CHAPTER: 1.0
THE PROBLEM AND DEFINITION OF TERMS

1.1 Introduction
In a society which is rapidly transforming itself into an industrial and technological society, knowledge is very much essential. Language, Social Science and Mathematics helps man in communication, living life in the society, quantify ideas, etc. and above all to be precise in his day to day living. Mathematics correlates to all subjects. Mathematics is inevitable, learning mathematics involves thinking mathematical ideas. Hence in order to study and utilize Mathematics, efficiency in thinking is required. Thinking is the ability within individual; it is logical, structural and can be developed.

According to Perkins (1988)\textsuperscript{1} good thinking is not something that comes naturally; it requires developing tactics, strategies, techniques and methods. Thinking ability is developed only when the concepts about what is to be thought are clear. Moreover concepts and generalizations make up the content of mathematics. According to Biggs (1985)\textsuperscript{2} concepts are general mental notions of things or events arrived at by process of perceptual classification and discrimination used as basis for thought and expressed through symbolic language. Thus in order to make teaching create wonders it should thus stress on concepts and generalizations. Also usage of technology in teaching is must to enhance efficiency of teaching-learning process. Conceptual learning can be done in a better way by not only using appropriate technology but active participation of students is must.

Bruner (1993)\textsuperscript{3} says that the process of education should enable children to gather and process information that will become organized into stable mental structures to assist them in problem solving. The process of instruction should utilize appropriate technology for teaching of concepts.

Having experience of teaching at secondary school level of nearly five years the investigator decided that Concept Attainment Model of Instruction should be

\textsuperscript{1}D.N.Perkins, Creativity and Quest for Mechanism, New York: Cambridge University, 1988, p.307.
prepared in Mathematics and its effectiveness should be assessed among different type of achievers. It is quite obvious that all children in schools have individual differences. Hence it is very much essential that teaching technology meets the need of every child. Thus investigator prepared Concept Attainment Model of Instruction for teaching of unit ‘Sets’ in Mathematics and assessed its effectiveness among under achiever, normal achiever and over achiever students of secondary schools.

1.2 The Problem

The present research was entitled as:

**Effect of Concept Attainment Model of Instruction on Achievement in Mathematics of Under achiever and Over achiever Students of Secondary Schools**

Firstly the unit 'Sets' of Std. 9 in subject Mathematics was chosen. The reason behind choosing this topic was very obvious, as we know that concepts of set theory are acting as a pillar of mathematics. For effective learning of higher mathematics concepts of set theory are very much essential. Moreover set theory is the only topic having many new concepts together. On basis of the topic, Concept Attainment Model of Instruction was developed.

Investigator also decided to prepare a Standardized Achievement Test in Mathematics on the topic “Sets” for class IX. For this investigator prepared test as per the objectives and specifications. For standardizing it investigator followed several steps. The objective behind preparing a standardized test was to have unbiased true evaluation of students achievement after teaching them through Concept Attainment Model of Instruction. As the standardized test construction part was finished investigator then worked for the implementation of the experiment.

The entire study was carried out in Mumbai. From the schools available, the students were tested on intelligence test and their intelligence scores were obtained. Final exam scores in Mathematics were taken and these scores were converted to t-scores. These t-scores were considered as achievement scores and based on these intelligence scores and achievement scores, regression equation were developed and over achiever, normal achiever and under achiever students were found. Then Concept Attainment Model of Instruction was used to teach them and its effectiveness was assessed using Standardized Unit Achievement Test in Mathematics. The effectiveness of Concept Attainment Model of Instruction was assessed on basis of
significant difference in average educational achievement. Gender and socio-economic status of pupils were also considered for the same.

1.3 Objectives of the Study

Objectives are very much essential to organize any work. The determination of the objectives gives the direction and motion to the work.

As per Uchat (1998)\(^4\), “Objectives of the study is a centre-part of whole research work. Research study cannot exist without clarification of its objectives. Objectives of the study do not denote (i) The importance of the study (ii) The reasons behind the study undertaken (iii) How and in which order, the study will be undertaken. But…. (i) They explain that which matter is to be studied (ii) They clarify the major departments of the study (iii) They are logically distributed sub-problems of the Main problem, selected for the research (iv)They are the sub-titles of the study, denoted in simple language”. The objectives of the present study were as follows:

1. To identify over achiever, normal achiever and under achiever students of secondary schools.
2. To study the effectiveness of Concept Attainment Model of Instruction on achievement in Mathematics of over achiever, normal achiever and under achiever students of secondary schools.
3. To study the effectiveness of Concept Attainment Model of Instruction on achievement in Mathematics among over achiever boys and girls.
4. To study the effectiveness of Concept Attainment Model of Instruction on achievement in Mathematics among normal achiever boys and girls.
5. To study the effectiveness of Concept Attainment Model of Instruction on achievement in Mathematics among under achiever boys and girls.
6. To study the effectiveness of Concept Attainment Model of Instruction on achievement in Mathematics of over achiever, normal achiever and under achiever students of secondary schools with reference to their Gender.

7. To study the effectiveness of Concept Attainment Model of Instruction on achievement in Mathematics among over achiever students with different (high, medium, low) Socio-Economic status.
8. To study the effectiveness of Concept Attainment Model of Instruction on achievement in Mathematics among normal achiever students with different (high, medium, low) Socio-Economic status.
9. To study the effectiveness of Concept Attainment Model of Instruction on achievement in Mathematics among under achiever students with different (high, medium, low) Socio-Economic status.
10. To study the effectiveness of Concept Attainment Model of Instruction on achievement in Mathematics of over achiever, normal achiever and under achiever students of secondary schools with reference to their Socio-Economic status.

1.4 Hypotheses of the Study

According to International Dictionary of Education (1971)⁵, Hypotheses are predictive statements capable of being tested by scientific methods that relates independent variable to some dependent variable. Hypotheses are suppositions which we make to deduce conclusions in accordance with fact. They are tentative solution, relates observation to theory and vice versa. They are non contradictory, verifiable, definite, clear and simplest.

In the present study the investigator developed Concept Attainment Model in Mathematics to assess its effectiveness on over achiever, normal achiever, under achiever boys and girls belonging to different (high, medium, low) socio-economic status. On the bases of objectives and measurement level of the data the investigator has farmed the null hypothesis.

“There will be no significant difference among mean achievement scores of over achiever, normal achiever and under achiever students when they are taught using Concept Attainment Model of Instruction”

Following were the hypotheses of the present study:

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1. There will be no significant difference between the mean scores of achievement in pretest and posttest of over achiever students when taught using Concept Attainment Model of Instruction.

2. There will be no significant difference between the mean scores of achievement in pretest and posttest of over achiever boys when taught using Concept Attainment Model of Instruction.

3. There will be no significant difference between the mean scores of achievement in pretest and posttest of over achiever girls when taught using Concept Attainment Model of Instruction.

4. There will be no significant difference between the mean scores of achievement in pretest and posttest of over achiever students with high Socio-Economic status when taught using Concept Attainment Model of Instruction.

5. There will be no significant difference between the mean scores of achievement in pretest and posttest of over achiever students with medium Socio-Economic status when taught using Concept Attainment Model of Instruction.

6. There will be no significant difference between the mean scores of achievement in pretest and posttest of over achiever students with low Socio-Economic status when taught using Concept Attainment Model of Instruction.

7. There will be no significant difference between the mean scores of achievement in pretest and posttest of normal achiever students when taught using Concept Attainment Model of Instruction.

8. There will be no significant difference between the mean scores of achievement in pretest and posttest of normal achiever boys when taught using Concept Attainment Model of Instruction.

9. There will be no significant difference between the mean scores of achievement in pretest and posttest of normal achiever girls when taught using Concept Attainment Model of Instruction.

10. There will be no significant difference between the mean scores of achievement in pretest and posttest of normal achiever students with high Socio-Economic status when taught using Concept Attainment Model of Instruction.

11. There will be no significant difference between the mean scores of achievement in pretest and posttest of normal achiever students with medium Socio-Economic status when taught using Concept Attainment Model of Instruction.
Socio-Economic status when taught using Concept Attainment Model of Instruction.

12. There will be no significant difference between the mean scores of achievement in pretest and posttest of normal achiever students with low Socio-Economic status when taught using Concept Attainment Model of Instruction.

13. There will be no significant difference between the mean scores of achievement in pretest and posttest of under achiever students when taught using Concept Attainment Model of Instruction.

14. There will be no significant difference between the mean scores of achievement in pretest and posttest of under achiever boys when taught using Concept Attainment Model of Instruction.

15. There will be no significant difference between the mean scores of achievement in pretest and posttest of under achiever girls when taught using Concept Attainment Model of Instruction.

16. There will be no significant difference between the mean scores of achievement in pretest and posttest of under achiever students with high Socio-Economic status when taught using Concept Attainment Model of Instruction.

17. There will be no significant difference between the mean scores of achievement in pretest and posttest of under achiever students with medium Socio-Economic status when taught using Concept Attainment Model of Instruction.

18. There will be no significant difference between the mean scores of achievement in pretest and posttest of under achiever students with low Socio-Economic status when taught using Concept Attainment Model of Instruction.

19. There will be no significant difference between the mean scores of achievement in posttest of over achiever boys and girls when taught using Concept Attainment Model of Instruction.

20. There will be no significant difference between the mean scores of achievement in posttest of normal achiever boys and girls when taught using Concept Attainment Model of Instruction.
21. There will be no significant difference between the mean scores of achievement in posttest of under achiever boys and girls when taught using Concept Attainment Model of Instruction.
22. There will be no significant difference between the mean scores of achievement in posttest of over achiever students with high, medium and low Socio-Economic status when taught using Concept Attainment Model of Instruction.
23. There will be no significant difference between the mean scores of achievement in posttest of normal achiever students with high, medium and low Socio-Economic status when taught using Concept Attainment Model of Instruction.
24. There will be no significant difference between the mean scores of achievement in posttest of under achiever students with high, medium and low Socio-Economic status when taught using Concept Attainment Model of Instruction.
25. There will be no significant difference between the mean scores of achievement in posttest of over achiever, normal achiever and under achiever students when taught using Concept Attainment Model of Instruction with reference to their gender.
26. There will be no significant difference between the mean scores of achievement in posttest of over achiever, normal achiever and under achiever students when taught using Concept Attainment Model of Instruction with reference to their Socio-economic status.
27. There will be no significant difference between the mean scores of achievement in posttest of over achiever, normal achiever and under achiever students when taught using Concept Attainment Model of Instruction.

1.5 Variables of the Study

The present research was an Experimental research. Certainly variables are involved in the study.
As per Shah (2004)\textsuperscript{6} “Variables are the characteristics that take various values”. Variables are conditions or characteristics that experimenter manipulates, control or observes. Variables in the present study were.

**Independent Variable.** In present study independent variable was Concept Attainment Model of Instruction. Independent Variable are those conditions or characteristics that experimenter manipulates or controls. Here teaching method was independent variable. Since only one method of teaching was used independent variable had only one level.

**Dependent Variable.** In present study dependent variable was academic achievement. It had three levels over achiever, normal achiever, under achiever students of secondary schools. These variables are those which changes as the experimenter introduces, changes or removes independent variable.

**Control Variables.** Controlled variables were the grade, novelty of experiment, number of lectures, selection of unit and subject. These types of variables are characteristics which can be controlled by investigator during experiment.

**Intervening Variables.** In the present study interest in mathematics, attitude towards study, study habits were intervening variables. These types of variables are difficult to observe in each sample students and their presence may be confused for the effect of independent variable on dependent variable.

**Moderator Variables.** The study included Gender and Socio-Economic status as moderator variables. These are the variables whose effect the investigator wants to know on the dependent variable when independent variable is altered.

The diagrammatic representation of the variables can be done as;

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1.6 Area of the Research

From initialization of education till today many researches are done. On basis of them the educational fields are decided. Each research belongs to many fields of education. It is essential to know various fields of research so that it can be justified that present research belongs to particular fields of educational research. Sixth survey of research has partial information about the various fields of research that is presented on the website. Hence the investigator referred to the Fifth Survey of Research in Education. According to the Fifth Survey of Research in Education there are 38 Fields of research\(^7\). Tabular presentation of various areas of educational research is done as;

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Table 1.1

*Areas of Educational Research*

<table>
<thead>
<tr>
<th>1.</th>
<th>Language Education</th>
<th>20. Mathematics Education</th>
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<tbody>
<tr>
<td>2.</td>
<td>Philosophy of Education</td>
<td>21. Physical and Health Education</td>
</tr>
<tr>
<td>5.</td>
<td>Economics of Education</td>
<td>24. Teaching Strategies</td>
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<td>6.</td>
<td>Psychology of Education</td>
<td>25. Teacher Education- Pre Service and In Service</td>
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<td>7.</td>
<td>Mental Health</td>
<td>26. Vocational and Technical Education</td>
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<td>8.</td>
<td>Cognitive Processes</td>
<td>27. Special Education</td>
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<td>9.</td>
<td>Social Processes</td>
<td>28. Open and Distance Education</td>
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<td>10.</td>
<td>Motivation</td>
<td>29. Adult, Continuing and Non Formal Education</td>
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<tr>
<td>11.</td>
<td>Creativity and Innovations</td>
<td>30. Education of the Scheduled Castes, Scheduled Tribes and Minorities</td>
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<tr>
<td>14.</td>
<td>Pre-Primary Education</td>
<td>33. Ecological and Environmental Studies in Education</td>
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<td>15.</td>
<td>Primary Education</td>
<td>34. Comparative Education</td>
</tr>
<tr>
<td>18.</td>
<td>Social Science Education</td>
<td>37. Organization, Administration and Management of Education</td>
</tr>
<tr>
<td>19.</td>
<td>Science Education</td>
<td>38. Co-relates of Achievement</td>
</tr>
</tbody>
</table>

Every research is attached to many field of research. The given study is associated with Mathematics Education, Secondary Education, Educational Assessment and Evaluation, Curriculum Development, Co-relates of Achievement,
etc. according to the selection of subject, sample, tool construction, development of teaching model.

The investigator categorized the present research in the field of Educational Technology.

1.7 Type of the Study

The type of the research can be mainly classified in three ways-
(1) The research carried out can be Basic, Applied or Action Research based on its product, (2) The research can be Quantitative or Qualitative based on its implementation and (3) The research can be Survey, Descriptive or Experimental based on methodology of the research.

This study is an applied research because its results are applicable. The Concept Attainment Model of Instruction was developed during the study. This model is very much useful for teachers and students for making teaching and learning process easier.

In respect of data collection and analysis it was a quantitative research and research methodology point of view it was experimental research.

1.8 Operational Definitions of the Terms

The terms used in the research have been defined with a view to clarify the notations in which they are used in present research.

The operational definitions of key terms are as follows:

1. Concept Attainment Model of Instruction. The Concept Attainment Model developed by Joyce and Weil (1985) is based on Bruner’s theory of concept attainment. It is an indirect instructional strategy that uses a structured inquiry process.

2. Achievement in Mathematics. Achievement in Mathematics refers to the effects of learning ‘Set theory’ that will be identified from the scores obtained on Unit Standardized Achievement Test in Mathematics prepared on the topic “Sets” of class 9 textbook of Maharashtra Board.

3. Intelligence. The score obtained from the test of Ravens Standard Progressive Matrices were taken as Intelligence score.

4. Under Achiever Students. The students whose scholastic achievement is less than their intelligence were considered as under achiever students. Here
scholastic achievement refers to the marks obtained by students in their final exam of Mathematics of class 8. These marks were converted to T-scores.

5. **Normal Achiever Students.** The students whose scholastic achievement is equal to their intelligence were considered as normal achiever students.

6. **Over Achiever students.** The students whose scholastic achievement is more than their intelligence were considered as over achiever students.

### 1.9 Significance of the Study

In the academic field, the academic achievement of the students varies. The present study was carried out to check the effectiveness of the Concept Attainment Model of Instruction on identified under achiever, normal achiever and over achiever students. It is useful to the teachers, parents, educational organizations, society and the future researchers as under.

- **The Teachers.** The study will help the teachers, in identifying the underachiever, normal achiever and over achiever students and in guiding them. The Unit Standardized Achievement Test was prepared to evaluate their achievement.

- **The Parents.** The study will help the parents, to provide the necessary encouragement to uplift academic achievement of their children.

- **The Schools.** The study will help the school counselors, to give guidance to the under achiever, normal achiever and over achiever students and to develop their scholastic achievement.

- **The Educational Organizations.** The study will help the educational organizations, to remove their negative attitude towards underachievers and more possessiveness towards over achievers, by finding out the reasons responsible for different types of achievement levels, and to create positive unbiased and balanced thought-pattern to develop the academic achievement of their pupils.

- **The Society.** The study will help to encourage the school, for the uplifting various types of achievers, which can restrict the huge wastage of students’ potential and it will lead towards the development of the society.

- **The Future Researchers.** The study will help the future researchers, to get the guidelines for the development of specific program for underachiever, normal achiever and over achiever students.
1.10 Limitations of the Study

The results of any research may not be same in different situations and time. Nothing is perfect in this world. Research is not an exception. Though the investigator tried her best there are some limitations.

The schools for the experiment were selected purposefully. The content and the standard were also selected objectively. These results may be applicable only to English medium secondary schools of Mumbai city.

1.11 Outline of the Study

The outline of the study is as follows:

1. The unit 'Sets' of the subject Mathematics in grade IX was selected for the development of teaching model.
2. Concept Attainment Model of Instruction was prepared after the content analysis of the selected unit. This model was tried out on small sample and the opinions of experts were taken on that instruction program and on the basis of suggestions the model was refined.
3. The Construction and Standardization of Unit Achievement Test on ‘Sets’ was done.
4. Test for measuring Intelligence and Socio-Economic status scale both were administered upon the sample.
5. The marks of previous year final examination in the subject Mathematics were taken and they were converted into t-scores and used as their scholastic achievement scores.
6. Using regression equations for intelligence scores and achievement scores, students were identified as over achievers, normal achievers and under achievers.
7. The implementation of the experiment was done on the students of I.E.S. high School and SVP high school. The standardized unit achievement test was prepared by the researcher was used as post test and was conducted at the end of experiment.
8. Using t-test, data analysis was done on the different groups for testing hypotheses pertaining to different objectives of the study.
9. Conclusions were drawn from results of analysis and various implementations were made. Suggestions and recommendations for further researches were made.

1.12 Organization of the Remaining Chapters

This report has been presented in six chapters. Next chapter contains review of related literature. Various theories behind this research subject and review of the past researches are discussed in this chapter and it also throws light on the distinguishing factors of the present study. Third chapter focuses on research design and procedure employed in the research. It contains information about universe, sample, tools, procedure of data collection and statistical techniques for analyzing data. Fourth chapter deals with two aspects one is development of Concept Attainment Model of Instruction and the other is constructing and standardizing Unit Achievement Test. Fifth chapter deals with analysis and interpretation of the data. This chapter explains how were the scores analyzed and which methods were used for the same. Last chapter deals with the summary of findings, conclusions of the study, educational implications and the suggestions and recommendations for further researches.