CHAPTER 9
SUMMARY

9.1.0 Introduction

During past few decades, curricula have increasingly reflected the belief that students should understand the facts rather than rote memorization. The National Curriculum Framework -2005 also proposed a shift in the approach to teaching and learning of facts. This shift is from behaviorist approach to constructivist approach (individual constructs his own knowledge through meaningful interaction with the world. New knowledge is built through active experience on the basis of their prior knowledge). For this very purpose, many schools have adopted alternate teaching-learning strategies that help the learner expand his horizon of knowledge and understanding.

One of the strategies that has evolved as a useful tool in leading students towards meaningful learning is Concept Mapping. It is seen as a useful tool for helping students learn about the structure of knowledge and the process of knowledge production i.e. meta-knowledge. In contrast to the students who learn by rote, the students who employ meaningful learning are expected to retain knowledge for a longer time and are able to learn new things easily.

The use of concept maps as a teaching strategy was first developed by J.D. Novak in the early 1980s, derived from Ausubel's Learning Theory which places central emphasis on the influence of students' prior knowledge on subsequent meaningful learning. Concept maps are diagrammatic representations. These show meaningful relationship between 'concepts’ in the form of propositions, which are linked together by words, circles and cross-links. Concepts are arranged hierarchically with the super-ordinate concepts at the top of the map and sub-ordinate concepts at the bottom that are less inclusive than higher ones. 'Cross-links’ are used to connect different segments of concepts. These connections result into new synthesis of old concepts. In short, concept maps are assessed on the basis of four components: hierarchy, propositions, cross-links and examples.

Concept Mapping is a technique or way for visualizing concepts and propositions in a schematic form. In other words, it provides a schematic summary of learning that has
occurred after a learning task has been completed. Besides this concept mapping is also an evaluation tool.

Much of the work on the topic has been done abroad. Few studies have been found in India. Rao (2008) studied the effect of concept mapping in science on science achievements, cognitive skills and attitude of students. Ahuja (2007) studied the effectiveness of concept mapping in learning Science. Kharatmal (2006) developed concept map on cell structure and function. Kharatmal (2006) and Nagarjun (2006) worked together on a proposal to refine concept mapping for effective science learning.

In all these studies the results show that concept mapping has a positive effect upon the learning of students as an instructional tool.

9.2.0 Rationale of the study

Scientific innovations and technological advancements have led to knowledge explosion. Above this, schools and universities employ traditional teaching methods that provide knowledge which is required by beginner but do not develop wisdom i.e. higher order thinking skills. Thus, it is not an easy task for students to keep pace with new knowledge which is required to solve day to day problems. The students of today live in the world of tomorrow where the things are totally different. In such circumstances, the students require higher order thinking skills i.e. problem recognition, finding new solutions to a problem, choosing out the best solution so that they can become effective learners. Consequently, it becomes the duty of educators to realize the importance of teaching-thinking skills to students. Many training programmes that teach thinking skills are there. One such programme of creativity training is CoRT Thinking lessons i.e. 'Cognitive Research Trust' thinking lessons. These lessons are divided into 6 groups with 10 lessons in each group. The six groups of CoRT Thinking lessons are: Breadth, Organization, Interpretation, Creativity, Information & Feeling and Action. This programme has been used for creativity training in the present study.

To sum up, there is dearth of research in the area of creativity and concept mapping. The concept maps represent the meaningful learning by the students and the way the students organize the knowledge. And if creativity training is given to the students, the thinking skills will enhance and the concept map performance of students
will improve. That is why an attempt is made to see the effect of creativity training programme upon concept map performance of students.

9.3.0 Statement of the Study:

The problem can precisely be stated as follows:

“The Effect of Creativity Training Programme on Concept Map Performance of Secondary School Students”

9.4.0 Operational Definitions of the key terms:

1) Creativity Training Program:

This is a group of educational activities designed to increase fluency, flexibility, elaboration and originality. It also includes exercises to bring new, different and unexpected response to a situation. As a result, creative thinking of one is improved. CoRT is one such programme that enhances the creativity of an individual. The same concept has been used in the present study.

2) Concept Map Performance:

Concept map is a visual representation of the concepts in a meaningful way. A concept map reflects individuals knowledge structure on a given topic or area. Additionally, as individual’s knowledge and understanding develops over time, his/her concept map will also change. This view has been used in the present study.

3) Secondary School Students:

The age period between 10-15 yrs is when children enjoy thinking most of all. They enjoy using their minds and having different ideas. Secondary school students are in such age limit. The same concept has been used in the present study.

9.5.0 Objectives of the Study:

1. To provide orientation to the secondary school students about concept mapping and creativity training programme.

2. To develop and standardize the criterion concept maps for evaluating the effect of creativity training program on secondary school students.
3. To find out the effect of creativity training program on various components of concept mapping ability.
4. To find out the effect of creativity training program on scientific creativity of secondary school students.
5. To find out the relationship between scientific creativity and concept mapping ability of secondary school students.
6. To find out the effect of creativity training program on depth of understanding of secondary school students.
7. To find out the effect of creativity training program on quality of concept maps (structural changes and type of learning quality, use of expert terms, conceptual richness and individuality of understanding) of secondary school students.

9.6.0 Hypothesis of the Present Study

In the absence of any research evidences, null hypothesis was framed in order to achieve the objectives of the study. It is as follows:

“There is no significant effect of creativity training program on concept map performance of secondary school students.”

9.7.0 Delimitations of the study

The study has its delimitation with respect to title, sample selected, experimentation process and treatment applied. Apart from this other delimitations of the study are:

1. The study is delimited to only De Bono’s CoRT Thinking Lessons strategy to develop creativity among students. There could be some other effective methods also to develop creativity.
2. As already mentioned the study has adopted concept mapping technique as evaluation tool as given by Novak. The basic components of concept mapping are proposition, example, hierarchy and cross links.
3. The experiment continued for nearly two month.
4. The sample was delimited to private schools located in an urban area.
5. Various extraneous variables might have affected the results. The variables that the investigator could not think of, or the variables which were beyond the control of the investigator, have not been included in the study.

9.8.0 Method and Procedure

The study was undertaken to find out the effects of creativity training program on concept map performance of secondary school students. The following steps were taken for the same:

1. Research Design
2. Sample
3. Tools used
4. Treatment Employed
5. Identification of variables
6. Experimental Controls used
7. Procedure of Experimental
8. Data Collection
9. Statistical Analysis

9.8.1 Research Design

In this experimental study Pre-test Post-test Control Group Design was used. The investigator used quantitative approach to compare the pre test- post test scores of two groups namely the students who were given training in creative thinking called the experimental group and the students who got no such training called the control group. These students were categorized further on intelligence as high, middle and low intelligent. All the groups thus formed were parallel with respect to sex, age, qualifications, and socio-economic status yet all these categories were different from each other, which is one of the characteristic of nesting design. The design was crossing because all the groups of the students were pre-tested as well as post tested for the dependent variables. Here the same students were pre-tested and post tested, which is one of the characteristics of crossing design. Thus, the design resembled nesting-cum-crossing (as per Lewis, 1968). The experiment resembled four way factorial (2X2X3X2) nesting-cum-crossing design.
9.8.2 Sample

The present study covered the target population of ninth and tenth grade students of two schools within the same campus from the urban area of Shahabad (Markanda), district Kurukshetra (Haryana). Each school had two sections (with 32-35 students in each section) in each grade level. There were about 128-138 students in each grade level. The students were matched on socio-economic status test and the scores proposed that majority of student-teachers belonged to the same i.e. average socio-economic status. After that the sample students were administered General Mental Ability Test prepared by Jalota. On the basis of mean and standard deviation, students were divided into two treatment groups with three parallel groups; high intelligence, middle and low intelligence randomly, making for 120 students in total in each grade level. These students were further divided into two groups randomly in such a way that there were 20 students of each intelligence level in all the categories. As the number of students relating to three different intelligence levels were same in both the groups, so the groups were homogenous with respect to intelligence. Initially the number of students was kept 120 for the fear of sample death (students who were non-serious, unable to be present throughout the experiment and could not take all the tests were labeled under sample death.); only 102 were retained in each grade. Therefore, there were 17 students in each category (17X3=51 students in each group) in each grade level.

9.8.3 Tools Used

The study employed two types of tools i.e. treatment tools and measuring tools.

I. Treatment Tools:

These were the tools used to impart creativity training to develop creative thinking in the students. The instructions varied in two ways i.e. creativity training and conventional method. For both instructional variations, tools consisted of lesson plans which were prepared according to assumptions, objectives and syntax of the instructional procedure as per given. For the training in creativity program, De Bono’s The CoRT Thinking Lessons were followed. Some of the modifications have been done for the purpose of Indian adaptation (such as in the context of syllabus, examples and practice activities).
II. Measuring Tools:

These were employed to measure change in students’ concept maps and creative thinking ability.

1. Criterion Concept Maps and Concept Map Performance Tests for IX & X class developed and standardized by investigator herself.
2. Scientific Creativity Test developed and standardized by Sucheta and Sharma (2009).
3. General Mental Ability Test developed and standardized by Jalota.
5. Semi structured Interviews and Case study developed by investigator herself

(i) Criterion Concept Maps and Concept Map Performance Tests

The concept map performance tests for both grade levels were devised to measure the concept mapping ability of the students. The test comprised of a worksheet that contains ‘focus question’ and the list of ‘concepts’ to be used by the students to answer the focus question. The test permits freedom to the students about using ‘concepts’ from the given list of ‘concepts’. The subjects were supposed to answer the focus question by using ‘concepts’ as per their understanding of the concepts. For this purpose criterion concept maps for both grade levels were also devised by investigator by following the various steps of development and standardization of criterion concept maps viz. preparation of preliminary draft, reviewing and editing, try out. The scoring of the test was entered on following four factors: proposition, hierarchy, cross-links, and example.

Reliability: The inter-rater reliability for criterion concept map for grade IX was found to be 0.92 and for grade X, it was 9.3.

Validity: For the validity purpose face validity of the concept maps of both grade levels was taken into account and was found to be sufficiently valid. For this purpose the concept maps were given to the teachers in science subject and their comments were noted down. It was observed that the teachers were satisfied with the concepts provided for answering the focus question.
(ii) Intelligence Test Scale (General Mental Ability Test):

In order to measure the intelligence of the students, General Mental Ability Test by Jalota was used. Reliability co-efficient of the test was found to be fairly high. Validity of the test was found to be .81.

(iii) Adapted Version of Kulshreshtha’s Socio-economic Status Scale

In order to record the information about socio-economic status of students, adopted version of Kulshreshtha’s Socio-Economic Status Scale (Urban Form A) designed and standardized by Sucheta and Sharma (2009) was applied. The test has reliability of 0.87 and the validity of the scale was found to be 0.89.

(iv) Test of Scientific creativity:

The investigator used the test of scientific creativity developed by Sucheta and Sharma to identify students’ scientific creativity. This test has test-retest reliability of 0.84. Inter factor correlates were computed that show fairly high validity.

(v) Scheduled Semi-structured Interview

Two students who scored highest marks in the post test and two students who scored lowest in the test along with the two students who gained highest marks in the concept map performance test were chosen for the interview. The interview consisted of 10 questions based on both: creativity training program and concept mapping technique.

To make the interview valid, the content validity was used.

The reliability or the consistency of the response was evaluated by restating a question in slightly different form at a later time in the interview. The questions of the interview were found to be sufficiently reliable and valid.

9.7.4 Treatment employed

There were two groups of students in (each of the two grades) study who were given two different types of treatment that lasted for one month. One of the groups was given training in creativity with the help of Edward de Bono’s CoRT Thinking Lessons and its exercises. This group was designated as experimental group. The second group
was designated as control group and was taught through traditional method. This group was not given creativity training.

As the objective of the study was to see the effectiveness of creativity training programme on secondary school students, the experimental group students were given training with the help of a training program. Before and after the treatment, concept map performance test and scientific creativity test were administered followed by the interviews of two top scorer and two least scorer student-teachers along with two students who gained maximum.

9.7.5 Identification of variables

In the present study three types of variables were used. These are as under:

Independent variables were manipulated to see their effect on concept mapping ability and scientific creativity of students. These included two grade levels (IX and X), Two treatment groups (experimental and control), Three level of intelligence (high, middle and low) and two testing occasions (pre-test and post-test).

Dependent variables were those which acted as criterion to test the effect of different independent variables. These were the scores on different factors of concept map performance test i.e. propositions, hierarchy, cross-links, example as well as summative scores of these called as concept mapping scores and on scientific creativity test in total.

Intervening variables were those that could not be measured directly but had their effect on the outcome of treatment. These include grade level, existing abilities, teacher behavior, sex of the students, other pupil variables (i.e. pupil’s cast, home environment etc.) school variables, physical environment of the classroom, contamination effect and study habits, socio-economic status etc. All these variables were either controlled experimentally, statistically or equalized by the ways of controlling them.

9.7.6 Experimental Control Used

Every possible attempt was made to control those factors, which could create bias. In order to control the inter-group variation in different treatment groups, the investigator herself provided treatment to all the groups. Every effort was made to maintain the
experimental conditions similar in all experimental groups. The experimental process, experiment and mode of testing were same for all the agreement groups. The students who were irregular or non-serious in any of the teaching groups were kept out of sample.

### 9.7.7 Procedure of Experimentation

The procedure of this study involved selection of students for treatment groups and experimentation. It involved stages like administration of intelligence test, administration of SES scale, then formation of the groups based on these tests and then assigning treatments to groups. The group which was assigned creativity training was called experimental group and the group which was assigned to traditional teaching method was called control group.

### 9.7.8 Data Collection

In this study, the data was collected keeping in view the objectives of the study. The data to study, the effectiveness of creativity training program was collected on two occasions. One was pre-test (before the treatment) called as occasion-I and the other after the treatment was called occasions-II. Scheduled Interview technique was used to know the process that goes on in the mind of children during creativity training program.

The experiment was conducted in three phases. In the first phase, the students were administered general mental ability test and distributed into two groups on the basis of general mental ability scores: control group and experimental group. Both of the groups were given pre test i.e. a test in concept map performance and scientific creativity test.

In the second phase, the experimental group students were given training with the help of a lesson plans on creative thinking. However, the students of control group were taught through expositional method in their class.

In the third phase, both groups were administered the post test i.e. Concept Map Performance Test and scientific creativity test. Thus the data was collected on two occasions. One was pre-test (before the treatment) called as occasion I. The other one was after the treatment called occasion II.
9.7.9 Statistical Techniques Used

1. The measures of central tendency and the measures of dispersion such as mean and standard deviations were worked out to know the nature of the data.

2. Multivariate analysis of variance was used to assess the data in order to find out the effect of different grade levels (IX & X), different groups (i.e. experimental and control), levels of intelligence (high, middle, low) and testing occasions (pre and post test) on concept mapping ability. The concept map performance test was employed and four way analysis of variance (2X2X3X2) factorial designs were used.

3. Multivariate analyses of variance were used to assess the data in order to find out the effect of different grade levels, different groups (i.e. experimental and control), levels of intelligence and testing occasions on different components of concept mapping i.e. propositions, hierarchy, cross links, examples.

4. Multivariate analysis of variance was used to assess the data in order to find out the effect of different grade levels (IX & X), different groups (i.e. experimental and control), levels of intelligence (high, middle, low) and testing occasions (pre and post test) on total scores of scientific creativity. The scientific creativity test was employed and four way analysis of variance (2X2X3X2) factorial designs were used.

5. Pearson’s product-moment correlation was calculated to find out relation between scientific creativity and concept mapping performance of the students.

6. Qualitative analysis for conceptual richness scores was carried out on gain scores.

7. Whenever F-ratio was significant, it was interpreted through means scores.

9.8 Findings

A) Findings related to effectiveness of creativity training program on concept map performance test.

Proposition

1) It was observed from the analysis that proposition factor of concept map has obtained the F-ratios highly significant for all the simple effects namely methods (F=26.69), occasions (F=975.1) except grade levels and intelligence level.
2) The testing occasions had significant interaction effect with all other simple effects and other higher order interactions. Testing occasions were very well interacting with method (F= 75.05) clearly indicated that the students of experimental group was more creative as compared to the control group when creativity training program was used. However, testing occasions have not shown any indication of interaction with class and intelligence groups.

3) From the analyses of mean scores, it was found that the students of experimental group achieved higher scores (M=8.06) than control group (M=6.5). So, it was concluded that creativity training program was effective in enhancing proposition component of concept mapping ability in experimental group.

4) Further, it was noticed that class and intelligence was not found to affect the results of proposition factor of concept map performance test. There was no significant difference between the grade IX & X and level of intelligence regarding the same.

5) The analyses further clarified that significant difference existed among the students of control and experimental group when they were pre –tested and post-tested. The experimental group achieved higher mean score (M=9.2) on the post test than their counterparts (M=6.2).

6) So, it is evident that creativity training program was helpful in increasing proposition ability of secondary school students.

Hierarchy

1) The analysis revealed that the creativity training program applied on simple effects were highly significant for different grades (F=31.83), methods of teaching (F=43.5) and testing occasions (F=188.5) but not with intelligence levels.

2) The testing occasions had significant interactional effect with all other simple effects and other higher order interactions except with intelligence levels. Testing occasions were very well interacting with grade levels (F= 4.20) and method (F= 46.0) clearly indicated that the students of experimental group of both grade levels were more creative as compared to the control group when creativity training program was used. However, testing occasions have not shown any indication of interaction with intelligence groups.
3) From the analyses of mean score it was found that the students of experimental group achieved much higher mean scores (M=7.3) on hierarchy component of concept map performance test than their counterparts in the control group (M=5.3). It indicted that hierarchy ability was much higher in the students of experimental group than control group.

4) It was also found that the different grade levels have different effect of creativity training program. Grade X was having higher mean score (M=7.3) than the grade IX (.). This means the ability to differentiate the concepts (on the basis of how important they are) was more in grade X students (M=5.5). It can be attributed to the fact that maturity level of class X students was high pertaining to their age, experience, knowledge and understanding. Therefore, these students performed better than grade IX students.

5) Also, there was significant effect of testing occasions on the hierarchy factor of concept map performance test. It was clear from the mean scores that students achieved higher (M=7.4) in their post test rather in their pre-test (M= 5.2). It meant that after experiment, students scored higher scores on concept map performance test.

6) It was found that grade X students of middle and low intelligence group achieved highest scores (M=8.5) in hierarchy. Grade X students of high intelligence group achieved second highest scores (M=7.5) in hierarchy. The middle intelligence group of grade IX achieved lowest scores (M=4.2). Moreover, the students of both grades who were taught through conventional method achieved lower in all the three intelligence groups than the students who were taught the creativity training program.

7) Concept mapping ability with regard to hierarchy has shown good impact of creativity training program over the conventional method of teaching.

Cross link

1) The analysis revealed that the creativity training program applied on simple effects for cross link factor of concept map performance were highly significant in
case of methods of teaching (F=23.08) and testing occasions (F=122.2) but not with grade levels and intelligence levels.

2) The testing occasions for cross link factor of concept map performance had significant interaction effect with all other simple effects and other higher order interactions except with intelligence levels. Testing occasions were very well interacting with grade levels (F= 18.56), intelligence levels (F= 3.51) and method of teaching (F= 106.2) clearly indicated that the students of experimental group of both grade levels belonging to different intelligence levels were more creative as compared to the control group when creativity training program was used.

3) Further, the students of experimental group achieved higher mean scores (M= 4.1) for cross link factor of concept map performance than their counterparts in control group (M= 1.7).

4) Testing occasion has also shown a significant difference in the mean scores. It means that the students of experimental group and control group, when pre-tested and post tested collectively, showed major differences for cross link factor of concept map performance in the mean scores of post test (M=4.4) and pre-test (M=1.5).

5) Grade IX students of low intelligence group achieved highest scores (M=5.8) for cross link factor of concept map performance. Grade IX students of middle intelligence group achieved second highest scores (M=4.4) in cross link. The low intelligence group who were taught through conventional method of grade IX achieved lowest scores (M=0.5).

6) Moreover, the students of both grades who were taught through conventional method achieved lower in all the three intelligence groups than the students who were taught the creativity training program. This indicated that irrespective of intelligence creativity training program was proved to be effective in enhancing cross link factor of concept mapping ability than conventional method of teaching after the experiment.
Example

1) The creativity training program applied on simple effects were highly significant for different grade levels (F=9.57), methods of teaching (F=23.76) and testing occasions (F=383.0) for example factor of concept map performance test.

2) The testing occasions had significant interactional effect with all other simple effects and double, triple and quadruple interactions for example factor of concept map performance test except with intelligence levels. The testing occasions were very well interacting with grade levels (F= 12.20) and method of teaching (F= 57.3) clearly indicated that the students of experimental group of both grade levels were more creative for example factor of concept map performance test as compared to the control group when creativity training program was used.

3) The students of experimental group achieved slightly higher mean scores (M=2.2) of example component on concept map performance test than their counterparts in the control group (M=1.4).

4) Moreover, the different grade levels have different effect of creativity training program for example factor of concept map performance test. Students of grade X was having higher mean score than the grade IX. Also, there was significant effect of testing occasions on the example factor of concept map performance test. It was clear from the mean scores that students achieved higher (M= 2.6) in their post test rather than in their pre-test (M=1.0).

5) Students of Grade X belonging to middle intelligence group achieved highest scores (M=3.0) in example. The low intelligence group who were taught through conventional method of class IX control group achieved lowest scores (M=0.7).

6) Creativity training program was proved to be effective in enhancing example factor of concept mapping ability than conventional method of teaching after the experiment.

Total Concept Map Performance or Concept Mapping Ability

1) The creativity training program applied on simple effects were highly significant for methods (F=60.8) and testing occasions (F=338.04) but not with grade levels, intelligence levels having value and respectively.
2) Testing occasions were very well interacting with grade levels \((F= 4.84)\) and method of teaching \((F= 106.38)\) clearly indicating that the students of experimental group of both grade levels were more responding to concept map performance test as compared to the control group when creativity training program was used.

3) From the analyses of mean scores, it was found that the students of experimental group achieved higher scores \((M=21.8)\) than control group \((M=15.0)\) on concept map performance test. So, it was concluded that creativity training program was effective in enhancing overall concept mapping ability.

4) The significant difference was existed among the students of control and experimental group when they were pre- and post-tested. The experimental group achieved higher mean score \((M=22.7)\) on the post test than their counterparts \((M=14.2)\).

5) Further, students of grade X belonging to middle intelligence group achieved highest scores \((M=23.7)\) in overall concept map performance test. The low intelligence group who were taught through conventional method of class IX control group achieved lowest scores \((M=12.1)\).

6) Overall mean scores of concept map performance test of experimental group were also better than control group who were taught through the conventional method of teaching. So, it is evident that creativity training program was helpful in increasing concept mapping ability of secondary school students in concept map performance test.

B) Findings related to effectiveness of creativity training program on summative scores on scientific creativity test.

1) The creativity training program applied on simple effects of scientific creativity test were highly significant for different methods of teaching \((F=29.41)\), intelligence levels \((F=17.97)\) and testing occasions \((F=1367.16)\).

2) The testing occasions were very well interacting with grade levels \((F= 33.85)\) and method of teaching \((F= 91.28)\), intelligence levels \((F= 186.94)\) clearly indicating that the students of experimental group of both grade levels of all intelligence
groups were more creative in scientific creativity test as compared to the control group when creativity training program was used.

3) The students of experimental group scored higher (M=66.3) than their counterparts (M=57.9) on scientific creativity test.

4) The students of high intelligence group achieved higher mean scores (M=67.5) on scientific creativity test. Low intelligent group achieved lowest scores in the scientific creativity test (M=56.2).

5) Testing occasion has also shown a major difference. Post test scores (M=70.6) were much higher than pre test scores (M=53.7) on scientific creativity test.

6) Students of grade IX belonging to high intelligence scored highest scores on the post test for overall scores of scientific creativity (M=70.3). Grade IX students of low intelligence achieved lowest scores (M=53.6) on the post test for overall scores of scientific creativity.

7) The experimental group achieved higher mean score (M=70.6) on the post test than their counterparts (M=53.7). So, it is evident that creativity training program was helpful in increasing scientific creativity of secondary school students.

C) Findings related to relationship between concept mapping ability and scientific creativity of secondary school students.

There was positive relationship between scientific creativity and concept mapping ability of secondary school students. This finding indicates that the students who performed better on scientific creativity test scored better in concept map performance test.

D) Findings related to effect of creativity training program on depth of understanding of concepts in secondary school students.

The students of experimental group were more attentive during concept map designing. These students were also creative while making new linkages as well as providing new meanings to the older ‘concepts’. Thus, this type of collaborative learning helped the students of experimental group to understand the deeper meaning underlying a particular ‘concept’ after creativity training program. Therefore, it can be concluded that
creativity training program enhanced the depth of understanding the concepts in secondary school students.

8.1.2 QUALITIATIVE ANALYSIS

The qualitative analysis was carried out on selected students as it was not possible to carry analysis on all the students. Therefore, two students from each category (i.e. achieving top score, achieving lowest score and top gain score after treatment) were selected. Analysis was carried out by three approaches (i.e. analysis of structural change and learning quality, use of expert terms, analysis of richness and individuality of student understanding) to study the conceptual richness score, linkage quality score, propositional score and hierarchy & structural score along with the quality of the learning i.e. deep, surface or non-learning. In addition, as the concept mapping was a new technique for students, therefore, it was of utmost importance for the investigator to know whether the low scores in concept map test were due to less practice on the part of students or creativity training program has not shown any effect on these students. For this purpose semi-structured interview had been conducted on both topics i.e. concept mapping technique and creativity training program. Interview was also scheduled to know the process that goes in the minds of children during training by creativity training program and preparing the concept maps.

A) The findings regarding the effectiveness of training program in term of analysis of structural change and learning quality in concept map performance test of secondary school students

1) It was found that creativity training program has affected the structure of concept map of students positively. Prior structure of concept map of students of the all three categories (top scorers, low scorers, and top gain scorers) was ‘spoke’ type. After creativity training program the concept map structure was ‘net’ type. A ‘net’ type structure is thought to be “a highly integrated and hierarchical network demonstrating a deep understanding of the topic” (Kinchin, Hay, and Adams 2000).
2) Analysis of learning quality revealed that the students who achieved top scores in the concept map performance post test showed surface-learning. The students who achieved low score on the post test showed non-learning quality of learning and the students who achieved highest gain score showed deep learning.

B) The findings regarding the effectiveness of training program in terms of use of expert linking terms in concept map performance of secondary school students

The students of the three categories selected for the purpose of qualitative analysis have used more than 15 expert terms in their concept maps in comparison to the expert map. There was a considerable change in the use of expert linking terms after exposure to creativity training program.

C) The findings regarding the effectiveness of training program in term of analysis of richness and individuality of understanding of secondary school students

The analysis was done on four sub-aspects (Concept richness score, Linkage quality score, propositional score and hierarchy & structural score) of richness and individuality of understanding aspect of the concept map performance test. The findings have been given in the proceeding paragraphs.

1) The students who achieved highest in concept map performance test showed a gain of +1 conceptual richness score, +7 to +9 in propositional scores, +1 to +2 in linkage quality score and no gain in hierarchy & structural score in their concept map performance test. The students who achieved low scores in their concept map performance post test showed gain of +/-1 conceptual richness score, +0 to +2 in linkage quality score, +2 to +3 propositional scores, +1 gain in hierarchy & structural score. The students who achieved highest gain score in their concept map performance test showed gain of +8 to +9 in conceptual richness aspect, +8 to +15 in linkage quality score, +5 to +10 in propositional scores, +1 to +3 gain in hierarchy & structural score.

2) The students who achieved highest in gain scores of concept map performance test have the highest conceptual richness score. The students who achieved
highest in gain scores of concept map performance test have the highest linkage and linkage quality score.

3) The students who achieved highest gain scores in the post test have a broad range in gain of propositional score.

4) The students who achieved highest score in concept map performance test post scores showed even a good gain in hierarchy score revealing the better complexity and validity of the concept map structure.

5) Moreover, the students showing deep learning quality have represented highest conceptual richness score and the students showing surface learning quality showed higher conceptual richness score in comparison to the students having non-learning quality.

Since these students have shown gain in their conceptual richness score, propositional scores, linkage quality score and hierarchy & structural score, therefore, it can be concluded from the above discussion that there was positive effect of creativity training program.

D) The findings regarding the effectiveness of training program in term of Interviews and Case-study of secondary school students

The case studies and the interview of top scoring and lowest scoring students showed that there was a perceived change in the moral and social values of students along with the effect on their creative thinking abilities after the exposure with creativity training program. Findings of the case study and interviews can be summarized as under:

1) There was a change in the creative thinking ability of all the students as they could put forward their ideas more fluently. They became more open-minded in their thinking. They began to think in multiple directions and became more active thinkers.

2) On individual level each one became confident in solving problems and open to take challenges in real life situation.

3) All the students admitted that creativity training program had helped them to think solutions to a problem in another direction rather than the one path beaten by
everyone. Concept mapping technique had helped them to know their misunderstanding about the concepts and better understanding of topic.

4) There was a considerable change with regard to social and moral values, of course. They showed a change in their viewpoint about other students after the treatment. Now they were able to accept views given by any individual in better way and put forward their ideas in decent manner. The participation in group activities increased in the subjects after the treatment.

It is concluded that treatment played an important role in developing positive attitude and generated more flexibility in them. They became more systematic in dealing with social problems, became active in discussions, cooperative and innovative in their ideas as well as in action.

9.9 Educational implications:

The findings have their implications for students, teachers, parents, administrators, teacher educators, policy makers and even the curriculum planners. The study reveals that the concept map performance of the students improved on exposure with the creativity training program. It further asserted that the creative thinking skills are trainable. The study paves a way for more of such studies that include package for the training in thinking skills.

The study can provide a very strong base for bringing a change in understanding of the future generation as well as making the educational reforms a smooth pathway. Teachers, teacher educators, curriculum planners, policy makers and administrators will also recognize the need to include such strategies in the teaching learning process so as to inculcate creative thinking skills in the children. As opposed to the traditional belief, the study focuses on the ideas that are not immediate obvious. So the study and the method have its implications for the firms and companies who always feel the dearth of new ideas.

9.10 Suggestions

The present study has its own limitations and delimitations. Therefore it is desired that similar studies may be conducted after overcoming the delimitations. However a few
suggestions regarding further research possibilities in the field have been put forward as given:

- Concept mapping technique has been a research topic for more than three decades, yet, to date, it is rarely used as a research topic in our country with creativity. Therefore, more research still needs to be done in both of these areas.
- Experimental results from the present study have demonstrated the feasibility of creativity training in enhancing students' creativity scores and performance on the concept maps. These results are interesting and highly promising for further study using different research designs which may provide us with more information and details.
- Since the present study did not address the effect of the creativity training on students' self-concept/self-efficacy, students' behavior and social skill development, and students' academic achievement achieved in a variety of curriculum areas such as reading, writing, and mathematics further studies could investigate these areas.
- Results of the present study add to a large number of experimental results on the CoRT thinking lessons which have confirmed the usefulness of using it to enhance students' thinking skills. However, the present study employed only twenty lessons from CoRT 1, 4, and 6. Therefore, an examination of the other parts or the entire programme is suggested for further study.