CHAPTER VII

SUMMARY AND IMPLICATIONS
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7.0.0 INTRODUCTION
In the previous chapter the results and discussion of the study have been presented. In this chapter the investigator intends to present the summary of all the previous chapters. The following captions namely rationale, statement of the problem, objectives, hypotheses, sample tools, design, procedure of data collection, statistical techniques used for data analysis, findings, implications and suggestions for further research are included in the chapter.

7.1.0 RATIONALE
The progress of human race depends to a large extent on the capacity to think. Throughout history, philosophers, educators and many others have been concerned with the art and Science of astute thinking. In today’s information age, Thinking Skills are viewed as crucial for educated person to cope with the rapidly changing world. According to Gough’s (1987) “Teaching children to become effective thinkers is increasingly recognized as an immediate goal of education. If students are to function successfully in a highly technical society, then they must be equipped with lifelong learning and Thinking Skills necessary to acquire and process to an ever changing world.”

The main purpose of thinking is to discover new truth and invention of a new device. A good thinker and a reasonable person decodes the most appropriate statement, develops the ability to recognize bias (prejudice), narrowness and contradictions in other’s point of view.

But the present formal system of education is lagging behind to fulfil need of the society and educationists. The lecture method still predominates as an important method of instruction at all levels. The objectives cannot be attended without having improved the classroom teaching. Many researchers are making efforts as an attempt to break the tradition by developing different types of Instructional Material, self-
learning material which can develop the potentiality of student and bring qualitative improvement in classroom teaching.

For this purpose, the research study pertaining to the development of the Thinking Skill and its sub skill, the skill of Identifying Pros/Cons (IPC) was undertaken. The co variates of the study were Intelligence, Creativity, Personality, Self Confidence, Study Habits and Tolerance of Ambiguity. The studies related with above co variates and Thinking Skill were divided into following categories.

- Research studies related to Thinking Skill.
- Research studies related to Self Confidence.
- Research studies related to Intelligence.
- Research studies related to Personality.
- Research studies related to Tolerance of Ambiguity.
- Research studies related to Creativity.
- Research studies related to Study Habits.

The researches related to all of these categories are described below separately.

7.1.1 Research studies related to Thinking Skill

Under this area the studies found were by Raths, Jonas, Rothstein and Wassermann (1967) they decried the lack of emphasis of thinking in schools and noted that “Memorization, drill, homework, the three R’s(and the) quit class room work were rewarded while inquiry, reflection and the consideration of alternatives were frowned upon” and this tendency hampers free thinking. Gallagher (1975) conducted a study to develop a Thinking Skill through different types of content based activities and stated that thinking must be practical from each content field. Lipmen (1980) considered that through thinking exercises like engaging children in constructive argument, debate, discussion and exploratory thinking, learner can exceed the predicted level of competency. Choudhary (1983) conducted an investigation into the trends of Creative Thinking of students of age 11+ to 13+ in relation to some psycho socio correlates and found no significant difference between
the mean Creative Thinking scores of male and female children of rural and urban areas. Raina and Vats (1983) studied style of learning and thinking (hemisphericity), openness to inner experience, sex and subject choice. Results indicated that in an experience as characterized by institution fantasy and imagination was positively associated with right hemisphere style of thinking. Worsham and Austin (1983) developed a program 'THINK' for high school seniors in Baltimore and made students engaged in Problem Solving activities in which they were encouraged to discuss the rational leading to higher level thinking. Vora (1984) conducted an investigation on the impact of divergent thinking program in mathematics on Creative level of the Children of classes 7th & 8th. Costa (1985) in his book 'Developing Minds' identified students' behavioral indicators that teachers can observe and record to determine whether instruction in Thinking Skill is having a beneficial effect on students' intellectual development. Dubey (1986) studied educational influence on development of Creative Thinking in children. Desai (1987) investigated Creative Thinking Ability (CTA) of higher secondary students of Gujarat state in the context of some psycho-socio factors. Patel (1987) investigated the effectiveness of the Creative Thinking program on the Creative abilities of elementary school children. Trimurthi (1987) studied Creative Thinking Ability (CAT) of secondary school students in the context of some psycho-socio factors. Amin (1988) studied the effectiveness of Creative Thinking programs on the Creativity level of school children in relationship to the program correlates. Ryar (1988) prepared and tried out the program for developing Creative Thinking ability among the students of the age group 10 to 12 controlling some psycho-socio factors. Piyavadee (1988) studied the Creative Thinking ability of students of higher secondary school of Bangkok in the context of some psycho socio factors. Dutt (1989) studied the effect of Problem Solving strategies on the Problem Solving ability in Science of high school students in relation to anxiety, Cognitive style and Intelligence. Gill (1990) studied the effect of training strategies on Identifying Pros/Cons skills and cerebral dominance in relation to Intelligence and Cognitive style. Parasnia (1990) conducted an independent study on development of problem-solving ability of students of Standard 9th. Kaur (1990) saw the effect of training strategies on Creative Thinking ability skills and cerebral
Thinking Skills to enhance the educational process in language arts. Asthana, S. (2007) studied Effectiveness of Instructional Material on Thinking Skill of IPC in terms of students’ Achievement and reactions at middle school level. The finding was that the Instructional Material was found to be significantly effective in terms of the development of Thinking Skill of Classification of students. Dhade (2008) studied the effectiveness of Instructional Material in Science based on Thinking Skill of Creative Problem Solving in terms of students’ Achievement and reactions at middle school level. The Instructional Material based on Creative Problem Solving Thinking Skill was found to be significantly effective in terms of development of Thinking Skill of Creative Problem Solving among students. Tiwari (2010) studied The Effectiveness of Instructional Material in Science based on Thinking Skill of Identifying Pros/Cons in terms of students’ Achievement and reactions at middle school level and found that the Instructional Material in Science based on Identifying Pros/Cons Thinking Skill to be significantly effective in terms of development of Thinking Skill of Identifying Pros/Cons among students. Tonke (2011) studied The Effectiveness of Instructional Material in social Science based on Identifying Propaganda Thinking Skill in terms of students’ Achievement and reaction at 9th school level. The finding was - the Achievement in Identifying Propaganda Thinking Skill was significantly effective in students treated through Identifying Propaganda Thinking Skill. Shukla (2014) conducted a study entitled Effectiveness of Instructional Material based on Problem Solving and Identifying Propaganda Thinking Skill in social Science in terms of students’ Achievement and Reaction at higher secondary level. The finding of the study was that Instructional Material was significantly effective in developing Identifying Propaganda Thinking Skill.

7.1.2 Research studies related to Self Confidence:

Thinking in relation to Self Confidence was studied by various researchers. Marsh et al. (1992), Metcalfe and Shimamura (1994), Harvey (1997), Crawford (1997), Baron (2000), Kleitman and Stankov (2001), Jonsson and Allwood...
The self confident student were found to posses more decision power, problem solving ability and to appraise and judge the quality of one's own cognitive work. It was found that high self confident students were emotionally controlled, self assured and reflect once believe in the accuracy of the decision. Sharma (1979) found the flexible and original students to be self confident. According to Agnihotri (1987), the fewer score, the higher is Self Confidence so it indicates that the mean Achievement score of low self confident student’s group. It indicated that the high Self Confidence students scored high in Achievement test than low Self Confidence students.

7.1.3 Research studies related to Intelligence:

Intelligence means having the ability to think. The term ‘Intelligence’ and ‘Thinking’ look entirely like synonyms. The level of thinking of any intelligent person can be at a higher level as compare to an average person. Some of the researches showing strong correlation between thinking and Intelligence were:


Chatterji (1983) found that out of the four academic groups, Science groups were the most intelligent and art students the least. Damale (1987) found that the general Intelligence significantly contributed in the learning and retention of the psychomotor skill. Yadav and Shrivatava(1989) found that the IQ and Creativity were found to be positive and significantly correlated.
7.1.4 Research studies related to Personality


Parwal’s (1987) reported that the disciplined students were found to be more introvert than indiscipline student, irrespective of gender, Achievement level and parental income. Dagur (1988) reported that anxiety affected both introverts and extroverts in their creative thinking. Samouel and Goodchild (1988) found a significant association between the moral development stage and Personality traits on the one hand and social factors on the other.

7.1.5 Research studies related to Tolerance of Ambiguity

The studies related to Tolerance of Ambiguity were Rani (1986) studied the intellectual and non intellectual correlates of Creative female school subjects. Positive and significant correlation was obtained between Creativity and in Tolerance of Ambiguity.Bhavalkar (1992) studied the relationship between Tolerance of Ambiguity and scientific Creativity. It was found that higher the level of Tolerance of Ambiguity, the higher was the scientific Creativity of student.

Singh (2001) explored the relationship between Tolerance of Ambiguity and verbal Creativity and its dimensions and found that The Tolerance of Ambiguity did not influence verbal Creativity and its dimensions significantly.

Lulla (2012) compared effectiveness of Co-Operative learning and Lecture method in terms of Achievement in Science of class VIII students. The findings were i. students belonging to low, moderate and high Tolerance of Ambiguity were found to have similar Achievement in Science when groups were matched with respect to Pre-Achievement in science. ii. Irrespective of level of Tolerance of Ambiguity, the Achievement in Science of students can be improved equally well by using Co-Operative Learning Strategy when the groups were matched with respect to Pre Achievement in Science.
7.1.6 Research studies related to Creativity


Afshan (1991) found that rural gifted girls in comparison to urban gifted girls were higher on Creativity. Shrivastava, Sushila and Srilatha (1992) found that the enrichment activities affected sufficient improvement in the Creativity levels of gifted students both boys and girls.

7.1.7 Research studies related to Study Habits

Study Habits affect learning significantly. The studies related to this area were by Prociuk and Breen (1974), Zimmerman and Pons (1986), Powell, Williams and Wechsler (2002), Ozsoy, Memis and Temur (2009), Mbah (2010).

Prociuk and Breen (1974) examined the relation between control focus (inner-outer), Study Habits, attitudes and academic performance. They found that there is a positive relation between them.

Ozsoy, Memis and Temur (2009) investigate the relationship between fifth grade students’ metacognition levels, and their Study Habits and attitudes. The results of the study showed that there is no significant relationship between metacognition and Study Habits and attitudes for low and medium achievers but, there is a significant relationship for high achievers.

7.1.0 Statement of the problem:
The problem is stated as follows:

Effectiveness of Instructional Material based on Thinking Skill of Identifying Pros/Cons in terms of Students’ Cognitive and Affective domain related variables at Secondary School Level.
7.3.0 OBJECTIVES:

Following objectives were formulated in this study.

17. To develop the Instructional Material in Science based on Thinking Skill of Identifying Pros and Cons.

18. To compare the adjusted mean scores of Achievement in Science of the students of Experimental and Control groups by considering Pre-Achievement in Science as covariate.

19. To compare the adjusted mean scores of Thinking Skill of Identifying Pros/Cons of students of the Experimental and Control groups by considering Pre-Thinking Skill of IPC as covariate.

20. To study the effect of Treatment, Intelligence and their Interaction on Achievement in Science of students by considering Pre-Achievement in Science as covariate.

21. To study the effect of Treatment, Personality and their Interaction on Achievement in Science of students by considering Pre-Achievement in Science as covariate.

22. To study the effect of Treatment, Creativity and their Interaction on Achievement in Science of students by considering Pre-Achievement in Science as covariate.

23. To study the effect of Treatment, Tolerance of Ambiguity and their Interaction on Achievement in Science of students by considering Pre-Achievement in Science as covariate.

24. To study the effect of Treatment, Study Habits and their Interaction on Achievement in Science of students by considering Pre-Achievement in Science as covariate.

25. To study the effect of Treatment, Self-confidence and their Interaction on Achievement in Science of students by considering Pre-Achievement in Science as covariate.
26. To study the effect of Treatment, Intelligence and their Interaction on Thinking Skill of Identifying Pros and Cons of students by considering Pre-Thinking Skill of IPC as covariate.

27. To study the effect of Treatment, Personality and their Interaction on Thinking Skill of Identifying Pros and Cons of students by considering Pre-Thinking Skill of IPC as covariate.

28. To study the effect of Treatment, Creativity and their Interaction on Thinking Skill of Identifying Pros and Cons of students by considering Pre-Thinking Skill of IPC as covariate.

29. To study the effect of Treatment, Tolerance of Ambiguity and their Interaction on Thinking Skill of Identifying Pros and Cons of students by considering Pre-Thinking Skill of IPC as covariate.

30. To study the effect of Treatment, Study Habits and their Interaction on Thinking Skill of Identifying Pros and Cons of students by considering Pre-Thinking Skill of IPC as covariate.

31. To study the effect of Treatment, Self-confidence and their Interaction on Thinking Skill of Identifying Pros and Cons of students by considering Pre-Thinking Skill of IPC as covariate.

32. To find out the effectiveness of Instructional Material in terms of reactions of students of the experimental group.

7.4.0 HYPOTHESES

The following hypotheses were formulated in the present study.

15. There will be no significant difference in the adjusted mean scores of Achievement in Science of students of the Experimental and Control groups by considering Pre- Achievement in Science as covariate.

16. There will be no significant difference in the adjusted mean scores of Thinking Skill of Identifying Pros/Cons of students of the Experimental and Control groups by considering Pre- Thinking Skill of IPC as covariate.
17. There will be no significant effect of Treatment, Intelligence and their Interaction on Achievement in Science of students by considering Pre-Achievement in Science as covariate.

18. There will be no significant effect of Treatment, Personality and their Interaction on Achievement in Science of students by considering Pre-Achievement in Science as covariate.

19. There will be no significant effect of Treatment, Creativity and their Interaction on Achievement in Science of students by considering Pre-Achievement in Science as covariate.

20. There will be no significant effect of Treatment, Tolerance of Ambiguity and their Interaction on Achievement in Science of students by considering Pre-Achievement in Science as covariate.

21. There will be no significant effect of Treatment, Study habits and their Interaction on Achievement in Science of students by considering Pre-Achievement in Science as covariate.

22. There will be no significant effect of Treatment, Self-confidence and their Interaction on Achievement in Science of students by considering Pre-Achievement in Science as covariate.

23. There will be no significant effect of Treatment, Intelligence and their Interaction on Thinking Skill of Identifying Pros and Cons of students by considering Pre-Thinking Skill of IPC as covariate.

24. There will be no significant effect of Treatment, Personality and their Interaction on Thinking Skill of Identifying Pros and Cons of students by considering Pre-Thinking Skill of IPC as covariate.

25. There will be no significant effect of Treatment, Creativity and their Interaction on Thinking Skill of Identifying Pros and Cons of students by considering Pre-Thinking Skill of IPC as covariate.

26. There will be no significant effect of Treatment, Tolerance of Ambiguity and their Interaction on Thinking Skill of Identifying Pros and Cons of students by considering Pre-Thinking Skill of IPC as covariate.
27. There will be no significant effect of Treatment, Study Habits and their Interaction on Thinking Skill of Identifying Pros and Cons of students by considering Pre- Thinking Skill of IPC as covariate.

28. There will be no significant effect of Treatment, Self-confidence and their Interaction on Thinking Skill of Identifying Pros and Cons of students by considering Pre- Thinking Skill of IPC as covariate.

7.5.0 SAMPLE

The present study was experimental in nature and conducted in two stages. At the first stage, Self Instructional Material and tools were developed. These tools were Achievement Test, Thinking Skill of Identifying Pros/Cons test and Reaction Scale. For developing these tools types of sample were used. At the second stage, experiment was conducted on another sample, but the sample used at the two stages belonged to the same population. Details in respect of samples used at two stages are given below separately.

7.5.1 First stage sample

At the first stage various tools were developed. The very first tool was for measuring Achievement. The Achievement of the students was assessed with the help of Achievement Test developed by the investigator. The test comprised of questions from different topics of Science subject such as agriculture, health, diseases, air pollution, water pollution, motion, green house effect, types of diseases, etc. For developing the IPC Thinking Skill test different topics of Science along with different steps of IPC were included to design the test and all the steps for standardization were followed to standardize the Thinking Skill of Identifying Pros/Cons Test. The students' reaction towards Instructional Material was assessed with the help of Reaction scale developed by the investigator. This scale comprised of 20 statements. The statements were related to various aspects of Instructional Material. Each statement was to be rated on a five point scale. For the development of Thinking Skill of Identifying Pros/Cons Test two types of sample were used.
Sample A- Researcher developed Thinking Skill of Identifying Pros/Cons Test for its standardization sample were used in 2 parts in part A 10 students of Green Field Public School were taken.

Sample B- For the second part of standardization 100 students were taken. Some were from Christian Eminent Public School, while some were from New Father Angel Higher Secondary School.

### 7.5.2 Second stage sample

At second stage, the experiment was conducted. For the purpose of experimentation, two sections of class 9th from the total four sections of New Father Angel Higher Secondary School, situated in Indore were selected randomly. All together there were 82 students belonging to these two sections (section A and section B). Out of these two sections, one section was selected as the Experimental Group randomly. Thinking Skill of Identifying Pros/Cons was taught to section A, along with other Science content. The treatment lasted for five months. It was M.P. Board School. The school was situated in urban area, so the sample represented urban population only. Majority of the students belonged to average and high socio economic status. All the children’s parents were not so highly educated, but they were able to help their children in academic matters. Mostly in urban areas the academic climate is very congenial.

### 7.6.0 Experimental Design

The present study was experimental in nature. The design used for this study was Non Equivalent Control Group Design. The layout of design as given by Campbell and Stanley (1963) is given as below

\[
\begin{array}{c c c}
O_1 & X & O_2 \\
\hline
\end{array}\
\]

Experimental Group

\[
\begin{array}{c c}
O_1 & O_2 \\
\end{array}\
\]

Control Group
Where

\[ O_1 = \text{Pre-test} \]
\[ X = \text{Treatment} \]
\[ O_2 = \text{Post-test} \]

As mentioned under the sample, from the selected school, two sections were selected randomly. The group receiving the treatment was called experimental group while the other was called the control group. Before beginning the experiment the Achievement Test and the Test for Thinking Skill of Identifying Pros and Cons developed by the investigator were administered on the students of both the experimental and control group. These constituted the Pre-Achievement and Pre-Thinking Skill of IPC scores. The experimental group was taught with the help of Instructional Material while the control group was taught by traditional method. The treatment was given for one period regularly for five months. At the end of the treatment, the same Achievement Test and Test of Thinking Skill of Identifying Pros and Cons were administered separately on both the groups. During the treatment period Intelligence, Personality, Tolerance of Ambiguity, Study Habits and Creativity were assessed with the help of appropriate standardized tools. At the end of the experiment the students of experimental group were also administered a reaction scale to find out their reactions towards the Instructional Material developed by the investigator.

Table 7.1: Schematic Representation of the Experiment

<table>
<thead>
<tr>
<th>Activity</th>
<th>Experimental Group</th>
<th>Control Group</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Formation</td>
<td>I. Sections were selected randomly but not the subject within each group.</td>
<td></td>
<td>45 min</td>
</tr>
<tr>
<td></td>
<td>II. Random assignment of treatment to section.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Pre testing of dependent variables

| I. Administration of Achievement Test. | 90 min |
| II. Administration of Thinking Skill of Identifying Pros and Cons Test. | 90 min |

### Testing of Covariates

| I. Intelligence | 40 min |
| II. Creativity | 35 min |
| III. Self Confidence | 20 min |
| IV. Study Habits | 15-20 min |
| V. Personality | 15-20 min |
| VI. Tolerance of Ambiguity | 30 min |

### Treatment

| Content was taught through Instructional Material based on Thinking Skill of Identifying Pros and Cons at all working days. | Content was taught through lecture method at all working days. | 45 min (as per day) |

### Post testing of dependent variables

| I. Administration of Achievement Test. | 90 min |
| II. Administration of Thinking Skill of Identifying Pros and Cons Test. | 90 min |
| III. Administration of Reaction Scale to find out reactions of students towards Instructional Material (Experimental Group). | 30 min |

### 7.7.0 TOOLS

The details of the tools used for measuring different co-variates in the present study are given in table 3.5.
Table 7.2: Description of the Tools

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Tool</th>
<th>Developed By</th>
<th>Status</th>
<th>Reliability</th>
<th>Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Achievement Test</td>
<td>Researcher</td>
<td>Self Developed</td>
<td>Not Established</td>
<td>Not Established</td>
</tr>
<tr>
<td>2</td>
<td>Thinking Skill of IPC Test</td>
<td>Researcher</td>
<td>Self Developed</td>
<td>0.90</td>
<td>Content and Face Validity</td>
</tr>
<tr>
<td>3</td>
<td>Verbal Intelligence Test</td>
<td>R. K. Ojha and K. Ray Chowdhary (1971)</td>
<td>Standardised</td>
<td>0.91</td>
<td>0.574</td>
</tr>
<tr>
<td>4</td>
<td>Creativity Test</td>
<td>BaqarMehndi (1973)</td>
<td>Standardised</td>
<td>0.946</td>
<td>0.385</td>
</tr>
<tr>
<td>5</td>
<td>Maudsley’s Personality Inventory</td>
<td>H.J. Eysenck (1972)</td>
<td>Standardised</td>
<td>0.567</td>
<td>Not Available</td>
</tr>
<tr>
<td>6</td>
<td>Self-confidence Inventory</td>
<td>Dr.RekhaAgnihotri (1987)</td>
<td>Standardised</td>
<td>0.95</td>
<td>0.82</td>
</tr>
</tbody>
</table>
In the present study, the data were collected in respect of Intelligence, Personality, Creativity, Tolerance of Ambiguity and Study Habits by administering the standardized tools. While the Achievement in Science, Development of Thinking Skill of Identifying Pros and Cons and Reactions towards Instructional Material were assessed by tools developed by the investigator. The details are given in the following captions.

### 7.7.1 Achievement Test:

The Achievement of the students was assessed with the help of Achievement Test developed by the researcher. Instructions were given in the test. The test comprised of 11 questions including Multiple choices, Fill in the blanks, Match the column, One word substitution, Mark the odd one, True or False and Short answer type of questions. The time limit for answering the questions was 90 minutes and the total marks for the test were 50.
7.7.2 Reaction Scale

A reaction scale was developed by the researcher which consisted of 20 statements. These statements were to be rated on a 5-point rating scale. The description of the rating scale was as follows -

a. To a very great extent - 5
b. To a great extent - 4
c. To an average extent - 3
d. To a little extent - 2
e. To a very little extent - 1

Out of these statements some were positive and some were negative. Instructions were given in the reaction scale. The scoring was done by scoring 5, 4, 3, 2, 1 for positive items and reversed as 1, 2, 3, 4, 5 for negative items. Thus the reactions of the students towards the Instructional Material were obtained.

7.7.3 Thinking Skill test for Identifying Pros/Cons:

The researcher had developed the Thinking Skill of Identifying Pros/Cons test. The test consisted of questions based on Science. In most of the questions the eight stages of Identifying Pros/Cons were incorporated namely:

- Identification of the statement/concept.
- Listing the statements showing strengths and opportunities of the concept.
- Listing the statements showing weaknesses and threats of the concept.
- Selecting the more applicable sentences for the statement/concept.
- Selecting the more harmful statements for the statement/concept.
- Finding arguments for the selected sentences in favour of the concept.
- Finding arguments for the selected sentences against the given concept.
- Drawing the boundaries by specifying for the judgment.

Instructions were given in the test. The test comprised of 10 questions including Multiple choices, Arrange in ascending order on the basis of Thinking process, One word, True or False, Analyse and Short answer type of questions. The time limit for answering the questions was 90 minutes and the total marks for the test were 50.
7.7.4 Tolerance of Ambiguity

The Tolerance of Ambiguity of students was assessed with the help of Tolerance of Ambiguity test developed by Dr. Smita Bhavalkar for the children of 13-15 years age group. The test comprised of 15 items having situations pertaining to day-to-day experiences, each followed by three alternatives. These three alternatives indicated the three levels of Tolerance of Ambiguity. The subjects were supposed to mark only one alternative which they found most suitable for themselves. The maximum score credit is 45 for this test. A score of 1-15 indicates low level of Tolerance of Ambiguity, that of 16-30 indicates moderate Tolerance of Ambiguity level and that of 31-45 indicates the high Tolerance of Ambiguity level. There is no time limit but usually an average time of 30-35 minutes is required for completing the task. The split half reliability coefficient was found to be 0.50. The content validity and face validity of the tool were also established.

7.7.5 Self Confidence Inventory

Self Confidence was measured by Self Confidence Inventory developed by Dr. Rekha Agnihotri in the year 1981. It consisted of 56 items. Each item has correct and incorrect response but there are no any right or wrong answers for the items. All items are right or wrong according to individual choices. A score of one is allotted for a response indicating lack of Self Confidence that is for making cross (x) to incorrect response to item numbers 2,7,23,31,40,41,43,44,45,53,54,55, and for making cross (x) to correct response to the rest of the items. Lower the score, higher the level of Self Confidence and vice versa. Its reliability ranged from 0.78 to 0.91 and validity was 0.82.

7.7.6 Creativity Test

Baqer Mehndi test of Creativity was used for Creativity assessment. In this test 3 sections were there for different activities. In activity I two figures are given. Subjects
were supposed to draw anything according to their Creativity with these figures. In activity I, 10 different small, incomplete figures were given. In activity III, some triangles and rounds were given. Subject can draw as many figures from them as they wanted according to their ideas. There is time limit of 15, 10, and 15 minutes for these activities respectively. Subjects were also required to give title for each figure. The scoring was for both the title and the figure. Marks were assigned according to instructions given in the manual. Low Creative and high Creative students can be categorized by it.

7.7.7 Personality Inventory

Personality of the students was assessed with the help of Maudsley’s Personality Inventory (MPI), originally developed by Eysenck and later adapted by Jalota and Kapoor for Indian population in Hindi and Punjabi language. The MPI was designed for assessing neuroticism, stability and introversion extroversion dimensions of the Personality. This inventory can be used for a group or an individual for both adolescents and adults. There was no time limit but the subjects usually took 30 minutes to respond. The inventory consisted of 48 items. Against each item, three choices were given, namely “Yes”, “?” and “NO”. The student had to read the statement and select any one choice. The scoring was done as per the instructions given in the manual.

7.7.8 Intelligence Test

For measuring Intelligence of the students, Verbal Intelligence Test developed by R. K. Ojha and K. Ray Chowdhary (1970) was used. This is an objective Intelligence test which had 8 parts namely classification, analogies, synonyms, number test, completion test, paragraph test, best reason and simple reasons. Each part has different number of items. The total numbers of items are 112. The maximum score is 112. Forty minutes were given to complete this test. The reliability of this test was established by split half method and Kudar Richardson Formula. These different parts have reliability 0.87, 0.81, 0.86, 0.71, 0.74, 0.64, 0.58, 0.79 and 0.75 respectively by Split half method while 0.91, 0.89, 0.88, 0.73, 0.88, 0.68, 0.79, 0.81 and 0.83
reliability respectively by KudarRicharson Formula. The validity of this test was established by calculating correlation between the eight parts of this test.

7.7.9 Study Habits

For the assessment of Study Habits of students Study Habits Inventory developed by Dr. M. Mukhopadhyaya and Dr. D. N. Sanasnwal (1983) was used. This inventory consisted of 9 different kinds of study behavior. These were comprehension, concentration, task orientation, sets, interaction, drilling, supports, recording and language. The test contained both positive and negative items. Total numbers of items were 52. The scoring procedure was 4, 3, 2, 1, and 0 for positive items while 0, 1, 2, 3, 4 for negative items. The reliability of the whole inventory was worked out by using Split Half Method. The reliability coefficient was 0.91.

7.8.0 Procedure of data collection:

In order to collect data for the study permission from 5-6 selected schools was taken. The students taken up for this experiment were informed about the objectives of the experiment with a purpose to establish rapport with them. This was followed by administration of the Achievement Test and Thinking Skill Test on both the groups. Then, one of the group was randomly selected as experimental group while the other group was considered as control group. Then the experimental group was taught using Instructional Material for a period for five months. The control group was taught by traditional method. After the treatment a post Achievement Test and post test of Thinking Skill of Identifying Pros and Cons test were administered to both the groups.

During the treatment, the Intelligence of students was assessed with the help of Verbal Intelligence Test of Ojha and Ray choudhary (1970), Personality (introversion-extroversion) was assessed by Maudsley Personality Inventory (MPI), developed by Eysenck (1972), Creativity was assessed with the help of BaqarMehndi test of Creativity, Tolerance of Ambiguity was assessed with the help of Tolerance of Ambiguity Test developed by Dr. SmitaBhavalkar (1992) and Study Habits were assessed with the help of Study Habits Inventory developed by Dr. M. Mukhopadhyaya and Dr. D. N. Sanasnwal (1983). Self-Confidence was assessed with...
the help of Agnihotri's Self-Confidence Inventory (ASCI, 1985). At the end of the experiment the students of experimental group were also administered a reaction scale to find out their reaction towards the Instructional Material developed by the investigator.

7.9.0 Analysis of data:

Objective wise statistical analysis is given below.

16. To compare the adjusted mean scores of Achievement in Science of the student of experimental and control group by considering Pre- Achievement in Science as covariate, the data were analyzed with the help of one way ANCOVA.

17. To compare the adjusted mean scores of Thinking Skill of Identifying Pros/Cons of the student of experimental and control group by considering Pre- Thinking Skill of IPC as covariate, the data were analyzed with the help of one way ANCOVA.

18. To study the effect of treatment, Intelligence and their interaction on Achievement in Science of students by considering Pre- Achievement in Science as covariate, the data were analyzed with the help of 2x2 factorial design ANCOVA.

19. To study the effect of treatment, Personality and their interaction on Achievement in Science of students by considering Pre- Achievement in Science as covariate, the data were analyzed with the help of 2x2 factorial design ANCOVA.

20. To study the effect of treatment, Creativity and their interaction on Achievement in Science of students by considering Pre- Achievement in Science as covariate, the data were analyzed with the help of 2x2 factorial design ANCOVA.

21. To study the effect of treatment, Tolerance of Ambiguity and their interaction on Achievement in Science of students by considering Pre-
Achievement in Science as covariate, the data were analyzed with the help of 2x3 factorial design ANCOVA.

22. To study the effect of treatment, Study Habits and their interaction on Achievement in Science of students by considering Pre-Achievement in Science as covariate, the data were analyzed with the help of 2x3 factorial design ANCOVA.

23. To study the effect of treatment, Self-Confidence and their interaction on Achievement in Science of students by considering Pre-Achievement in Science as covariate, the data were analyzed with the help of 2x3 factorial design ANCOVA.

24. To study the effect of treatment, Intelligence and their interaction on development of Thinking Skill of Identifying Pros and Cons of students by considering Pre-Thinking Skill of IPC as covariate, the data were analyzed with the help of 2x2 factorial design ANCOVA.

25. To study the effect of treatment, Personality and their interaction on development of Thinking Skill of Identifying Pros and Cons of students by considering Pre-Thinking Skill of IPC as covariate, the data were analyzed with the help of 2x2 factorial design ANCOVA.

26. To study the effect of treatment, Creativity and their interaction on development of Thinking Skill of Identifying Pros and Cons of students by considering Pre-Thinking Skill of IPC as covariate, the data were analyzed with the help of 2x2 factorial design ANCOVA.

27. To study the effect of treatment, Tolerance of Ambiguity and their interaction on development of Thinking Skill of Identifying Pros and Cons of students by considering Pre-Thinking Skill of IPC as covariate, the data were analyzed with the help of 2x3 factorial design ANCOVA.

28. To study the effect of treatment, Study Habits and their interaction on development of Thinking Skill of Identifying Pros and Cons of students by considering Pre-Thinking Skill of IPC as covariate, the data were analyzed with the help of 2x3 factorial design ANCOVA.
29. To study the effect of treatment, Self-Confidence and their interaction on development of Thinking Skill of Identifying Pros and Cons of students by considering Pre-Thinking Skill of IPC as covariate, the data were analyzed with the help of 2x3 factorial design ANCOVA.

30. To find out the effectiveness of Instructional Material in terms of reactions of students, for this objective the data were analyzed with the help of Mean, SD and by employing percentage.

7.10.0 FINDINGS OF THE STUDY

Objective wise findings of the study are as follows.

2. Instructional Material was found to be effective in terms of Achievement in Science of students when Pre – Achievement in Science was taken as covariate.

3. Instructional Material was found to be effective in terms of Thinking Skill of IPC of students when Pre – Thinking Skill of IPC was taken as covariate.

4.2 Above Average and Below Average Intelligence students were found to possess Achievement in Science to the same level when Pre-Achievement in Science was taken as covariate.

43. There was no significant influence of interaction between Treatment and Intelligence on Achievement in Science when Pre-Achievement in Science was taken as covariate.

5.2 Extrovert and Introvert Personality students were found to possess Achievement in Science to the same level when Pre-Achievement in Science was taken as covariate.

5.3 There was no significant influence of interaction between Treatment and Personality on Achievement in Science of students when Pre-Achievement in Science was taken as covariate.

6.2 High and Low Creative students were found to possess Achievement in Science to the same level when Pre-Achievement in Science was taken as covariate.
6.3 There was no significant influence of interaction between Treatment and Creativity on Achievement in Science of students when Pre-Achievement in Science was taken as covariate.

7.2 Achievement in Science of students was found to be independent of level of Tolerance of Ambiguity of students when Pre-Achievement in Science was taken as covariate.

7.3 Achievement in Science of students was found to be independent of the interaction between Treatment and Tolerance of Ambiguity when Pre-Achievement in Science was taken as covariate.

8.2 Achievement in Science of students was found to be independent of levels of Study Habits of students when Pre-Achievement in Science was taken as covariate.

8.3 Achievement in Science of students was found to be independent of the interaction between Treatment and Study Habits when Pre-Achievement in Science was taken as covariate.

9.2 Low and High Self Confidence students were found to possess Achievement in Science to the same level when Pre-Achievement in Science was taken as covariate.

9.3 There was no significant influence of interaction between Treatment and Self Confidence on Achievement in Science of students when Pre-Achievement in Science was taken as covariate.

10.2 Above Average and Below Average Intelligent students were found to possess IPC Thinking Skill to the same level when Pre-Thinking Skill of IPC was taken as covariate.

10.3 There was no significant influence of interaction between Treatment and Intelligence on IPC Thinking Skill when Pre-Thinking Skill of IPC was taken as covariate.

11.2 Extrovert and Introvert Personality students were found to possess IPC Thinking Skill to the same level when Pre-Thinking Skill of IPC was taken as covariate.
11.3 There was no significant influence of interaction between Treatment and Personality on IPC Thinking Skill when Pre-Thinking Skill of IPC was taken as covariate.

12.2 High and Low Creative students were found to possess Thinking Skill to the same level when Pre-Thinking Skill of IPC was taken as covariate.

12.3 There was no significant influence of interaction between Treatment and Creativity on IPC Thinking Skill when Pre-Thinking Skill of IPC was taken as covariate.

13.2 IPC Thinking Skill was found to be independent of level of Tolerance of Ambiguity of students when Pre-Thinking Skill of IPC was taken as covariate.

13.3 IPC Thinking Skill was found to be independent of the interaction between Treatment and Tolerance of Ambiguity when Pre-Thinking Skill of IPC was taken as covariate.

14.2 IPC Thinking Skill was found to be independent of level of Study Habits of students when Pre-Thinking Skill of IPC was taken as covariate.

14.3 IPC Thinking Skill was found to be independent of the interaction between Treatment and Study Habits when Pre-Thinking Skill of IPC was taken as covariate.

15.2 Low and High Self Confidence students were found to possess IPC Thinking Skill to the same level when Pre-Thinking Skill of IPC was taken as covariate.

15.3 There was no significant influence of interaction between Treatment and Self Confidence on IPC Thinking Skill when Pre-Thinking Skill of IPC was taken as covariate.

16 The reactions of the students towards the Instructional Material were found to be favorable.
7.11.0 IMPLICATIONS

This study revealed that Thinking Skill of IPC can be developed through deliberately designed Instructional Material and systematic procedure. This finding has implications for teachers, teacher educators, students, parents, curriculum constructors, administrators, text-book writers and society. They are discussed below one by one.

7.11.1 Teachers

The status of the teacher reflects the socio-cultural ethos of society. The quality of all education is associated with the quality of teacher and most important aspect of teaching-learning process. Generally it is observed that our educational system is built in such a way that it is putting more emphasis on the development of abilities related to lower level thinking and rest of the levels are either totally neglected or their application is very limited. The reasons behind this may be the use of traditional method, which discourages students to think in innovative and divergent way. Secondly, teachers lay more emphasis in providing information rather to teach students as to how to apply it. Students also try to memorize the facts without understanding it. Thirdly, faulty designed curriculum also does not provide any scope for the development of abilities related to higher level thinking.

Teacher education courses don’t include methods of enhancing IPC skills. Perhaps the reason for this is
a) Teachers don’t know enough about it.
b) Teachers are not sufficiently aware of knowledge which could make teaching of it more effective.

To overcome such difficulties the Instructional Material are the ideal programs. In the schools the time table is always over crowded but some provision should be kept for teaching through Instructional Material. If not all, at least some subjects can be taught through Instructional Material. When teacher wants something to be learned and understood by the students they should design Instructional Material for that purpose.
 Instructional Material can provide a designed experience that can result in predictable change in the learner's Thinking Skill. Workshops should be organized for teachers and training should be provided to them for the development of Instructional Material.

Although it has been observed that majority of teachers working in different schools are trained. Some of them might have got their training long back. Due to the advancement of knowledge many new methods, innovative ideas, advance instrument to impart education have cropped up in the field of education. In order to keep teachers updated, well informed with new and advance knowledge, several orientation programs in the form of workshops, seminars and summer courses are being organized. In the present study Instructional Material designed to develop Thinking Skill of IPC was found to be significantly superior to traditional method in the development of Thinking Skill of IPC. Teachers teaching in schools can make use of this Instructional Material for developing this skill. They can also develop similar types of exercises for teaching other subjects. As well as while setting question papers the teachers can use the language used in Instructional Material for easy understanding of students which will promote higher Achievement. The Instructional Material available in the form of module may be used for this purpose.

Further, while the teachers are being exposed to the developed Instructional Material, there is a need to make them aware that while developing Instructional Material the given content in the syllabus should be critically analyzed and sequenced. Care should be taken to accomplish the goal and to fulfill the needs of learner.

7.11.2 Teacher Educators

Teachers are the ideals in front of the students. They learn ways to face problems in their life by their teacher. If teacher teaches student to think critically about each concept then students will be able to choose right path in a confusing situation. So the Thinking Skill of IPC should be inculcated among students through Teacher Education Programs. Teacher education is a vital issue that needs immediate attention for the betterment of our education system. This paves the way for a more Creative kind of education which is possible only through Creative teacher, who can
solve their own problems by IPC. This revolution should start at the teacher education level.

The Education Commission (1964-66) stated that "Destiny of our nation is being shaped in the classrooms." It means all round development of students to a great extent remains in the hands of teachers. Teachers accept these challenges through promoting innovative practice in teaching-learning and making it powerful throughout the education system. The progress of an individual, society and nation depends on its education system and progress of education remains in the hands of teachers, who by applying innovative ideas, linking new information with existing knowledge, assisting in dissemination of knowledge and by providing systematic guidelines makes the class lively and interesting.

Due to the advancement of technology and explosion of knowledge, better connectivity with media, students are getting more curious for thirst of knowledge. They are trying to keep themselves updated with new knowledge. They are not satisfied with the type of development taking place in the classroom. These days most of the schools appoint trained teachers but also teachers are being trained through pre service as well as in service program.

During the process of teacher-training, teacher educators play an important role. They are considered as the founder of the teaching system. So teacher educators are supposed to be oriented for the innovation in new techniques, methods of teaching as well as training. The teacher-educators should also know how to design and develop different varieties of Instructional Material, games, and exercises to give training to teacher and also can give practice to student-teachers in the development of questions which can measure higher Cognitive abilities like application, analysis, synthesis and evaluation.

In the present study treatment through Instructional Material, for developing Thinking Skill of IPC of class IX students, was found to develop significantly IPC skill of the students and also helped in the enhancement of Achievement of students. It clearly reflects that teacher educator should train the teacher in developing Instructional Material on Thinking Skills by integrating many other types of exercises in a meaningful way so that understanding about the subject can be increased.
Not only the pre-service but whenever in-service training is organized, the teachers should be trained to develop Instructional Material on Thinking Skills to make teaching more interesting, interactive and fruitful. Before training the teachers as to how to use and develop Instructional Material, the teacher educators should get trained themselves. The lesson plans given in the thesis can be used for this purpose. In this way, the present study has the implication for the teacher educators.

7.11.3 Students

Students are the central point of all the education system. All the activities like curriculum design, co-curricular activities, teacher trainings etc are there for the all round development of the students. Students are considered as the future of the Nation. The scenario of the society is getting changed day by day and so is our educational system and the types of institution, because the main aim of education is to fulfill the requirements of society. Due to the advancement of means of communication, influence of media and availability of study material, there is explosion of knowledge in every field. It becomes impossible for teachers to keep themselves updated with all types of knowledge and information necessary for the growth and development and to develop all the domains. If teachers fail to provide necessary information, students start losing interest in class. They become only a passive listener. It curbs the development of their active mental activities. But these days students have become so aware that they don't rely only on educational institutions for keeping themselves well informed. They have started feeling self-responsible for their progress. Students cannot remain untouched with the change, they experience in day to day life, which directly or indirectly put effect on their success or failure. Students have to come forward to shoulder their own responsibility. If they are not watchful and careful for their own activities no one can come forward to help them out in this fast changing society and world. So, there is a dire need to develop self-study habits, self-awareness, self-actualization, self-thoughtfulness, critical, creative and analytical vision in the students.
The kind of Thinking Skill our children need today and in the future are those which can keep them adapt to a world of accelerating change. They need to learn how to think rather than to learn the products of others people thinking. Children need to develop the skill of IPC as they are supposed to take many decisions in their life related to their education and vocation. If they learn to look properly on positive as well as negative aspects of each concept then they will be able to take correct decision. If the students learn to deal with the problems in this way, they can successfully transfer this skill to any area of thinking including other subjects and real life situations. This will prove beneficial to students for understanding the changing and diversified information. In the present study it was found that through the use of Instructional Material, all the concepts related to the IPC skill were found to be significantly developed in class IX students which also helped in the enhancement of achievement of students.

In the findings of the present study, the students were also found favorably inclined towards the Instructional Material. Therefore the lesson plans and exercises developed in the present study may be used by students to attain the clear concept. The students can get firsthand experience by studying the lesson plans and other related exercises. In this way the Instructional Material developed by the investigator may be made available to students for studying Science.

7.11.4 Implications for Parents

To nourish any ability or attitude within individual, a conductive environment at home is also necessary. An orientation of parents towards the Instructional Material on Thinking Skill of IPC can serve this purpose. This helps the students in practicing the Instructional Material at home especially in finding a solution to a conflicting situation. This may also prove useful in improving parent child relationship. For this parents must provide a conductive atmosphere at home.
7.11.5 Administrators

In educational institutions a good administrator is the key to the success of any work. It is a well known fact that a few are born teachers and majority of teachers are trained by Teachers Training Colleges to gain mastery over the different aspects of teaching skills, methods and strategies. For this purpose proper, systematic and well informative training sessions should be arranged by the administrator for teachers working under them so that they may be trained in new methods and strategies. The Instructional Material mainly designed by the investigator to develop Thinking Skill of IPC of the students by taking Science may be used during training. In the present study the treatment through Instructional Material for developing Thinking Skill of IPC proved significantly superior to traditional method. So the Instructional Material which contains different types of exercises, picture composition, and information transfer, modular can be used by teacher for facilitating Thinking Skill of IPC of the students.

Along with arranging workshops and programs the administrator should try to provide books, study material which may be utilized by teachers to develop their own Instructional Material on Thinking Skills taking the help from present available Instructional Material in the study. The success of any institution solely depends on its administration and this responsibility of getting success totally remains in the hands of the administrator. Only the administrators may look after needs and fulfill the requirements related to academics and for the betterment of students and teacher.

7.11.6 Implications for Curriculum Constructors

Many educationists have observed that the focus of education is on the information transfer. De Bono (1976) observed “Invariably the list of objectives of education is led by teaching pupils to think for them. It seems obvious that this must be the underlying aim of education and that all else stems from this. Unfortunately the universality to this aim is not matched by any practical attempt to teach thinking as a skill”
None of the education courses at any institution at present offers instruction in Thinking Skills or methods for enhancing IPC ability which plays a vital role in students' life. It helps them to solve educational problems as well as the problem they face in their day to day life. IPC ability should be included in the curriculum as an essential part of different subjects.

7.11.7 Text Book Writers

The Kothari Commission (1964-66) states "A good text book written by a qualified and competent specialist in the subject and produced with due regard to quality of printing, illustrations and general get up, stimulates the pupil's interest and helps the teacher considerably in his work". Different authors write different books for students of different mental levels taking various subjects. The format of these books remains more or less stereo type because it was observed that most of the writers try to stick to the same old pattern. When students follow these books, sometimes they fail to comprehend the subject matter presented in these books and thus miss the opportunity of applying the knowledge in the given situation.

In the present study the Instructional Material was found to be significantly effective in terms of the development of Thinking Skill of IPC. So, various phases of Instructional Material may be easily incorporated in the books by the writers. The text book writers should he trained as how to develop different types of Instructional Material by using various techniques and procedures. Text-book writers can make students to think before proceeding further. They should try to incorporate challenging questions, argumentation for certain issues, exercises which can provoke thinking on the part of learner, so that the reader may be easily influenced and significant changes may be observed in readers' way of thinking and personality.

The Instructional Material developed by the investigator in the present study may be utilized by different textbook writers. They can make it more activity based and interesting by taking some points and guidelines from the developed Instructional Material mainly to develop Thinking Skill of IPC. The writers should present the content in such a manner that can activate students' mental process to higher level.
thinking. Thus, the findings of the present study have major implications for text-book writers.

7.11.8 Implications for society

Acc. to De Bono (1981) “It was Einstein himself who said that everything had changed except our way of thinking.” In a complex society as ours which is no longer stable offers more opportunities, freedom and more pressures, where people have to do more thinking and make decisions than ever before. In this complex society we need more IPC oriented persons, problem solvers, talented people etc. focusing on those issues which stand between ourselves and the lives we-want.

From the above discussion it is evident that introducing Thinking Skill of IPC is essential to everyone irrespective of the field, profession, gender, religion, social status, one participates in and the one adapts in various situations.

7.12.0 SUGGESTIONS FOR FURTHER RESEARCH

Similar to other studies, the present study also had its limitations. Studies may be conducted for the overcoming of the limitations. The experimental studies like the present one need to be repeated in different cultures, so as to arrive at broad generalization. Below are given some suggestions for researchers, who want to work in this area. The studies can be designed taking other aspects as mentioned below:

1. Thinking Skill of IPC may be used in combination with other skills of thinking like Sequencing, Problem Solving, Classification, Sequencing, Translating etc. Thus, the proper and appropriate sequence of different Thinking Skills may be worked out and their effectiveness may be determined using different criteria.

2. Only five units from Science were taught through Instructional Material. A research may be conducted where in full course of Science may be taught through the use of the designed Instructional Material.
3. In the present study Science was taught through Instructional Material. The other subjects may also be taught efficiently by developing Instructional Material on Thinking Skill of IPC.

4. In the present study effectiveness of each component was studied in terms of reactions of students. The researcher may study effectiveness of components on the basis of some other criteria like their thinking, attitude towards Instructional Material etc.

5. Sample from rural area having different socio-economic background may be taken and its effectiveness may be determined.

6. Instructional Material on Thinking Skills can be developed at different levels as primary, high school, higher secondary and college level.

7. In the present study Instructional Material was developed in English Language. The researchers may develop Instructional Material in other languages also.

8. An experimental study may be undertaken to explore the attitude of students, teachers, school authorities and curriculum makers towards the instruction of the teaching and learning through Instructional Material.

9. Studies may be conducted to see the effect of Instructional Material on perceptual change of attitudes and values.

10. Studies may be undertaken to see the effect of different aspects of Instructional Material with exceptional children like gifted, creative, learning disables and backward students on their various cognitive aspects.
11. Studies may be conducted to find the effect of Instructional Material and training on teacher educators as well as teacher trainees and teaching skills.

12. Comparative studies may be conducted to find out the effectiveness of Instructional Material based on IPC by taking students from rural and urban areas.

13. Comparative studies may be conducted to find out the effectiveness of Instructional Material based on IPC by taking students from State board and CBSE board schools.

14. Comparative studies may be conducted to find out the effectiveness of Instructional Material based on IPC by taking students from Hindi and English medium schools.

15. Comparative studies may be conducted to find out the effectiveness of Instructional Material based on IPC by taking students from government and private schools.

16. Comparative studies may be conducted to find out the effectiveness of Instructional Material based on IPC by taking gender as dependent variable.