CHAPTER: 6.0
SUMMARY, CONCLUSIONS, EDUCATIONAL IMPLICATIONS AND RECOMMENDATIONS

6.1 Introduction

Research plays a significant role in all the fields of knowledge. Researches carried out in various fields opens up avenue for more studies that would, in future, contribute in the process of enhancing knowledge. At the end of any research it is of prime importance to find that till what extent the objectives of the study were fulfilled and what else can be done in future particularly pertaining to the study carried out.

In this chapter the summary of the study conducted is presented in detail. A brief description of procedure adopted for the study is presented. The analysis of data and major findings are also described. The concluding part of the present study includes a discussion of the implications of the present study and recommendations for further research in the area of teaching strategies.

6.2 Summary

The main work of the present study was to develop Concept Attainment Model of Instruction on the topic “Sets” in Mathematics for class IX and to find out its effectiveness on the students’ academic achievement. Research also aimed to find whether gender and socio-economic status of students had any genuine effect on students’ achievement when they were taught using Concept Attainment Model of Instruction. Investigator selected the students of grade IX. Standardized unit achievement test was also developed by the investigator to examine the achievement levels of different kind of achievers after they were taught using Concept Attainment Model of Instruction.

The investigator used regression equation with Intelligence as independent variable and Achievement as dependent variable to identify over achiever, normal achiever and under achiever students before implementing experiment. The final exam marks of students in mathematics were converted to t-scores and these scores were used as achievement scores. Students were also provided with Socio-economic status scale to assess their socio-economic status.

Implementation of the program was done on all the student, standardized achievement test was administered as the post test. Effectiveness of the Concept
Attainment Model of Instruction was also found with respect to pretest scores (standard scores based on final year mathematics marks of previous class) and the scores obtained on standardized achievement test in mathematics. Mean, S.D. and t-values were calculated from the data. The effectiveness of the program in respect to the academic achievement was found out on basis of t-value. The accepted levels of significance were 0.05 and 0.01 levels.

6.3 Testing of Hypotheses

Presentation of hypotheses and its testing in the present study is done as:

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

   The result of t-value indicates that the mean difference of pretest and posttest scores was 3.78. This is significant at both 0.01 level and 0.05 levels. So the first null hypothesis was not accepted. Hence effect of Concept Attainment Model of Instruction was significantly higher on the over achiever students.

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

   The t-value was found as 2.91. This indicates that means difference between the pretest and posttest scores of over achiever boys group is significant at both levels. Thus the second null hypothesis was rejected. This means that the Concept Attainment Model of Instruction was found effective in enhancing achievement of over achiever boys group.

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

   The t-value for the over achiever girls group was 2.48. This indicates that means difference between the pretest and posttest scores of over achiever girls group is significant at 0.05 level. Thus the third null hypothesis was
rejected. This means that the Concept Attainment Model of Instruction was found effective in enhancing achievement of over achiever girls group.

4. There will be no significant difference in 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.

   According to the t-value of 3.06, the fourth null hypothesis was not accepted as there was significant difference in mean scores of pretest and posttest of over achiever students with high Socio-Economic status. There was a significant difference at 0.05 and 0.01 levels. This indicated that Concept Attainment Model of Instruction was effective in enhancing the academic achievement among over achievers with high socio-economic status.

5. There will be no significant difference in 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.

   The t-value was 2.46, which was significant at 0.05 level. The fifth null hypothesis was not accepted as there was significant difference in mean scores of pretest and posttest of over achiever students with medium Socio-Economic status. This indicated that Concept Attainment Model of Instruction was effective in enhancing the academic achievement among over achievers with average socio-economic status.

6. There will be no significant difference in 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.

   The t-value found was 1.39 which was not significant at 0.05 and 0.01 level. The sixth null hypothesis was accepted as there was no significant difference in mean scores of pretest and posttest of over achiever students with low Socio-Economic status. This indicated that Concept Attainment Model of Instruction was not much significant in enhancing academic achievement among over achievers with low socio-economic status.
7. There will be no significant difference in between the mean scores of achievement in pretest and posttest of normal achiever students when taught using Concept Attainment Model of Instruction.

The obtained t-value for seventh null hypothesis was 7.81. The result of t-value indicates that the mean difference of pretest and posttest scores is 7.81. This is significant at both 0.01 level and 0.05 levels. So the seventh null hypothesis was not accepted. Hence effect of Concept Attainment Model of Instruction was significantly higher on the normal achiever students.

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

It was revealed that t-value for the normal achiever boys group is 6.04. This indicates that means difference between the pretest and posttest scores of normal achiever boys group is significant at 0.01 level. Thus the eighth null hypothesis was rejected. This means that the Concept Attainment Model of Instruction was found effective in enhancing achievement of normal achiever boys group.

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

The t-value for the normal achiever girls group is 4.95. This indicates that means difference between the pretest and posttest scores of normal achiever girls group is significant at 0.01 level. Thus the ninth null hypothesis was rejected. This means that the Concept Attainment Model of Instruction was found effective in enhancing achievement of normal achiever girls group.

10. There will be no significant difference in 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.

According to the t-value of 5.08 the tenth null hypothesis was not accepted as there was significant difference in mean scores of pretest and
posttest of normal achiever students with high Socio-Economic status. There was a significant difference at 0.01 level. This indicated that Concept Attainment Model of Instruction was effective in enhancing the academic achievement among normal achiever students with high socio-economic status.

11. There will be no significant difference in 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.

   The t-value was 7.78 which was significant at 0.01 level. The eleventh null hypothesis was not accepted as there was significant difference in mean scores of pretest and posttest of normal achiever students with medium Socio-Economic status. This indicated that Concept Attainment Model of Instruction was effective in enhancing the academic achievement among normal achievers with average socio-economic status.

12. There will be no significant difference in 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.

   The t-value was 5.44 which was significant at 0.01 level. The twelfth null hypothesis was rejected as there was significant difference in mean scores of pretest and posttest of normal achiever students with low Socio-Economic status. This indicated that Concept Attainment Model of Instruction was significant on the academic achievement among normal achievers with low socio-economic status.

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

   The t-value for under achiever students was found as 7.49. The result of t-value indicates that the mean difference of pretest and posttest scores is 7.49. This is significant at both 0.01 level and 0.05 levels. So the thirteenth
null hypothesis was not accepted. Hence effect of Concept Attainment Model of Instruction was significantly higher on the under achiever students.

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

The t-value for the under achiever boys group is 4.81. This indicates that means difference between the pretest and posttest scores of under achiever boys group is significant at 0.01 level. Thus the fourteenth null hypothesis was rejected. This means that the Concept Attainment Model of Instruction was found effective in enhancing achievement of under achiever boys group.

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

The t-value for the under achiever girls group is 5.55. This indicates that means difference between the pretest and posttest scores of under achiever girls group is significant at 0.01 level. Thus the fifteenth null hypothesis was rejected. This means that the Concept Attainment Model of Instruction was found effective in enhancing achievement of under achiever girls group.

16. There will be no significant difference in 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.

According to the t-value of 7.25 the sixteenth null hypothesis was not accepted as there was significant difference in mean scores of pretest and posttest of under achiever students with high Socio-Economic status. There was a significant difference at 0.01 level. This indicated that Concept Attainment Model of Instruction was effective in enhancing the academic achievement among under achiever students with high socio-economic status.

17. There will be no significant difference in 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.

The t-value was 3.95 which was significant at 0.01 level. The seventeenth null hypothesis was not accepted as there was significant difference in mean scores of pretest and posttest of under achiever students with medium Socio-Economic status. This indicated that Concept Attainment Model of Instruction was effective in enhancing the academic achievement among under achievers with average socio-economic status.

18. There will be no significant difference in 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.

The t-value was 1.99 which was significant at 0.05 level. The eighteenth null hypothesis was not accepted as there was significant difference in mean scores of pretest and posttest of under achiever students with low Socio-Economic status. This indicated that Concept Attainment Model of Instruction was significant on the academic achievement among under achiever students with low socio-economic status.

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

The t-value 0.26 indicates that mean difference between the scores of posttest of over achiever boys and girls was not significant. ie. There was no effect of gender on achievement of over achievers when they were taught using Concept Attainment Model of Instruction. Hence the nineteenth null hypothesis was accepted. Acceptance of the hypothesis indicates that Concept Attainment Model was equally effective on over achiever boys and girls.

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

The t-value 4.33 indicates that mean difference between the scores of posttest of normal achiever boys and girls was significant. ie. There was effect
of gender on achievement of normal achievers when they were taught using Concept Attainment Model of Instruction. Hence the twentieth null hypothesis was rejected. Rejection of the hypothesis indicates that Concept Attainment Model was not equally effective on normal achiever boys and girls. Normal achiever girls had shown significant increase in academic achievement as compared to boys when they were taught using Concept Attainment Model of Instruction.

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

The t-value 3.18 indicates that mean difference between the scores of posttest of under achiever boys and girls was significant. i.e. There was effect of gender on achievement of under achievers when they were taught using Concept Attainment Model of Instruction. Hence the twenty-first null hypothesis was rejected. Rejection of the hypothesis indicates that Concept Attainment Model was not equally effective on under achiever boys and girls. Under achiever girls had shown significant increase in academic achievement as compared to boys when they were taught using Concept Attainment Model of Instruction.

22. There will be no significant difference in 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.

The twenty-second hypothesis was rejected. The academic achievement of over achiever students when taught using Concept Attainment Model of Instruction showed significant effect of socio-economic status.

23. There will be no significant difference in 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.
The twenty-third hypothesis was accepted. The academic achievement of normal achiever students when taught using Concept Attainment Model of Instruction showed no significant effect of socio-economic status.

24. There will be no significant difference in 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.

The twenty-fourth hypothesis was rejected. Thus the academic achievement of under achiever students when taught using Concept Attainment Model of Instruction showed significant effect of socio-economic status.

25. There will be no significant difference in between the mean scores of achievement in posttest of over achiever, normal achiever and under achiever students in reference to their gender when taught using Concept Attainment Model of Instruction.

The Twenty-fifth null hypothesis was not accepted. There was a significant difference in the academic achievement of students with different achievement levels when their gender was considered.

26. There will be no significant difference in between the mean scores of achievement in posttest of over achiever, normal achiever and under achiever students in reference to their Socio-economic status when taught using Concept Attainment Model of Instruction.

The Twenty-sixth null hypothesis was not accepted. There was a significant difference in the academic achievement of students with different achievement levels when their Socio-economic status was considered.

27. There will be no significant difference in 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.
The Twenty-seventh null hypothesis was not accepted. There was a significant difference in the academic achievement of students with different achievement levels.

6.4 Conclusions

The conclusions of the present study were as follows:

- Effect of Concept Attainment Model of Instruction was significantly higher on the over achiever students.
- The Concept Attainment Model of Instruction was found effective in enhancing achievement of over achiever boys group.
- The Concept Attainment Model of Instruction was found effective in enhancing achievement of over achiever girls group.
- Concept Attainment Model of Instruction was effective in enhancing the academic achievement among over achievers with high socio-economic status.
- Concept Attainment Model of Instruction was effective in enhancing the academic achievement among over achievers with average socio-economic status.
- Concept Attainment Model of Instruction was not much significant on the academic achievement among over achievers with low socio-economic status.
- Effect of Concept Attainment Model of Instruction was significantly higher on the normal achiever students.
- The Concept Attainment Model of Instruction was found effective in enhancing achievement of normal achiever boys group.
- The Concept Attainment Model of Instruction was found effective in enhancing achievement of normal achiever girls group.
- Concept Attainment Model of Instruction was effective in enhancing the academic achievement among normal achiever students with high socio-economic status.
- Concept Attainment Model of Instruction was effective in enhancing the academic achievement among normal achievers with average socio-economic status.
- Concept Attainment Model of Instruction was significant on the academic achievement among normal achievers with low socio-economic status.
• Effect of Concept Attainment Model of Instruction was significantly higher on the under achiever students.
• Concept Attainment Model of Instruction was found effective in enhancing achievement of under achiever boys group.
• The Concept Attainment Model of Instruction was found effective in enhancing achievement of under achiever girls group.
• Concept Attainment Model of Instruction was effective in enhancing the academic achievement among under achiever students with high socio-economic status.
• Concept Attainment Model of Instruction was effective in enhancing the academic achievement among under achievers with average socio-economic status.
• Concept Attainment Model of Instruction was significant on the academic achievement among under achiever students with low socio-economic status.
• Concept Attainment Model was equally effective on over achiever boys and girls.
• Normal achiever girls had shown significant increase in academic achievement as compared to boys when they were taught using Concept Attainment Model of Instruction.
• Under achiever girls had shown significant increase in academic achievement as compared to boys when they were taught using Concept Attainment Model of Instruction.
• The academic achievement of over achiever students when taught using Concept Attainment Model of Instruction showed significant effect of socio-economic status.
• The academic achievement of normal achiever students when taught using Concept Attainment Model of Instruction showed no significant effect of socio-economic status.
• The academic achievement of under achiever students when taught using Concept Attainment Model of Instruction showed significant effect of socio-economic status.
• There was a significant difference in the academic achievement of students with different achievement levels in reference to their gender.
There was a significant difference in the academic achievement of students with different achievement levels in reference to their Socio-economic status.

There was a significant difference in the academic achievement of students with different achievement levels.

6.5 Product of the Research

In the present research keeping in mind the objectives of study a Concept Attainment Model of Instruction was developed and to check its effectiveness in terms of achievement a Standardized Unit Achievement Test was developed by the investigator.

6.5.1 Tool

The investigator developed Standardized Unit Achievement Test to measure the effectiveness of Concept Attainment Model of Instruction. This test measured the educational achievement of class IX students in Mathematics on the topic “Sets”. Appropriate content analysis was done and various concepts were found out. Keeping in mind objectives like knowledge, understanding, application and skill content analysis was also done. Question bank was prepared. Three dimensional blue print was prepared. The test was administered on sample of few students then item analysis was done. Difficulty Index and Discriminating Powers were found. Distracter analysis was also done to find the effectiveness of options in the answers provided. After Item Analysis the items that did not fit the criterion were rejected and final form of test was created. Validity and reliability was checked and the norms were established.

6.5.2 Program

The Concept Attainment Model of Instruction was developed keeping in mind objectives and basic principles of teaching – learning process. Inductive - deductive approach was used and basic axioms of teaching like. Know to unknown, simple to complex etc. were used while developing this model that belongs to the family of Information Processing Models. This program is excellent combination of text and charts. Various characteristics of concepts, its examples and non-examples as well as essential and non-essential attributes are also mentioned. The lesson transcripts were prepared keeping in mind various objectives. All the concepts in the topic were properly analyzed and their relations were established. Taking in to account the procedure various phases were developed. Charts were prepared according to
examples and non-examples and the presentation was made ready by keeping in mind various steps.

6.6 Educational Implications
Following are the educational implications of the experiment.

- This brings novelty in education.
- Concept building is the heart of this program so children can learn easily and deeply.
- This model also enhances the thinking ability of students as they are forced to find examples and characteristics on their own which in turn increases their ability to memorize things.
- Demonstration of various activities can be done by various figures, charts, games etc that brings learning with fun in classroom.
- Due to the visualization effects in charts and gaming in the learning process, content teaching becomes more effective as this increases concentration of the students.
- Students learn while they do so various psychological processes are involved in the same.
- Students are active participants so this model develops various qualities among students and can always be useful to find hidden knowledge and talents among children.
- It inspires more teachers to prepare such models.
- This Concept Attainment Model of Instruction can satisfy basic necessities of slow learners as well as visual learners.
- Government can also arrange the programs to train and motivate the school teachers to actively prepare such models.
- Drilling and revision can be easily done.
- This model is even useful for diagnostic and remedial teaching.
- Interest and concentration of the students can be increased in subject.

6.7 Recommendations for Future Researches
Following are the recommendations of the study.

- Similar experiment of teaching through Concept Attainment Model can be done in other subjects.
The effectiveness of Concept Attainment Model of Instruction can be compared to programmed learning or self-learning material or other methods.

In the present research only Concept Attainment Model was used for teaching. Other teaching methods or models may be implemented to check its comparative effectiveness.

In the present study charts were used to present examples and non-examples. Three-dimensional virtual effects can be provided as non-examples and examples. So that newness can be brought in program. Transparencies can also be prepared for same.

Same experiment in same subject for different units or in different classes can be done. This program was developed for grade IX students on the unit ‘Sets’ in Mathematics.

The effectiveness can be tested in reference to main educational aims (Knowledge, Understanding, Application and skill).

Instead of Concept Attainment Model of Instruction other models from the family of information processing models can be used. The present study was pertaining only to cognitive domain; other studies can be made for assessing the effectiveness of program on affective and psychomotor domain.

This program was made for English medium school only. Same program can also be prepared for Gujarati medium schools or any other regional medium schools.

This program was only developed from Mathematics textbook prepared by Maharashtra State Board, CBSE, ICSE, IGCSE or IB boards can also be considered.

This Program was constructed for groups similar experiment can be done for individual teaching.

This Programme was made for only one unit it can be made for the whole syllabus and effectiveness can be checked for long term.

Factorial experiments can also be carried out to study the interactive effect of conceptual style. Thus Effectiveness of this Concept Attainment Model of Instruction can also be compared with other information processing family of models.

Reception oriented Concept Attainment Model of Instruction was used in the present study. Other studies can be carried out by developing Selection
oriented Concept Attainment Model of Instruction or Unorganized Material Concept Attainment Model of Instruction.

- Similar Model can be developed and retention can also be checked.
- For Remedial teaching this type of model can also be constructed.
- This Model was developed for students at secondary level similar such models can be developed at primary stage or senior secondary stage.
- Linear programming or branched programming can be combined with conceptual understanding technology and its effectiveness can be assessed.
- More researches should be carried out on academic achievement. Special methods and technologies should be developed in enhancing the academic achievement of students with different achievement levels.
- Curriculum designers and textbook writers should use this approach to present concepts in each topic. Investigations can be carried out in the same.
- In the present study gender and socio-economic status were taken as moderator variables. Other Variables such as Attitude towards mathematics, study habits, school climate, parental stress etc. can be taken as moderator variables to check its effectiveness with reference to the implementation of Concept Attainment Model of Instruction.
- In the present study for assessing the effectiveness of Concept Attainment Model of Instruction, Standardized Unit Achievement Test was prepared by the investigator. Another such evaluating technologies can be produced for assessing the fulfillment of desired objectives for content study.

The investigator through the present study opens up many ways for more studies in the field to enhance the achievement levels of students.
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**Online Resources**

**INFLIBNET**, An Inter University Centre of UGC, Gujarat University Campus, Ahmadabad.

http://VUDAT.msu.edu/tech.michigan state university

http://www.virtual school.edu

www.DAV.org

www.googlebooks.com

www.onlinethesies.org

www.geocities.com

www.mathlearning.org

Appendix – A

Instructional objectives

1. Pupils acquire understanding about terminology of sets.
2. Pupils acquire the knowledge of concept of set.
3. Pupils acquire understanding about terminology of sets.
4. Pupils acquire ability to make comparisons of sets with other collections.
5. Pupils can identify examples of sets from the given examples.
6. Pupils can give examples for sets.
7. Pupils can identify essential attributes of sets.
8. Pupils can define sets.
9. Pupils acquire the knowledge of concept element of set.
10. Pupils acquire understanding about elements of sets.
11. Pupils acquire ability to make comparisons of elements of sets with other non elements.
12. Pupils can identify elements of sets from the given examples.
13. Pupils can give examples for elements of sets.
14. Pupils can identify essential attributes for becoming elements of sets.
15. Pupils acquire the knowledge of cardinality of set.
16. Pupils acquire understanding about terminology of cardinality of sets.
17. Pupils acquire ability to find cardinality of sets.
18. Pupils can identify examples cardinality of sets from the given examples.
19. Pupils can give examples for cardinality of sets.
20. Pupils can identify essential attributes of cardinality of sets.
21. Pupils can define cardinality of sets.
22. Pupils acquire the knowledge of concept of Finite set.
23. Pupils acquire understanding about terminology of Finite sets.
24. Pupils acquire ability to make comparisons of Finite sets with other sets.
25. Pupils can identify examples of Finite sets from the given examples.
26. Pupils can give examples for Finite sets.
27. Pupils can identify essential attributes of Finite sets.
28. Pupils can define Finite sets.
29. Pupils acquire the knowledge of concept of Infinite set.
30. Pupils acquire understanding about terminology of Infinite sets.
31. Pupils acquire ability to make comparisons of Infinite sets with other sets.
32. Pupils can identify examples of Infinite sets from the given examples.
33. Pupils can give examples for Infinite sets.
34. Pupils can identify essential attributes of Infinite sets.
35. Pupils can define Infinite sets.
36. Pupils acquire the knowledge of concept of Empty set.
37. Pupils acquire understanding about terminology of Empty sets.
38. Pupils acquire ability to make comparisons of Empty sets with other sets.
39. Pupils can identify examples of Empty sets from the given examples.
40. Pupils can give examples for Empty sets.
41. Pupils can identify essential attributes of Empty sets.
42. Pupils can define Empty sets.
43. Pupils acquire the knowledge of concept of Singleton set.
44. Pupils acquire understanding about terminology of Singleton sets.
45. Pupils acquire ability to make comparisons of Singleton sets with other sets.
46. Pupils can identify examples of Singleton sets from the given examples.
47. Pupils can give examples for Singleton sets.
48. Pupils can identify essential attributes of Singleton sets.

49. Pupils can define Singleton sets.

50. Pupils acquire the knowledge of concept of Equal sets.

51. Pupils acquire understanding about terminology of Equal sets.

52. Pupils acquire ability to make comparisons of Equal sets with other sets.

53. Pupils can identify examples of Equal sets from the given examples.

54. Pupils can give examples for Equal sets.

55. Pupils can identify essential attributes of Equal sets.

56. Pupils can define Equal sets.

57. Pupils acquire the knowledge of concept of disjoint sets.

58. Pupils acquire understanding about terminology of disjoint sets.

59. Pupils acquire ability to make comparisons of disjoint sets with other collections.

60. Pupils can identify examples of disjoint sets from the given examples.

61. Pupils can give examples for disjoint sets.

62. Pupils can identify essential attributes of disjoint sets.

63. Pupils can define disjoint sets.

64. Pupils acquire the knowledge of concept of Subset.

65. Pupils acquire understanding about terminology of Subsets.

66. Pupils acquire ability to make comparisons of Subsets with other sets.

67. Pupils can identify examples of Subsets from the given examples.

68. Pupils can give examples for Subsets.

69. Pupils can identify essential attributes of Subsets.

70. Pupils can define Subsets.

71. Pupils acquire the knowledge of concept of Power set.
72. Pupils acquire understanding about terminology of Power set.
73. Pupils acquire ability to make comparison of Power set with other sets.
74. Pupils can identify examples of Power sets from the given examples.
75. Pupils can give examples for Power set.
76. Pupils can identify essential attributes of Power set.
77. Pupils can define Power set.
78. Pupils acquire the knowledge of concept of Universal set.
79. Pupils acquire understanding about terminology of Universal set.
80. Pupils acquire ability to make comparison of Universal set with other sets.
81. Pupils can identify examples of Universal set from the given sets.
82. Pupils can give examples of Universal set.
83. Pupils can identify essential attributes of Universal set.
84. Pupils can define Universal set.
85. Pupils acquire the knowledge of concept of Complement of a set.
86. Pupils acquire the understanding of terminology of Complement of a set.
87. Pupils acquire the ability to make comparison of Complement of a set with other sets.
88. Pupils can identify examples of Complement of sets from the given examples.
89. Pupil can identify essential attributes of Complement of a set.
90. Pupils can define Complement of a set.
91. Pupils acquire the knowledge of concept of Union of sets.
92. Pupils acquire the understanding of terminology of Union of sets.
93. Pupils can identify examples of Union of sets from the given examples.
94. Pupils can identify essential attributes of Union of sets.
95. Pupils can define Union of sets.
96. Pupils acquire the knowledge of concept of Intersection of sets.
97. Pupils acquire the understanding of terminology of Intersection of sets.

98. Pupils can identify examples of Intersection of sets from the given examples.

99. Pupils can give examples for Intersection of sets.

100. Pupils can identify essential attributes of Intersection of sets.

101. Pupils can define Intersection of sets.
Appendix B

Lesson Plan No. 1

Unit : Sets
Concept : Sets

Concept Analysis

Concept Name : Sets
Definition : Set is a collection of well-defined things, objects or ideas
Attributes : It is a collection
Super ordinate Concept : Collections
Sub ordinate concept : Set of elements having common characteristics
                     Set of objects having no common characteristics
Co-ordinate concept : Herd, Bunch, Team, Group

Examples

Positive Examples

- Collection of natural numbers between 1 and 12
- Collection of symbols of four fundamental operations in Mathematics
- Collection of days in a week
- Collection of odd numbers between 1 and 10
- Collection of even numbers greater than 10
- Collection of two digit numbers ending with 5
- Collection of alphabets in the word 'toy'
- Collection of odd natural numbers greater than 3
- Months having only 31 days

Negative Examples

- Collection of good books in your school library.
- Group of all good boys in your school.
- Group of clever students in your class
- Group of good persons in your locality
Collection of beautiful flowers

Content Goals

Pupil

1. acquires the knowledge of terminology and concept of set
2. acquires ability to make comparisons of sets with other collections
3. acquires ability to formulate and validate generalisations.
4. develops interests and motivation in learning more about sets
5. develops appreciation towards mathematics
6. develops cognitive ability skills

Materials required.
Charts showing different types of collections, bunch of flowers

Phases/Stages

1. Establishment of a relaxed atmosphere
2. Analysis of Conceptual Network Involved
3. Providing examples and non-examples
4. Response Sensitive Discussion
5. Providing more examples and non-examples
6. Students Generate Examples
7. Defining the Concept
8. Assessing the Attainment of Concept
9. Analysis of Thinking Strategy Involved

Phase 1. Establishment of a Relaxed Atmosphere.

Teacher: Students, today let us have a different type of game. Everybody should participate in it and share your ideas. Don't worry whether you are right or wrong, but your involvement is important. So are you ready now? Let us start.

Students: Yes teacher, we will start.

Teacher discusses ideas relating to 'set' in the class i.e. different types of collections, bunch, herd, group, team etc. Students give examples of them and share ideas relating to different types of collections.

Teacher by asking thought provoking questions elicits more and more ideas and examples from students in the class.

Phase 3. Providing Examples and Non-Examples.

Teacher: I will show you some charts. Look at them carefully. A few of them are examples of 'something' in my mind and the rest are not.

<table>
<thead>
<tr>
<th>Chart</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>♥ Collection of even numbers between 4 and 12.</td>
<td>Yes.</td>
</tr>
<tr>
<td>♥ Good books in your library.</td>
<td>No.</td>
</tr>
<tr>
<td>♥ Months having days less than 30.</td>
<td>Yes.</td>
</tr>
<tr>
<td>♥ Beautiful girls in your class.</td>
<td>No.</td>
</tr>
<tr>
<td>♥ Alphabets in the word &quot;toy&quot;.</td>
<td>Yes.</td>
</tr>
<tr>
<td>♥ Tall boys in your school.</td>
<td>No.</td>
</tr>
<tr>
<td>♥ Symbols of four fundamental operations in Mathematics.</td>
<td>Yes.</td>
</tr>
</tbody>
</table>

Students read the chart carefully.

Phase 4. Response Sensitive Discussion

Teacher: Are you successful in getting the idea in my mind? Recollect the contents in the chart. Each one of the items gives indications relating to the idea. With these clues you can just guess what it is. Now tell me what you think.

Students: The idea is relating to collections.
Teacher: Correct, you got it.
Students: The idea is a collection of symbols.
Teacher: O.K., try to make it more clear.
Students: The difference between the idea and the other collections are relating to the objects in those collections
Teacher: It is correct.
Students: The items belonging to those collections are easily identifiable and not vague.
Teacher: Well; that is good. Can you elaborate it further?
Students: Those collections are having well defined objects.
Teacher: Well done.

**Phase 5. Providing more Examples and Non-Examples.**

Teacher presents some more examples for 'yes' and 'no'. Students observe these and make sure that their conclusion is correct.

**Phase 6. Students Generate Examples.**

Teacher: Now each of you gives one example, the rest will say 'yes' or 'no' and the one who gives the example will judge the answer.

**Students perform accordingly.**

**Phase 7. Defining the Concept.**

Teacher: Your conclusion is correct. These types of collections are called 'sets'. Now can you define 'set'?
Students: Collections having well defined objects are called 'sets'.
Teacher: Yes. In other words, a well defined collection of objects, symbols or ideas is called a 'set'. The symbol of a 'set' is {}. George cantor was the famous mathematician who gave theories of sets.

**Phase 8. Assessing the Attainment of Concept.**

Teacher: Let us examine whether you got the concept clearly. I will give some examples. You have to say 'yes' if it is set, otherwise 'no'.

Beautiful flowers in school garden.
Students: No.
Students: Yes.
Teacher: Collection of two digit numbers ending in 5.
Students: Yes.

Teacher : Correct

Like this teacher gives more and more examples and students answer 'yes' or 'no'.

**Phase 9. Analysis of Thinking Strategy Involved.**

Teacher : Now explain how you arrived at this idea.

Students explain how they got the idea. They share the thinking strategies among themselves.
Appendix C

DRAFT FORM

ACHIEVEMENT TEST IN MATHEMATICS ON THE TOPIC- SETS
FOR CLASS IX

GUIDE INVESTIGATOR
Dr. H.O.Joshi Mrs. Bhavika K. Vyas

Dear friends,
This test booklet contains 100 questions. Each question has four alternatives. Only one response is correct from each alternative. Mark only one alternative which is most suitable as the answer according to you. This is not your test but your answers would be useful in my research study. Lot of thanks to all the dear students as with your kind support I will be able to carry out my study successfully.

INSTRUCTIONS:
All answers are to be marked in answer sheet only.
Put tick mark against only correct response in proper place inside the box.
Try to answer all the questions taking adequate time.

Name of the Pupil: ____________________________

Gender: boy/girl

Name of the School: ____________________________

1. Which is a set among the collections given below?
   A. Natural numbers
   B. Brilliant pupils in your class
   C. Good books in your school library
   D. Beautiful flowers in your school garden

2. All the collections are not set what about all sets?
   A. Are collections
   B. Are not collections
   C. May be collections or may not be
   D. None of these

   Q: Collection of fundamental Operations: +, -, ÷, x.
   A. P and Q are not sets
   B. P and Q are sets
   C. P is a set but not Q
   D. Q is a set but not P

4. If \( Y = \{1,2,3,\ldots,10\} \) then
   A. \( Y \) is an infinite set
   B. \( Y \) is a finite set
   C. \( Y \) is singleton set
   D. \( Y \) is an empty set

5. If \( G = \{1,2,3,\ldots,10\} \) then cardinality of set \( G \) is
   A. 11
   B. 09
   C. 10
   D. 01
6. Compliment of compliment of set I is____
   A. I                               C. Ø
   B. I'                              D. U

7. If A∪B then it is read as:
   A. A is subset of B.          C. A and B are disjoint sets
   B. B is subset of A.          D. A is compliment of B

8. If cardinality of Set O is 100 then O is________
   A. Finite set                      C. Null set
   B. Infinite set                     D. Universal set

9. If n(P) = 6, n(Q) = 8 and n(P∪Q) = 10, then n(P∩Q) = ______
   A. 5                               C. 6
   B. 4                               D. 12

10. If T = {1} then,
    A. T is empty set                 C. T is singleton set
    B. T is infinite set              D. T is a complement set

11. Which is not a set among the collections given below?
    A. Natural numbers               C. English books in your
    B. Pupils in your class           school library
    D. Beautiful flowers in
    B. Hanging garden

12. \(A∪B = A∩B\)
    A. A and B are equal sets       C. A and B are disjoint sets
    B. A and B are not sets         D. None of these

    Q: Collection of letters in the word “Maths” then.
    A. P and Q are equal sets       C. P is a subset of Q
    B. P and Q are null sets        D. Q is a subset of P

14. If Y = \{1,2\} then P(Y) is ______
    A. \{\{1\}, \{2\}, \{1,2\}, Ø\}           C. Y itself
    B. \{1,2\}                           D. 4

15. Cardinality of non singleton set is____
    A. Always 1                        C. Never 1
    B. Always 0                        D. Can’t say

16. Symbol used to indicate subset.
    A. ⊂                                C. Ø
    B. ⊆                                D. none of these

17. How are Ø and set A related?
    A. A is subset of Ø.              C. A and Ø are disjoint sets
    B. Ø is subset of A.              D. A is compliment of Ø

18. If cardinality of Set O is 0 then O is________
    A. Finite set                      C. Null set
    B. Infinite set                     D. Universal set

19. If n (P) = 6, n (Q) = 8 then n(P∪Q) = _______, where P and Q are disjoint
    sets.
20. If \( T = {} \) then,
A. \( T \) is empty set                         C. \( T \) is singleton set
B. \( T \) is infinite set                     D. \( T \) is a complement set

21. \( A \cap B = B \) then what is true from the following
A. \( A \) and \( B \) are empty sets           C. \( A \) is subset of \( B \)
B. \( B \) is subset of \( A \)                  D. \( A \) and \( B \) are equal sets

22. If \( A = \{a,b,c,d,e,f\} \) and \( B = \{b,c,g,h,i,j\} \) then \( A \cup B = \) _______?
A. \( \{a,b,c,d,e,f,g,h,i,j\} \)             C. \( \{a,b,c,d,e,f,b,c,g,h,i,j\} \)
B. \( \{b,c\} \)                          D. None of these

23. P: Collection of letters in the word “Mathematics” without repeating letters.
Q: Collection of letters in the word “Science” without repeating letters and \( R \)
is a set containing elements that are in common to both the sets then set \( R \)contains______
A. \( \{s,c,i\} \)                         C. \( \{s,c,e\} \)
B. \( \{i,s,e,m,t,n,h,c,a\} \)              D. \( \{s,c,i,e\} \)

24. If \( Y = \{1,2,3,\ldots,10\} \) and \( X = \{10,9,8,7,6,5,4,3,2,1\} \) then
A. \( X = Y \)                            C. \( X \cup Y = \emptyset \)
B. \( X = Y = \emptyset \)                 D. \( X \cap Y \)

25. If \( G \) has 4 subsets then cardinality of set \( G \) is____
A. 4                                       C. 1
B. 2                                       D. 16

26. Among the students in IX A,B,C classes, 60 students like science, 80 students like mathematics, and 20 students like both. 10 students do not like both. Then what are the total numbers of students?
A. 170                                      C. 130
B. 140                                      D. 150

27. If \( A \) is set of letters of word “laptop” without repeating letters, \( B \) is a set of letters of word “lap” and \( C \) is set of letters of word “top” then
A. \( C = A \cup B \)                         C. \( A = B \cup C \)
B. \( B = A \cup C \)                        D. \( A = B = C \)

28. If \( A \) is the set containing months with 30 days then \( n(A') = \) ________
A. 7                                       C. 24
B. 8                                       D. 12

29. If \( A = \{1,3,5,7,9\} \) then
A. \( 3 \cup A \)                           C. \( \{3\} \cup A \)
B. \( 5 \cup A \)                           D. \( \{5\} \cup A \)

30. If \( E \) is the set of even numbers and \( O \) is the set of odd numbers then what is true about them?
A. \( E \) is infinite and \( O \) is infinite   C. \( E \) is infinite and \( O \) is finite
B. \( E \) is finite and \( O \) is infinite     D. \( E \) is finite and \( O \) is finite

31. \( F = \{f,i,s,h,f,s,h,i,h,f,s,l,h,s,f\} \) then \( n(F) = \) ______?
32. A set subset to all sets is_______?
   A. Ø                           C. singleton set
   B. U                           D. finite set

33. P and Q are disjoint sets and P={1,3,5,7,2,4} and Q= {8,9,__,10} then what does __ stand for?
   A. 1                           C. 2
   B. 7                           D. 6

34. If Y={1,2,3,…..10} then Y∪Ø is ______
   A. Finite set                 C. Infinite set
   B. Ø                          D. can’t say

35. If G = {1,2,3,…} then set G has _____subsets
   A. infinite                   C. no
   B. finite                     D. can’t say

36. Compliment of null set is_____
   A. I                           C. Ø
   B. Iꞌ                          D. U

37. If A is set of months in a year and B is a set of days in a week then
   A. A is subset of B.          C. A and B are disjoint sets
   B. B is subset of A.          D. A is compliment of B

38. If cardinality of Set O is 5 then number of subsets of set O are__________
   A. 23                         C. 32
   B. 5                          D. 16

39. If n(P) = 6, n(Q) = 8 and n(P∪Q) = 10, then
   A. P∩Q                        C. Q∩P
   B. P∪Q = Ø                   D. none of these

40. If T = {1,2,3,4} and S= {a,b} then,
   A. n(T) = 4, n(S) = 3          C. n(S) = 2, n(T) = 4
   B. n(T)=3, n(S) = 4            D. n(S)=4,n(T) = 2

41. If Set M contains months in a year 2012 then how is July related to set M?
   A. element                     C. equal
   B. compliment                  D. not related at all

42. All the collections are not set what about all sets?
   A. Are collections            C. May be collections or may not be
   B. Are not collections        D. none of these

43. If H is a set of squares of 2 then set H is __________
   A. Null set                   C. Infinite set
   B. Finite set                 D. subset

44. If Y={1,2,1,3,2,4,2,1,3,4,2,1} then
   A. Y is a infinite set        C. Y is singleton set
   B. Y is a finite set          D. Y is an empty set

45. If cardinality of set G is 6 then number of elements in set G is ____?
46. Compliment of compliment of U is_____
   A. I
   B. I'
   C. Ø
   D. none of these

47. If A∩B and A = {1,2,3,} and B = {2,4} then which number will replace ___?
   A. 4
   B. 2
   C. any number
   D. data inadequate

48. K={come,come,come,come,come} then K is_____
   A. Finite set
   B. Infinite set
   C. Null set
   D. Universal set

49. Which among the following set is not infinite set?
   A. Finite set
   B. Set of Integers
   C. Set of Real numbers on number line
   D. Universal set

50. If T = {1,0,2} then,
   A. T has 3 subsets
   B. T has 4 subsets
   C. T has 8 subsets
   D. T has 6 subsets

51. If L= {l,i,o,n} then n(P(A)) = _____?
   A. 14
   B. 16
   C. 4
   D. 18

52. U= R and A = N then what is U∩A?
   A. U
   B. R
   C. N
   D. None of these

53. P: Collection of letters in the word “Sets” without repeating letters.
   Q: Collection of letters in the word “subset” without repeating letters. Then
   A. P and Q are equal sets
   B. P and Q are null sets
   C. P is a subset of Q
   D. Q is a subset of P

54. Y =∞ then its power set is _______.
   A. ∞
   B. Finite set
   C. Ø
   D. an empty set

55. If G = {1,2,3,…..10} and set H is a set of natural numbers less than 11 then
   A. G and H are equal sets
   B. G and H are disjoint sets
   C. GUH = Ø
   D. G=H=∞

56. Number of elements in Power set are_____
   A. n
   B. 2^n
   C. Ø
   D. can’t say

57. If A∩B then what is not true about them?
   A. A is superset of B.
   B. B is subset of A.
   C. A and B are disjoint sets
   D. none of these

58. If O is the set of odd numbers and E is the set of even numbers then set containing common elements will be______.
   A. Finite set
   B. Infinite set
   C. Null set
   D. Universal set
59. There are 600 pupils in your school, 280 pupils played football, 300 played cricket, 70 pupils played both then how many students did not participated at all?

A. 25  
B. 90  
C. 20  
D. 500

60. If T = \{0\} and S = \{1,2,3\} then T and S are__________ ,

A. Empty sets  
B. Disjoint sets  
C. Equal sets  
D. complement sets

61. If A and B are two sets and A \cap B =B, then A __ B ?

A. \in  
B. =  
C.  \emptyset  
D. \equiv

62. U =N, A= \{1,2,3,4,5\} and B = \{1,6,3,8,5,7,9\} then what is compliment of A \cup B ?

A. N-\{1,3,5\}  
B. N  
C. \{1,3,5\}  
D. None of these

63. P = \{α,β,γ,δ,ε,μ,ν,σ,τ\}. n(P) =______

A. \infty  
B. \emptyset  
C. 11  
D. 10

64. If Y =\{ \} then

A. Y is a infinte set  
B. Y is a finite set  
C. Y is singleton set  
D. Y is an empty set

65. The set containing all the elements from A and B is denoted as_____

A. AUB  
B. A \cap B  
C. A \setminus B  
D. A \cup B

66. If A and B are two sets then A \cap B =______

A. A  
B. U  
C. \emptyset  
D. can’t say

67. If A and B are two sets then AUB and BUA are_______

A. Equal sets  
B. Subsets  
C. Disjoint sets  
D. Complement sets

68. Set is always denoted by capital letters and its elements are written inside_____

A. [ ]  
B. ( )  
C. \{}  
D. < >

69. n(P) = 6 means:

A. Number of elements in set P is 6  
B. Number of proper subsets of set P is 6  
C. Number of elements in power set is 6  
D. Number of subsets is 6

70. If T = Set of Natural numbers more than 100 then,

A. T is empty set  
B. T is infinite set  
C. T is singleton set  
D. T is a complement set

71. If A= \{0\} then

A. A is not a set  
B. A is infinite set  
C. A is a singleton set
B. A is an empty set

72. If U = \{a,b,c,d,e,f,g,h\} and M = \{d,e,f\} then M' = ____________
A. M
B. \{a,b,c,g,h\}
C. \{h,g,f,e,d,c,b,a\}
D. \{a,b,c,d,e,f,g,h\}

73. P = \{1,2,3,4,5,6,7,8,9,10\}
Q = \{1,4,6,9,10,2,3,5,8,7\}
A. P is subset of Q
B. Q is subset of P
C. P and Q are equal sets
D. P and Q are disjoint sets

74. Find which is not an empty set
A. \{ \}
B. \{\phi\}
C. \phi
D. none of these

75. If G is the set of letters in word “tab” and H is a set of letters in word “bat” then
A. G and H are equal sets
B. G and H are disjoint sets
C. G and H are complement set
D. none of these

76. If A = Set of Natural numbers, B = Set of Prime numbers then what is relation between the two sets A and B?
A. A is subset of B
B. B is subset of A
C. A = B
D. A \cap B = N

77. If A = \{1,2\} then P(A) = _______
A. \{\{1\}, \{2\}, \{1,2\},\phi\}
B. \{\}
C. \{\{1\},\{2\}\}
D. none of these

78. If cardinality of Set O is 0 then O is ____________
A. Finite set
B. Infinite set
C. Null set
D. Universal set

79. If n(P) = 6 than set P contains _____ elements in its power set
A. 56
B. 64
C. 62
D. 12

80. If T = \{1,0\} then,
A. T is empty set
B. T is infinite set
C. T is singleton set
D. none of these

81. S contains team of cricketers who played well in IPL then
A. S is a finite set
B. S is not a set
C. S is empty set
D. S is subset

82. A = \{3,5,7,11,13,17,19,23,…….\} then
A. 3 \in A
B. 3 \notin A
C. \{3\} \in A
D. 3 \notin A

83. P: Collection of letters in the word “myself”
Q: Collection of letters in the word “self” then
A. P and Q are not sets
B. P and Q are infinite sets
C. P is a subset of Q
D. Q is a subset of P

84. If Y = \{1,2,3,…….50\} then
A. Y is an infinite set
B. Y is a finite set
C. Y is singleton set
D. Y is an empty set
85. If \( G = \{abcd \} \) then set \( G \) is____
   A. Singleton set  
   B. Power set  
   C. Subset  
   D. Can’t say

86. Set of counting numbers is ________
   A. Infinite set  
   B. Finite set  
   C. Ø  
   D. U

87. If \( A = \{1,2,3,4,5\} \) and \( B = \{6,7,8,9,10\} \) then
   A. A is subset of B.  
   B. B is subset of A.  
   C. A and B are disjoint sets  
   D. A is compliment of B

88. If number of subsets of a set is 1 then the set is__________
   A. Finite set  
   B. Infinite set  
   C. Null set  
   D. Universal set

89. \( A= \{p, q, r, s, t, u, v, w, x, y, z\} \) then \( P(A) \) contains _____ elements.
   A. \( 2^{11} \)  
   B. \( 4^{11} \)  
   C. \( 2^{10} \)  
   D. \( 2^{12} \)

90. If \( T = \{1\} \) then its number of subsets are___
   A. 1  
   B. 2  
   C. 3  
   D. 4

91. \( U = \mathbb{N}, A = \mathbb{N}-\{1, 3, 5 \ldots \} \) and \( B = \mathbb{N}-\{2, 4, 6\ldots \} \)
   A. A and B are null sets  
   B. A and B are not sets  
   C. A and B are disjoint sets  
   D. A and B are both Universal sets

92. \( R \) is a set of Real numbers then it is __________ set
   A. a finite  
   B. an infinite  
   C. a null  
   D. None of these

93. \( P:\{p,q,r\} \) and.
   Q: Collection of alphabets then
   A. P and Q are not sets  
   B. P and Q are sets  
   C. P is a set but not Q  
   D. Q is a set but not P

94. If \( J = \{1,2,3,\ldots,10\} \) and \( P = \{1,2,3,\ldots,11\} \)
   A. P and J are finite sets  
   B. J is a finite set but not P  
   C. J and p are singleton sets  
   D. P is an empty set but not J

95. If \( N = \{1,2,3,\ldots\} \) then cardinality of set \( N \) is____
   A. finite  
   B. infinite  
   C. zero  
   D. can’t say

96. Compliment of \( A \cap B \) is ____
   A. \( A' \cup B' \)  
   B. \( A \cup B \)  
   C. \( \emptyset \)  
   D. U

97. A set containing all the elements is called________
   A. Null Set  
   B. Universal Set  
   C. Infinite Set  
   D. Finite Set

98. If cardinality of Set \( P \) is 10 then it can be represented as______
   A. \( n(P(A)) = 10 \)  
   B. \( n(P) = 0 \)  
   C. \( n(P(P)) = 10 \)  
   D. \( n(P) = 10 \)
99. \( D = \{d,u,s,t\} \) and \( X = \{j,u,s,t\} \) then \( DUX = \) _______
   A. \( \{d,j,u,s,t\} \)  
   B. \( \{d,u,s,t\} \)  
   C. \( \{j,u,s,t\} \)  
   D. \( \{u,s,t\} \)

100. \( U = \) set of alphabets and \( A = \{a,b,c,d,e,f,g\} \) then \( A' = \) _______
   A. \( U \)  
   B. \( \emptyset \)  
   C. \( U-\{a,b,c,d,e,f,g\} \)  
   D. \( \{a,b,c,d,e,f,g\} \)
### Appendix D

**Difficulty Value and Discriminating Index of test items selected in final form**

<table>
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<th>Sr No.</th>
<th>Difficulty Value (D.V.)</th>
<th>Discriminating Index (D.I.)</th>
<th>Sr No.</th>
<th>Difficulty Value (D.V.)</th>
<th>Discriminating Index (D.I.)</th>
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</table>
Appendix E

ACHIEVEMENT TEST IN MATHEMATICS ON THE TOPIC- SETS
FOR CLASS IX

GUIDE  INVESTIGATOR
Dr. H.O.Joshi  Mrs. Bhavika K. Vyas

Dear friends,

This test booklet contains 50 questions.
Each question has four alternatives.
Only one response is correct from each alternative.
Mark only one alternative which is most suitable as the answer according to you.
Each of the questions carries 1 mark for correct response and 0 for wrong answer there are no negative marks.

INSTRUCTIONS:
All answers are to be marked in answer sheet only.
Put tick mark against only correct response in proper place inside the box.

Name of the Pupil:______________________________________

Gender: boy/girl (tick mark which is applicable)

Name of the School:____________________________________

Do not open the seal of booklet before instructions
1. All the collections are not set what about all sets?  
   A. Are collections  
   B. Are not collections  
   C. May be collections or may not be  
   D. None of these

2. P: Collection of letters in the word “Mathematics” without repeating letters.  
   Q: Collection of fundamental Operations: +, -, ÷, x.  
   A. P and Q are not sets  
   B. P and Q are sets  
   C. P is a set but not Q  
   D. Q is a set but not P

3. If \( Y = \{1,2,3,\ldots,10\} \) then  
   A. \( Y \) is a infinite set  
   B. \( Y \) is a finite set  
   C. \( Y \) is singleton set  
   D. \( Y \) is an empty set

4. If \( G = \{1,2,3,\ldots,10\} \) then cardinality of set \( G \) is  
   A. 11  
   B. 09  
   C. 10  
   D. 01

5. Compliment of compliment of set \( I \) is  
   A. \( I \)  
   B. \( I' \)  
   C. \( \emptyset \)  
   D. U

6. If \( A \cap B \) then it is read as:  
   A. A is subset of B.  
   B. B is subset of A.  
   C. A and B are disjoint sets  
   D. A is compliment of B

7. If cardinality of Set \( O \) is 100 then \( O \) is  
   A. Finite set  
   B. Infinite set  
   C. Null set  
   D. Universal set

8. If \( n(P) = 6 \), \( n(Q) = 8 \) and \( n(P \cup Q) = 10 \), then \( n(P \cap Q) = \)  
   A. 5  
   B. 4  
   C. 6  
   D. 12

9. If \( T = \{1\} \) then,  
   A. \( T \) is empty set  
   B. \( T \) is infinite set  
   C. \( T \) is singleton set  
   D. \( T \) is a complement set

10. Which is not a set among the collections given below?  
    A. Natural numbers  
    B. Pupils in your class  
    C. English books in your school library  
    D. Beautiful flowers in hanging garden

11. \( \overline{A \cup B} = A \cap B \)  
    A. A and B are equal sets  
    B. A and B are not sets  
    C. A and B are disjoint sets  
    D. None of these

    Q: Collection of letters in the word “Maths” then.  
    A. P and Q are equal sets  
    B. P and Q are null sets  
    C. P is a subset of Q  
    D. Q is a subset of P

13. If \( Y = \{1,2\} \) then \( P(Y) \) is  
    A. \{\{1\}, \{2\}\}  
    B. \{\{1,2\}, \emptyset\}  
    C. \( Y \) itself  
    D. 4
14. Cardinality of non singleton set is____
   A. Always 1   C. Never 1
   B. Always 0   D. Can’t say
15. How are Ø and set A related?
   A. A is subset of Ø.   C. A and Ø are disjoint sets
   B. Ø is subset of A.   D. A is compliment of Ø
16. If \( n(P) = 6, n(Q) = 8 \) then \( n(\text{PUQ}) = \)_______, where P and Q are disjoint sets.
   A. 5   C. 14
   B. 4   D. 12
17. \( A \cap B = B \) then what is true from the following
   A. A and B are empty sets   C. A is subset of B
   B. B is subset of A   D. A and B are equal sets
18. If \( A = \{a, b, c, d, e, f\} \) and \( B = \{b, c, g, h, i, j\} \) then \( A \cup B = \)_______?
   A. \( \{a, b, c, d, e, f, g, h, i, j\} \)   C. \( \{a, b, c, d, e, f, b, c, g, h, i, j\} \)
   B. \( \{b, c\} \)   D. None of these
19. If \( Y = \{1, 2, 3, \ldots, 10\} \) and \( X = \{10, 9, 8, 7, 6, 5, 4, 3, 2, 1\} \) then
   A. \( X = Y \)   C. \( X \cup Y = \emptyset \)
   B. \( X = Y = \emptyset \)   D. \( X \cap Y \)
20. If \( G \) has 4 subsets then cardinality of set \( G \) is____
   A. 4   C. 1
   B. 2   D. 16
21. Among the students in IX A, B, C classes, 60 students like science, 80 students like mathematics, and 20 students like both. 10 students do not like both. Then what are the total numbers of students?
   A. 170   C. 130
   B. 140   D. 150
22. If \( A \) is set of letters of word “laptop” without repeating letters, \( B \) is a set of letters of word “lap” and \( C \) is set of letters of word “top” then
   A. \( C = A \cup B \)   C. \( A = B \cup C \)
   B. \( B = A \cup C \)   D. \( A = B = C \)
23. If \( A = \{1, 3, 5, 7, 9\} \) then
   A. \( 3 \in A \)   C. \( \{3\} \not\in A \)
   B. \( 5 \in A \)   D. \( \{5\} \not\in A \)
24. If \( E \) is the set of even numbers and \( O \) is the set of odd numbers then what is true about them?
   A. \( E \) is infinite and \( O \) is infinite   C. \( E \) is infinite and \( O \) is finite
   B. \( E \) is finite and \( O \) is infinite   D. \( E \) is finite and \( O \) is finite
25. \( F = \{f, i, s, h, f, s, h, i, h, f, s, i, h, s, f\} \) then \( n(F) = \)____?
   A. 4   C. 16
   B. 15   D. 8
26. A set subset to all sets is____?
   A. \( \emptyset \)   C. singleton set
   B. \( U \)   D. finite set
27. P and Q are disjoint sets and P = \{1,3,5,7,2,4\} and Q = \{8,9,\_,10\} then what does \_ stand for?
   A. 1                     C. 2
   B. 7                     D. 6

28. If G = \{1,2,3,…\} then set G has _____ subsets
   A. infinite               C. no
   B. finite                 D. can’t say

29. Compliment of null set is_____
   A. I                     C. \Ø
   B. I’                    D. U

30. If A is set of months in a year and B is a set of days in a week then
   A. A is subset of B.       C. A and B are disjoint sets
   B. B is subset of A.       D. A is compliment of B

31. If n(P) = 6, n(Q) = 8 and n(P\cup Q) = 10, then
   A. P\cap Q                 C. Q\cap P
   B. P\cup Q = \Ø          D. none of these

32. If Set M contains months in a year 2012 then how is July related to set M?
   A. element                 C. equal
   B. compliment             D. not related at all

33. If H is a set of squares of 2 then set H is________
   A. Null set               C. Infinite set
   B. Finite set             D. subset

34. Which among the following set is not infinite set?
   A. Finite set               C. Set of Real numbers on number line
   B. Set of Integers         D. Universal set

35. If L= \{l,i,o,n\} then n(P(A)) = _____?
   A. 14                    C. 4
   B. 16                    D. 18

36. Number of elements in Power set are_____
   A. n                        C. \Ø
   B. 2^n                  D. can’t say

37. If A\cap B then what is not true about them?
   A. A is superset of B.       C. A and B are disjoint sets
   B. B is subset of A.        D. none of these

38. There are 600 pupils in your school, 280 pupils played football, 300 played cricket, and 70 pupils played both then how many students did not participated at all?
   A. 25                    C. 20
   B. 90                    D. 500

39. If A and B are two sets and A\cap B =\Ø, then A ___ B?
   A. \in                      C. \Ø
   B. =                      D. \subseteq
40. \( U = \mathbb{N} \), \( A = \{1,2,3,4,5\} \) and \( B = \{1,6,3,8,5,7,9\} \) then what is compliment of \( A \cap B \)?
   A. \( N - \{1,3,5\} \)  
   B. \( N \)  
   C. \( \{1,3,5\} \)  
   D. None of these

41. If \( Y = \{\} \) then
   A. \( Y \) is a infinite set  
   B. \( Y \) is a finite set  
   C. \( Y \) is a singleton set  
   D. \( Y \) is an empty set

42. The set containing all the elements from \( A \) and \( B \) is denoted as_____
   A. \( A \cup B \)  
   B. \( A \triangle B \)  
   C. \( A \cap B \)  
   D. None of these

43. Set is always denoted by capital letters and its elements are written inside____
   A. \( [\ ] \)  
   B. \( (\ ) \)  
   C. \( \{\} \)  
   D. \( <> \) 

44. If \( A = \{0\} \) then
   A. \( A \) is not a set  
   B. \( A \) is an empty set  
   C. \( A \) is a singleton set  
   D. None of these

45. If \( U = \{a,b,c,d,e,f,g,h\} \) and \( M = \{d,e,f\} \) then \( M' = \)______
   A. \( M \)  
   B. \( \{a,b,c,g,h\} \)  
   C. \( \{h,g,f,e,d,c,b,a\} \)  
   D. \( \{a,b,c,d,e,f,g,h\} \)

46. Find which is not an empty set
   A. \( \{\} \)  
   B. \( \{\emptyset\} \)  
   C. \( \emptyset \)  
   D. None of these

47. If \( n(P) = 6 \) than set \( P \) contains_____ elements in its power set
   A. \( 56 \)  
   B. \( 64 \)  
   C. \( 62 \)  
   D. \( 12 \) 

48. \( U = \mathbb{N} \), \( A = \mathbb{N} - \{1,3,5\} \) and \( B = \mathbb{N} - \{2,4,6\} \)
   A. \( A \) and \( B \) are null sets  
   B. \( A \) and \( B \) are not sets  
   C. \( A \) and \( B \) are disjoint sets  
   D. \( A \) and \( B \) are both Universal sets

49. Compliment of \( A \cap B \) is____
   A. \( A \cup B' \)  
   B. \( A \cup B \)  
   C. \( \emptyset \)  
   D. \( U \) 

50. A set containing all the elements is called_______
   A. Null set  
   B. Universal set  
   C. Infinite set  
   D. Finite set
Appendix F

Answer sheet
Unit Achievement Test in Mathematics

Topic – Sets
Std. – 9_____

Name - ____________________________

School - ____________________________

Gender - Boy / Girl (Put a tick mark √ for whichever is applicable)

Date of Birth - ______________ (dd/mm/yy format)

Instructions
➢ Mark only the correct response out of the four alternatives.
   As for example-

   00 A B C D

➢ If by chance any response is marked and you want to change answer than put cross X and then indicate your correct choice.
➢ Start only when instructed.
➢ Do rough work on the extra sheet provided with the test booklet.

|   | A   | B   | C   | D   |   | A   | B   | C   | D   |   | A   | B   | C   | D   |   | A   | B   | C   | D   |   | A   | B   | C   | D   |
|---|-----|-----|-----|-----|---|-----|-----|-----|-----|---|-----|-----|-----|-----|---|-----|-----|-----|-----|---|-----|-----|-----|-----|---|-----|-----|-----|-----|
| 1 | A    | B    | C    | D    | 16| A    | B    | C    | D    | 31| A    | B    | C    | D    | 41| A    | B    | C    | D    | 42| A    | B    | C    | D    |
| 2 | A    | B    | C    | D    | 17| A    | B    | C    | D    | 32| A    | B    | C    | D    | 43| A    | B    | C    | D    | 44| A    | B    | C    | D    |
| 3 | A    | B    | C    | D    | 18| A    | B    | C    | D    | 33| A    | B    | C    | D    | 45| A    | B    | C    | D    | 46| A    | B    | C    | D    |
| 4 | A    | B    | C    | D    | 19| A    | B    | C    | D    | 34| A    | B    | C    | D    | 47| A    | B    | C    | D    | 48| A    | B    | C    | D    |
| 5 | A    | B    | C    | D    | 20| A    | B    | C    | D    | 35| A    | B    | C    | D    | 49| A    | B    | C    | D    | 50| A    | B    | C    | D    |
| 6 | A    | B    | C    | D    | 21| A    | B    | C    | D    | 36| A    | B    | C    | D    |   |       |       |       |       |   |       |       |       |       |
| 7 | A    | B    | C    | D    | 22| A    | B    | C    | D    | 37| A    | B    | C    | D    |   |       |       |       |       |   |       |       |       |       |
| 8 | A    | B    | C    | D    | 23| A    | B    | C    | D    | 38| A    | B    | C    | D    |   |       |       |       |       |   |       |       |       |       |
| 9 | A    | B    | C    | D    | 24| A    | B    | C    | D    | 39| A    | B    | C    | D    |   |       |       |       |       |   |       |       |       |       |
|10 | A    | B    | C    | D    | 25| A    | B    | C    | D    | 40| A    | B    | C    | D    |   |       |       |       |       |   |       |       |       |       |
|11 | A    | B    | C    | D    | 26| A    | B    | C    | D    |   |       |       |       |       |   |       |       |       |       |   |       |       |       |       |
|12 | A    | B    | C    | D    | 27| A    | B    | C    | D    |   |       |       |       |       |   |       |       |       |       |   |       |       |       |       |
|13 | A    | B    | C    | D    | 28| A    | B    | C    | D    |   |       |       |       |       |   |       |       |       |       |   |       |       |       |       |
|14 | A    | B    | C    | D    | 29| A    | B    | C    | D    |   |       |       |       |       |   |       |       |       |       |   |       |       |       |       |
|15 | A    | B    | C    | D    | 30| A    | B    | C    | D    |   |       |       |       |       |   |       |       |       |       |   |       |       |       |       |
## Appendix - G

### LIST OF EXPERTS

<table>
<thead>
<tr>
<th>No.</th>
<th>Name and Qualification</th>
<th>Designation</th>
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<tr>
<td>1.</td>
<td>Dr. B.B. Ramanuj</td>
<td>Head of Department Saurashtra University</td>
</tr>
<tr>
<td>2.</td>
<td>Dr. Kishor Pillai</td>
<td>Head International Curriculum Jamnabai School</td>
</tr>
<tr>
<td>3.</td>
<td>Dr. P.N. Chavda</td>
<td>Principal Thakur college of Education</td>
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<tr>
<td>4.</td>
<td>Smt. Deepa Iyer</td>
<td>Mathematics Head IBDP</td>
</tr>
<tr>
<td>5.</td>
<td>Mrs. Shella Mallya</td>
<td>Principal Children’s Academy</td>
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<tr>
<td>6.</td>
<td>Dr. Minikutty</td>
<td>Associate Prof. School of pedagogical sci.</td>
</tr>
<tr>
<td>7.</td>
<td>Mrs. Karundatti Patnickk</td>
<td>Principal Hiranandani Foundation School</td>
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<tr>
<td>8.</td>
<td>Mr. Nikunj Thoriya</td>
<td>Mathematics Teacher S.V.P. School</td>
</tr>
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<td>9.</td>
<td>Mrs Hiral Kothari</td>
<td>Mathematics Teacher IES School</td>
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<tr>
<td>10.</td>
<td>Shree Dilip Vora</td>
<td>Retired Principal Saurashtra High School</td>
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Appendix - H

CD-ROM

[For all lesson plans]
Appendix - I

Paper Published in International Journal – Research Analysis and Evaluation

EFFECTIVENESS OF TECHNOLOGY: MEETING NEEDS OF UNDER ACHIEVERS

Paper presenter: Mrs. Bhavika K. Vyas

Research Scholar
Dept. of Education,
Saurashtra University
Email id: bhavikakvyas@gmail.com

Abstract: Present investigation is centered on developing teaching technology for under achiever students of secondary schools. Researcher has developed Concept Attainment Model of Instruction and its effectiveness was assessed among under achiever boys and girls.

Introduction
In a society which is rapidly transforming itself in to technological society, mathematical literacy is very much essential. Mathematics helped man to quantify ideas, to be precise and to utilize special concepts in his day to day living. Mathematics is very crucial subject and building proper concepts among learners is must.

Especially meeting needs of under achievers has been a great challenge since years. Thus investigator prepared Concept Attainment Model of Instruction for teaching in Mathematics and assessed its effectiveness among underachiever students of secondary schools.

Objectives of Present Study
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 under achiever students of secondary schools.
3. To study the effectiveness of Concept Attainment Model of Instruction on achievement in Mathematics among under achiever boys and girls.

Sample
There were 240 students from IES School and 238 students from SVP School in Mumbai. Out of them 143 under achievers were found out of which 87 were boys and 56 were girls.
Construction of Teaching Material and Tool

The investigator developed lesson plans using Concept Attainment Model of Instruction. Standardized unit achievement test was also prepared by the researcher.

Testing of Hypotheses

Presentation of hypotheses and its testing in the present study is done as:

1. There will be no significant difference in between the mean scores of achievement in pre test and post test of under achiever students when taught using Concept Attainment Model of Instruction.

To check the effectiveness of Concept Attainment Model of Instruction, the pre test and post test scores of entire sample were considered – mentioned in table 1.2.

**TABLE 1.1**

Significance of Mean Difference in Pre–test and Post-test scores of
Under achiever students

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Achievement Level</th>
<th>Test</th>
<th>No. of Students</th>
<th>Mean</th>
<th>S.D.</th>
<th>t-value</th>
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<td>Under Achievers</td>
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<td>143</td>
<td>20.61</td>
<td>6.14</td>
<td>7.49**</td>
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<td></td>
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<td>Post-Test</td>
<td></td>
<td>25.62</td>
<td>5.13</td>
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</table>

** indicates significant at 0.01 level

The table indicates the t-value as 7.49. First hypothesis was not accepted. Hence effect of Concept Attainment Model of Instruction was significantly higher on the under achiever students.

In order to check the effectiveness model on boys and girls separately t-test was carried out between the pre-test and post-test scores of underachiever students as shown in table 1.3.

**TABLE 1.2**

Significance of Mean Difference in Pre–test and Post-test Scores of
Under Achiever Boys and Girls

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Gender</th>
<th>Test</th>
<th>No. of Students</th>
<th>Mean</th>
<th>S.D.</th>
<th>t-value</th>
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<td>Boys</td>
<td>Pre-Test</td>
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<td>19.98</td>
<td>6.48</td>
<td>4.81**</td>
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<tr>
<td></td>
<td></td>
<td>Post-Test</td>
<td></td>
<td>24.21</td>
<td>5.02</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Girls</td>
<td>Pre-Test</td>
<td>56</td>
<td>21.24</td>
<td>5.79</td>
<td>5.55**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post-Test</td>
<td></td>
<td>27.02</td>
<td>5.24</td>
<td></td>
</tr>
</tbody>
</table>

*indicates significant at 0.05 level  ** indicates significant at 0.01 level

2. There will be no significant difference in between the mean scores of achievement in pre test and post test of under achiever boys when taught using Concept Attainment Model of Instruction.

The t-value for the under achiever boys group is 4.81. Thus the second hypothesis was rejected. This means that the Concept Attainment Model of Instruction was found effective in enhancing achievement of under achiever boys group.
3. There will be no significant difference in between the mean scores of achievement in pre test and post test of under achiever girls when taught using Concept Attainment Model of Instruction.

The t-value for the under achiever girls group is 5.55. Thus the third hypothesis was rejected. This means that the Concept Attainment Model of Instruction was found effective in enhancing achievement of under achiever girls group.

4. There will be no significant difference in between the mean scores of achievement in post test of under achiever boys and girls when taught using Concept Attainment Model of Instruction.

To check the effectiveness of Concept Attainment Model of Instruction, the post test scores of entire under achiever sample were considered. The results obtained can be tabulated as:

**TABLE 1.3**

<table>
<thead>
<tr>
<th>Achievement Levels</th>
<th>Gender</th>
<th>No. of Students</th>
<th>Mean</th>
<th>S.D.</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>UA</td>
<td>Boys</td>
<td>87</td>
<td>24.21</td>
<td>5.02</td>
<td>3.18**</td>
</tr>
<tr>
<td></td>
<td>Girls</td>
<td>56</td>
<td>27.02</td>
<td>5.24</td>
<td></td>
</tr>
</tbody>
</table>

**significant at 0.01 level * significant at 0.05 level**

The t-value 3.18 indicates that mean difference between the scores of post test of under achiever boys and girls was significant. Hence the fourth hypothesis was rejected.

5. There will be no significant difference in between the mean scores of achievement in post test of under achiever students in reference to their gender when taught using Concept Attainment Model of Instruction.

This hypothesis was not accepted. Girls showed significant increase in academic achievement as compared to boys when they were taught using Concept Attainment Model of Instruction.

**Conclusions**

The conclusions of the present study were as follows:

- Effect of Concept Attainment Model of Instruction was significantly higher on the under achiever students.
- Concept Attainment Model of Instruction was found effective in enhancing achievement of under achiever boys group.
- The Concept Attainment Model of Instruction was found effective in enhancing achievement of under achiever girls group.
- Under achiever girls had shown significant increase in academic achievement as compared to boys when they were taught using Concept Attainment Model of Instruction.

**References**


