching tool but it also has concern with that the teaching package so developed is equally effective for learners with different levels of achievement. Hence it was prime important to know the factors that actually affects achievement. Thus investigator studied researches carried out in past concerned with Co-relates of Achievement.

**Shrivastava (1967)**\(^8^5\) has done an investigation on the factor affecting achievement. He found that underachievement was related to poor study habits, reading ability, low motivation, poor health, and social and emotional adjustment, various background and personal factors like age, socio-economic status, birth order, size of family and father’s profession etc. but, he did not find any significant


relationship between underachievement and intactness of parental structure, hobbies, interest in games, sports and music and attitude towards school.

**Dhaliwal (1971)** had studied about personality correlates of academic over, underachievement. He found in his research that, overachievement was corresponded to superior study-habits, reservedness, high verbal ability, home, emotions and school adjustment, but poor social adjustment while inferior study habits, outgoing tendencies, low verbal ability, emotional instability, assertiveness, poor adjustment in home but good social adjustment were associated with underachievement.

**Sharma (1978)** studied the attributes of underachieving undergraduates. The study was carried out on 1000 students through stratified random sampling technique. Various tools like intelligence test, socio-economic status scale, habits inventory and questionnaire were used for data collection. The data were analyzed using product moment correlation and analysis of variation. Regression equations were used for identifying under achievers. Sharma’s findings states that, the more personality needs viz. exhibition, autonomy, affiliation, succorance, nurturance, endurance and order were frustrated, the more were the chance of an undergraduate becoming an underachievers. Withdrawal, inferiority and emotional instability have contributed significantly to academic underachievement. Interest area like: agriculture, crafts and outdoor sports contributed significantly to academic underachievement. Study habits and socio-economic status were found to be affecting underachievement. One interesting finding was that, unrealistic level of admiration adversely affected the academic achievement.

**Tandon (1978)** undertook psychological and ecological study of underachievers. Tandon explained his findings that, Male groups of underachievers were easy-going, out-going emotionally less stable, diffident, pessimistic, and less interested in study, highly anxious, disobedient and irregular in the school. Physical, emotional and socio-economic conditions of the male underachievers were not

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wholesome. Tandon had not found any effect of home environment on girl underachievers.

Grover (1979)\textsuperscript{89} had studied to find out the relationship between parental aspiration, certain personality traits and scholastic achievement. In that study, Grover finds that, the high aspiring parents showed significant correlation between father’s high aspiration and traits of dominance in boys. He also found that, there was a significant difference between father’s aspiration and mother’s aspiration.

Sharma (1981)\textsuperscript{90} studied factor related to academic underachievement and found that, poor academic motivation, linguistic ability, emotional insecurity contributed to underachievement. Underachievers were significantly poor in their performance on all the variables, whichever Sharma studied. In the end, he suggested that remedial program for underachiever is necessary.

Seethamony (1988)\textsuperscript{91} had studied familial and social factors associated with underachievement. Some important findings, which came out from the study were: The mean score of normal achievers were significantly greater than mean scores of underachievers with respect to the eleven familial and social factors. With respect to the nine of the familial and social variables, the mean scores of overachievers were significantly greater than the mean scores of underachievers. The rural underachievers were proportionately higher than urban underachievers and the overachievers were proportionately higher in urban area in comparison with over achievers in rural area. The proportion of underachievers was comparatively greater in backward caste groups.

Diwan (1992) \textsuperscript{92} studied academic achievement of Student teachers in terms of Aptitude, Attitude, Participation and Human Values. The objectives of the study were to determine the relationships between academic achievement in (theory and practical) with aptitude, attitude, participation and human values of the student.


\textsuperscript{92}Diwan Kumar: Study of the Predictors of Academic Achievement of Student teachers in terms of Aptitude, Attitude, Participation and Human Values. PhD. (Edu.), M.D.University, 1992.
teachers in reference to their gender. Sample of 400 student Teachers was selected randomly from the College of Education. The Normative Survey Method was used for study. The following tools were used: (1) Personal Information Blank - developed by the investigator; (2) Teaching Aptitude Test (TAT) developed by Jai Prakash and R. P. Shrivastav; (3) Teaches Attitude Inventory (TAI) developed by S. P. Ahluwalia and (4) Human Values Test (HVT) constructed by the investigator.

The findings of the study were that (1) Highly significant positive relationship has been found between aptitude, attitude and human values with academic achievement of student teachers and total as well as in theory and practical. (2) Female student teachers of urban background have been found significantly better as compared to their male counterparts in ten variables viz. academic achievement in total, theory and practical, attitude, aptitude, co-operation, dedication, nationalism, tolerance and entry level, except scientific outlook where no significant difference has been found between male and female student teachers of urban background. (3) Female student teachers of rural background have been found significantly better as compared to their male.

Charles (1993) studied factors affecting the academic performance of standard X students of Greater Bombay at the S.S.C. examination of March 1989 conducted by the Bombay Divisional Board. The objectives of the study were to identify and analyze various factors (personal, sociological, psychological and academic) likely to affect the academic performance of standard X students at the S.S.C. examination and study relationship between them in reference to gender.

The study employed descriptive & co-relational method. Using purposive sampling, 790 students from 12 different schools of greater Bombay were selected. The tools used for measuring variables were: G.H. Nafde’s non-verbal test of Intelligence and Otis self administering test of mental ability (verbal-Form B), Tara Chand’s personality measure, students’ academic performance record during the last three years of schooling (standard VIII, IX and X), Four point rating scale for teacher, Questionnaire for students, Principals, S.S.C. teachers and some examiners and moderators. Data were analyzed by using Chi-square test, product- moment correlation, Critical Ratio, and one way and two ways ANOVA.

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The findings of the study were: (1) Girls show a significant higher level of performance than boys all through the study. (2) Children of professional parents perform significantly better than children of non-professional parents; and children having both parents who are professional. (3) Students' performance level is positively related to their SES. (4) The study environment at home also shows significant relationship with performance both in case of boys and girls. (5) Verbal Intelligence is highly and significantly correlated with students' performance at the S.S.C. examination. It was in general found that the overall predictability level of students' performance at the S.S.C. examination increases as one moves from personal through the sociological and psychological to academic factors.

Joshi (1998) studied some factors affecting the achievement of the students of the Ashramshalas. The objectives of the study were (i) To find out the relationship of achievement of the students studying in Ashramshalas with their intelligence, some factors of personality, creativity, self-concept and school climate. (ii) To compare achievement of the students studying in Ashramshalas in respect of their areas, standards and gender respectively by taking intelligence and creativity as covariates. Normative survey method was used. Stratified Cluster Sampling method was used.

The tools used were Personality inventory developed by K.G. Desai, creative ability test developed by J. Z. Patel, General Ability test by M. T. Patel, self-concept inventory by J. H. Shah, and organizational climate description questionnaire by K. A. Gandhi. Multiple regression and multiple co-efficient of correlation were used for describing the relationship between the dependent and independent variables, where as ANOVA and t-test were used for the differential studies. The major findings were that creativity, intelligence, self-concept and school climate are related to achievement of the students of Ashramshalas. Gender and personality have no influence the achievement of the students.

Trama (1998) studied academic achievement in relation to intelligence, parental involvement and children’s motivational resources - control understanding, perceived competence and self-regulation at upper elementary and secondary schools. The objectives of the study were that how far does intelligence and parental (both

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maternal and paternal) involvement and children’s motivational resources affect the academic achievement of children? The sample comprised 496 students of class V and VI (upper elementary school) and 451 students of class IX and X (secondary school) from schools of Panchkula and Mohali.

Colored standard progressive matrices by Raven, multidimensional measure of children’s perceptions of control by Connell, Perceived competence scale for children by Hooter, Self-Regulation Questionnaire by Reyan and Connell, Parental Involvement Scale (α reliability coefficient ranged from 0.79 to 0.91 for different aspect of scale) were developed by investigator for data collection. The data were analyzed by inter correlation, path analysis, and regression techniques. It was found that all the variables under consideration affected to some extent scholastic achievement.

**Kumari (1999)** studied Socio – economic Status and Educational Aspirations of Secondary School Students in Relation to their Achievement in Social Studies. The objectives of study were to find out the level of Socio – economic Status, educational aspirations, locality, achievement and interrelations between them of the Secondary School Students. The sample comprised of 700 Students of class XI from West Godavari District of Andhra Pradesh. The sample was selected through the use of Random Stratified Sample Method. Socio – Economic Scale of Beena Shah and Educational Aspiration Scale of S.K.Saxena were used for data collection. The average marks in different tests in Social Studies were taken as Achievement scores. The data were analyzed with the help of CR and Chi – square test.

The findings of study were: (1) There was no significant difference in the level of Socio - economic Status, Educational aspirations and achievement of Residential and Non - residential School Students, Rural and Urban Students, and Boys and Girls. (2) There was relationship between Achievement and Socio – economic Status in Non – residential Students and boys, and there was no relationship between Achievement and Socio – economic Status in the Students studying in Residential Schools, Private and Government Schools, Rural and Urban Schools, Telugu medium and English medium Schools and girls. (3) There was a significant association between Achievement and Educational Aspiration in the whole sample.

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Govinda (2002) studied influence of certain Psycho-Sociological Factors in Scholastic Achievement of DIET Students. The objectives of the study were to study the influence of personality factors, attitude, study habits and socio-demographic variables on scholastic achievement of DIET students and to develop multiple regression equations in order to predict the scholastic achievement in theory, practical work and total achievement of DIET students with the help of different sets of independent variables.

The sample consisted of 600 students using stratified random sampling procedure from among 25 DIETS from the state of Andhra Pradesh. The 2 x 3 factorial design was used with two divisions of gender and three divisions of the variable region. The tools used for the study were: Objective Achievement Test (OAT), Teacher Attitude Inventory (TAI), Study Habits Inventory (SHI), Cattell’s 16 Personality Factors Questionnaire (16PF) Form-C, Demographic and Socio-Economic Status Scale (DSES), and college records and examination results records. The inferential statistical techniques, such as, t-test F-test and Regression analysis were employed to analyze the data.

The findings were that gender does not have significant influence on scholastic achievement of DIET students but region, attitude and study habits have significant influence on scholastic achievement.

Varma (2003) studied the relationship of Academic Achievement of Middle School Students with their Intelligence, Adjustment and Achievement Motivation. The objectives of study were: (1) To find out the significance of difference between intelligence, achievement motivation, adjustment and academic achievement of students. (2) To find out the significance of correlation between intelligence, achievement motivation, adjustment and academic achievement of students. (3) To find out the significance of difference between intelligence, achievement motivation, adjustment and academic achievement of students on the basis of gender.

The research was Descriptive Survey in nature. 600 Students of Arts and Science from Intermediate Schools of Firozabad selected as a sample by Random Sampling Method. Group Intelligence Test by Dr. S.S. Jalota, Adjustment Inventory

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98 Varma, M.K. *Relationship of Academic Achievement of Middle School Students with their Intelligence, Adjustment and Achievement Motivation*. PhD. (Edu.), Bundelkhand University, 2003.
by Dr. A.K.P. Sinha & Dr. R.P. Singh, Achievement Motivation Test by Dr. V.P. Bhargav and High School’s Marks as Academic Achievement were used for data collection. The data were analyzed with the help of Critical Ratio, Correlation, Partial Correlation and Analysis of Covariance. The findings revealed mean critical ratio of science and arts, science and female students, arts and female students and arts and male students was significant.

Singh (2004) studied effect of Some of Non – Cognitive Factor on the Scholastic Achievement of Girls Studying in Class X. The main objective of study was to find out the extent to which personality traits are related to academic achievement. Normative survey method of research was used by investigator. The sample selected through Random sampling method comprised of 1200 Girls of Class X from different School of Chitrakoot Mandal. An Indian adaptation of 16PF Questionnaire by Shanta Kumari Agarwal, SES Scale by S.P. Kulshrestha, and Jalota Group Test of General Mental Ability (JGTGMA) were used for data collection.

The data were analyzed by using Coefficient of correlation, multiple regression analysis and critical ratio. The major findings of study were that personality factors are positively correlated with scholastic performance. Religious and social values are negatively correlated while educational and social values are positively correlated.

2.3.2.5 Researches pertaining to Interrelation between Over achiever, Normal achiever and Under achiever Students

In the present study investigator intended to develop the Concept Attainment Model of Instruction in Mathematics. It was intended in the study to find the effectiveness of this model of instruction on learners with various achievement levels ie. over achievers, normal achievers and under achievers. Thus investigator studied the researches pertaining to inter relation between them.

Pal and Saxena (1970) studied the problems of over, under and normal achieving students at college level. The random sample consisted of 305 students from biology curriculum and 517 students from mathematics curriculum of science faculties of Lucknow, Gorakhpur and Allahabad. The tools were joshi’s test of mental

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ability and B.Sc. part-1 marks. The three groups of over, under and normal achieving students were identified based on mental ability test and achievement scores. Those above average in ability and below average in achievement were regarded as underachievers. Opposite category represented overachievers. Those students with their mental ability similar to achievement were considered as normal achievers. Thus 173 over achievers and 259 under achievers were identified and rests were considered as normal achievers. The three groups were matched for age, sex, caste, marital status, parental education, income and occupations.

The analysis revealed that:

1. The overachiever students had very less problem levels. They differed from curriculum to curriculum.
2. The under achiever were having more positive attitude towards school and teachers.
3. The under achievers had problems in concentration, living conditions, family adjustment.

Bhatt (1971) undertook a study on the adjustment problems of underachieving students. The sample included 100 overachievers and 106 underachievers from 67 schools of Ahmadabad city. The tools used were Desai-Bhatt intelligence test and semi projective technique. The findings revealed that i) The underachievers and overachievers differed in their achievement in the incomplete sentence inventory. ii) This difference was noticed in the group of boys and girls. iii) The underachiever students had less adjustment problems than overachievers. iv) Sensitivity was also observed.

Menon (1973) undertook a comparative study of personality characteristics of high ability over achievers and under achievers. The sample was of 1900 students. The technique used was stratified random sampling giving proportionate weigh to rural and urban boys, girls and co-educational schools. The tools used were: i) General mental ability test- verbal form A and B. ii) Personality inventory iii) Motivational inventory iv) Interest inventory v) General data questionnaire. Final exam marks were taken as academic achievement of subjects.
The result revealed that:

1) Overachieving groups of boys and girls of superior ability as well as the general groups were found to show great academic interests and endurance.

2) Overachieving girls from general group and overachieving boys of both groups were also found to have greater general ambition.

3) High ability overachievers among boys showed an interest in mechanical activities.

4) Overachievers and underachievers were found to be influenced by socio-economic and demographic characteristics.

Jayagopal (1974)\(^{103}\) studied personality profile of under and high achievers students of Madras city. The sample consisted of total 275 students from class class IX. The Tamil translation of Catell’s Questionnaire of 14 personality factors was used as the tool. Product moment correlation technique was used. Findings were; i) Underachiever students had more willingness and readiness for work. ii) High achievers were more humble and conceptual.

Kohali (1976)\(^{104}\) studied the characteristic behavior and environmental correlates of academic achievement on over, under and normal achiever students. The sample for study included 264 overachievers, 276 normal achievers 219 underachievers. The data analysis was done with help of t scores and method of correlation. There was significant difference in behavior of different kinds of achievers.

Koul (1978)\(^{105}\) studied personality needs of high and low achievers in mathematics. Koul found that, low achievers in mathematics were more exhibitory, succoring, hetro-sexual and aggressive. The high achievers differed significantly from low achievers.


D’Lima (1979)\textsuperscript{106} had studied of high and low achievement syndrome of creativity gifted and intellectually gifted children. Findings of the study were: The double talented group had high percentage of high achievers and single talented group had a high percentage of low achievers. Creatively and intellectually gifted children were found, highly similar in academic achievement, social interaction, self concept and motivation.

Deka (1985)\textsuperscript{107} studied about school failure. A casual comparative study of high and how achievers was done. Deka has seen in the particular study that, school success and failure were significantly and positively related to family income, involvement in domestic activities and home study, while they were unrelated to parental education and occupation. Sex and residence did not effect to proficiency of the students.

Haq (1988)\textsuperscript{108} had studied certain personality correlates of over, under achievement in different school subjects. Haq found different effects of different correlates on under and over achievement in relation to the subjects' viz. Hindi, English, Mathematics and Science.

Uchat (1989)\textsuperscript{109} studied under achievers and over achievers in relation to personal and family elements. The objectives of the study were to study the effect of non cognitive variables on i) intelligence, ii) academic achievement, iii) under achievement- over achievement phenomenon and iv) vocational aspiration. 1143 students of class 10 were selected as sample that included 718 boys and 425 girls of Rajkot City. Desai – Bhatt (verbal) group intelligence test was used to find intelligence quotient. Percentage obtained in S.S.C. was considered as achievement scores. Nominal measurement scales and t- tests were used for data analysis. The findings revealed that non-cognitive variables have effect on academic achievement.


\textsuperscript{109}D.A.Uchat, “A Study of the influences of some non-cognitive variables on intelligence, academic achievement, under achievement-overachievement phenomenon and vocational aspiration”,P.hD. Saurashtra University : Rajkot, 1989.
intelligence and vocational aspiration. It was concluded that age was the only variable that had influenced UA-OA phenomenon.

Sarojamma (1990)\textsuperscript{110} studied readability and social maturity of under, normal and overachievers. At the end of the research work, Sarojamma states that, there was significant difference in the reading ability of normal and underachievers, over and normal achievers, girls and boys, high and low social maturity, high and normal social maturity, students of private and government schools.

Rajyaguru (1991)\textsuperscript{111} did comparative study of over and underachievers in mathematics. He found that, there was positive and significant correlation between intelligence test and achievement in mathematics and numerical aptitudes. Overachievers and underachievers did not differ in intelligence & numerical aptitude. Rajyaguru also found that there was no association between achievement in mathematics and sex, existence or otherwise of father or mother, birth order, social status, professional status and income of the father.

Joshi (2005)\textsuperscript{112} studied the effectiveness of a Program for the Development of the Academic Achievement of the Underachievers. 472 students from urban, semi-urban and rural area school were taken as sample. Area and gender were taken as moderator variables. Intelligence test was administered upon entire sample. Scores of previous year final exam marks were taken as achievement scores. Regression equations were developed using these two scores. Various achievement levels among students were found. The entire study was carried out on underachievers only. Guidance and Counseling Program was developed for the identified under achiever students. Only one group post test design was used. Data analysis was done using t-tests. Major finding was that guidance and counseling program was found effective in enhancing academic achievement of under achiever students and many of them were transferred to normal achievers.


\textsuperscript{111}Rajyaguru, A Comparative Study of Over and Underachievers in Mathematics, PhD. Bhavnagar University, 1991.

\textsuperscript{112}Joshi Meeta, Effectiveness of a Program for the Development of the Academic Achievement of the Underachievers, PhD. Saurashtra University, 2008.
George (2009)\textsuperscript{113} did study on incidence of underachievement in secondary and higher secondary schools of Kerala. The objectives of the study were: i) To identify over achiever, normal achiever and under achiever students from secondary and higher secondary schools. ii) To find out whether there is significant difference in the proportion of male and female subsamples of over, normal and under achiever students in secondary and higher secondary schools of Kerala. iii) To find out whether there is significant difference in the proportion of rural and urban sub-samples of over, normal and under achiever students. The sample included 1,730 students in the secondary and higher secondary schools of Kerala. Composite tests of achievement in school subjects and Raven’s Standard Progressive Matrices were tools used. The study revealed that 15.26 per cent students in secondary and higher secondary schools of Kerala are underachievers. 70.46 percent were normal achievers and 14.28 percent were overachievers. Female students were found more overachievers. From the underachievers group more were male students.

These were the researches that dealt with different types of achievers.

2.4 Analytical Review of the Researches Studied

The analytical review of various research works can be cited by answering the questions that were framed earlier for the study.

Answers of the questions for analyzing review are as under:

1. Researches selected for review were Sixty Eight. Among them, Passi, Singh and Sansanwal (1986), Agarwal (1988), Chaudhary (1989), Mukherjee (2009), Ali (2011), Jadhav (2011), Sindhu (2011) were independent studies. One of the study of Basapura (2012) was carried out at M.phil level. Three studies were done at M.Ed. level they were Vyas (1991), Shah (1995) and Raval (1996). Rest all 57 researches were carried out at PhD. level.

2. Investigator tried to study all the researches that were pertaining to at least one of the field of the present study. The study included the researches from 1960 to 2012. Thirteen studies by: Shrivastava (1967), Pal and Saxena (1970), Bhatt (1971), Dhaliwala (1971), Menon (1973), Jayagopal (1974), Kohali (1976), Gosai (1977), Koul (1978), Sharma (1978), Tandon (1978), D’lima

\textsuperscript{113} George, “Incidence of underachievement in secondary and higher secondary schools of Kerala”, PhD. School of pedagogical sciences, Mahatma Gandhi University, Kottayam. 2009.
(1979), Grover (1979) were carried out between the time span of 1960 to 1979.


4. The samples selected ranged from 10 to 2500 subjects. Passi, Singh and Sansanwal (1986) took sample of 2500 students, 45 teacher educators, 393 budding teachers- a total of 25 institutions was the largest sample size among all researches. Chaudhary(1989) took the sample size of 10 female B.Ed. teachers which was the least sample size among all the studies.


5. The standard of samples varies from pre-primary to college level and professional courses and even in some studies teachers were also included as sample which is discussed in above 4.


9. Pal and Saxena (1970) found that over achievers have less problem levels compared to others while under achievers have more positive attitude towards school and teachers. Bhatt (1971) also observed less adjustment problems with over achievers. Dhaliwal (1971) studied and found that personality correlates had significant effect on achievement. Menon (1973) found that socio economic and demographic characteristics have effect on achievement. Jayagopal (1974) found that underachiever students were more willing and ready to work. Kohali (1976) found significant difference in behavior of students with different achievement levels. Koul (1978) found that low achievers are more succoring and aggressive. Sharma (1978) found that study habits and socio-economic status has significant effect on achievement. Tondon (1978) found that physical, social, economic and emotional conditions affect achievement. Deka (1985) found that sex and residence has no effect on proficiency of students. Haq (1988) found that personality correlates had significant effect on achievement. Seethamony (1988) found that proportion of underachievers was high among backward caste group.


Uchat (1989) found that non cognitive variables and cognitive variables have effect on over achievement and under achievement phenomenon. Sarojamma (1990) found that reading and social maturity had significant effect on students with different achievement levels. Rajayaguru (1991) found that gender, birth order, social status, professional status or
economic status had no significant effect on achievement. Diwan (1992) found significant relationship between aptitude, attitude and human values with achievement. Charles (1993) found gender and intelligence has effect on intelligence. Joshi (1998) found that creativity, intelligence, school climate and self concept are related to achievement. According to Trama (1998) all variables under consideration affected achievement. Kumari (1999) found socio-economic status, educational aspirations, locality and inter relations among students has effect on achievement.

Solanki (1999) found that area, sex, I.Q. had significant effect on relationship of reasoning ability of students with achievement of concepts of mathematics while caste had no effect on relationship. Govinda (2002) found that gender had no significant effect on achievement but region, attitude and study habits have significant effect on achievement. Arora (2003) found significant relationship between intelligence and school-home climate with moral reasoning among children. Varma (2003) found that students of science, arts and commerce stream show differences in achievement. Singh (2004) found correlation exists between values, personality factors and scholastic performance. George (2009) found that under achiever group contains more male students and over achiever group contains more female students.

10. There were only six studies till now in which Concept Attainment Model of Instruction was prepared for teaching certain concepts in mathematics. They were Tavde (1991), Vyas (1991), Raval (1996), Suvarna (1994), Faffal (2003) and Minikutty (2005). All of them dealt with finding the effectiveness of CAM with traditional method of teaching.

2.5 Conclusions of the Researches Studied

The conclusions drawn from various research works can be done as;

1) Researches selected for review were Sixty Eight. Among them, seven were research projects, one of the studies was carried out at M.Phil level, three studies were done at M.Ed. level and 57 studies were carried out at PhD. level.

2) Investigator tried to study all the researches that were even pertaining to only one or more fields of the present study. The study included the researches from 1960 to 2012. Thirteen researches were carried out between the time span of 1960 to 1979. Twelve researches were carried out in the years 1980-
1989. Twenty seven researches were carried between years 1990-1999. Sixteen researches were carried 2000 onwards.

3) The main objective in most of the experimental studies was to compare the different teaching techniques mainly with traditional method. While in others main focus was on to found the effect of certain variables on achievement.

4) The samples selected ranged from 10 to 2500 subjects.

5) The standard of samples varies from grade V to college level and professional courses and even in some studies teachers were also included.

6) Mainly, two groups- one controlled and other experimental design was followed, some researches had three randomized group design and few had 2x2x2x2 factorial design. Some researches highlighted the use of mixed designs while some studies indicated only one group post test design. Some researches pointed out usage of even four groups.

7) Achievement test was prepared in almost all the experimental studies. Many were only achievement test while some of the investigators prepared criterion reference test while one of them also standardized the test. For testing of I.Q. Desai group verbal ability test, Joshi’s mental ability test, Jalota’s mental ability test, Ravens Progressive standard matrices were used. For socio-economic status Kuppuswamy’s socio-economic status scale was used. Creativity was measured using Mehndi’s scale. Some other studies used different tools like study habit inventory, cognitive ability test, attitude scale and other self prepared tools as per the need of the study.

8) For data analysis mainly t-tests and F-tests were done to compare groups. Mean and S.D. were also found. Some of the studies used chi-square test. In one study data was analyzed using Man Whitney U test. Few research studies also quotes the use of ANCOVA, regression analysis, correlation and other multiple techniques.

9) Most of the findings indicated that the teaching technique other than conventional method sounds effective in enhancing achievement of pupils. Few researches that were related to factors affecting achievement also suggested that there are various factors like gender, Socio-Economic status, area; I.Q., study habits, attitude towards study, school environment, personality factors, psychological factors, emotional factors etc. have effect on achievement. The investigator also studied researches that were pertaining to
inter relations between different kinds of achievers. Those researches also revealed that there exists difference between different levels of achievers.

10) There were only six studies till now in which Concept Attainment Model of Instruction was prepared for teaching certain concepts in mathematics. All of them dealt with finding the effectiveness of CAM with traditional method of teaching.

No study was done till now in which Concept Attainment Model of Instruction was developed in mathematics to enhance the achievement of students with different levels of achievement.

2.6 Online References

There were many sources available related to teaching of Mathematical concepts. It is must for the investigator to be aware of ideas and thoughts pertaining to attainment of concepts in mathematics. The investigator in the present research in order to get familiar with previous books, periodicals, journals, thesis, study abstracts etc related with present content had contacted INFLIBNET\footnote{INFLIBNET, An Inter University Centre of UGC, Gujarat University Campus, Ahemdabad.} centre of Gujarat University for the same. The investigator mainly studied the sources pertaining to concept attainment in mathematics at secondary level. There were nearly 325 sources partially related to the topic. Out of which 15 sources were really relevant and were studied in detail by the investigator. The details are given in the table as;

Table 2.3
Review of Online Sources

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Title</th>
<th>Authors</th>
<th>Journal</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Once Upon A Time</td>
<td>Grithits Russel and Klen Margaret</td>
<td>Australian Mathematics Teacher, Vol-47, April-1991.</td>
<td>Using story telling methods examples and non examples were presented</td>
</tr>
<tr>
<td>No.</td>
<td>Title</td>
<td>Author</td>
<td>Source</td>
<td>Description</td>
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<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>3.</td>
<td>Large Entertainment</td>
<td>Hitchcock Gevin</td>
<td>For The Learning of Mathematics, Vol-12, Feb-1992</td>
<td>Dramatization technique used for concept attainment</td>
</tr>
<tr>
<td>4.</td>
<td>Algebraic Concepts</td>
<td>Moreli Lien</td>
<td>Mathematics Teacher, Vol - 85, Sept-1992</td>
<td>Transparencies were developed related to variables and characteristics</td>
</tr>
<tr>
<td>7.</td>
<td>Mathematical Interpretations</td>
<td>Koyoma, Masataka</td>
<td>Mathematical Teaching, Vol – 1, March – 1993</td>
<td>Various concepts were taught with its components</td>
</tr>
<tr>
<td>9.</td>
<td>Conceptual Development</td>
<td>Cipernicus Anna</td>
<td>Focus and Learning</td>
<td>Various learning</td>
</tr>
<tr>
<td>No.</td>
<td>Title</td>
<td>Author(s)</td>
<td>Journal/Source</td>
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<td>Diagrammatic presentations are to be analyzed and explained.</td>
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<td>Softwares were prepared for teaching mathematical concepts.</td>
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<td></td>
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<td>Various techniques were used for teaching Mathematics.</td>
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<td></td>
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<td></td>
<td>Technology related program was developed to renovate the wrong mathematical concepts.</td>
<td></td>
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<tr>
<td>14</td>
<td>Concepts and Calculations</td>
<td>Jiyaquito Marks</td>
<td>Mathematics-Cognition, Vol. 1,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Conceptual learning for teaching basic</td>
<td></td>
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</table>
2.7 Distinguishing factors of the Present Study

In reference to the researches carried out before, this is a special research. The specialties can be highlighted as below.

1. This is the Experimental research carried out on the student of English medium schools in Mumbai city.

2. Not a single research up till now is carried out in subject Mathematics for Std. IX in English medium school following Maharashtra state board syllabus.

3. The medium of teaching was English also Standardized Unit Achievement Test and Concept Attainment Model of Instruction both were developed in English.

4. The present research was carried out on the sample size of 478 students. It is enough for generalization of results.

5. The study included the development of Concept Attainment Model of Instruction on the topic “Sets” from the subject Mathematics for class 9.

6. Standardized Unit Achievement Test was also developed on the topic “Sets” from the subject Mathematics for class 9. This is the first research in which Standardized Unit Achievement Test is prepared.

7. The Concept Attainment Model of Instruction includes information down loaded from internet. The Concept Attainment Model of Instruction also contains extra information from reference materials other than that given in textbook.

8. Before the development of Concept Attainment Model of Instruction content analysis was done. Content was logically divided into small parts and all the concepts were found and model was prepared so that all the concepts can be taught effectively.
9. The content was made more interesting by game sessions while implementing model.

10. During various stages of study like revision, drilling or remedial teaching this model is useful.

11. Achievement levels of students were considered and based on it three groups were made of under achiever, normal achiever and over achiever students. The implementation of model was done on all the three groups. No such study is carried out till now.

The next chapter contains Research Design and its basis in detail.