CHAPTER – VII

SUMMARY, FINDINGS AND EDUCATIONAL IMPLICATIONS
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SUMMARY, FINDINGS AND EDUCATIONAL
IMPLICATIONS

In the preceding chapters, introduction to the variables of the study, review of related literature, emergence of the problem, the objectives, hypotheses and delimitations of the study were presented. Also, the design of the study, the tools used for data collection, procedure of the study, analysis of data and results were discussed. The present chapter has been devoted to a brief summary, findings and implications of a study.

7.1 INTRODUCTION

One of the important goals of education is to improve both academic achievement and social relations in school. There is an urgent need to practice alternative education programs or instructional strategies to solve the problem of students' poor achievement as well as an attempt to provide environments and curriculum that meet the needs of students.

Among the strategies for change outlined in the new reform movement for teaching mathematics is a recommendation for using different instructional methods, such as cooperative learning, for building students' capacity for mathematical thinking and reasoning (Mevarech, 1999). The report of the National Governor's Association, Washington (Brown and Goren, 1993), indicated the following:

In cooperative learning, small groups of students of mixed ability work together to solve problems and complete tasks. In this setting, lower achieving students can model the study skills and
work habits of more proficient students. In the process of explaining the material, higher achieving students often develop greater mastery themselves by developing a deeper understanding of the task or skill.

Cooperative learning is an instructional technique designed to promote the academic and social development of students. It is one of most common techniques used by educators throughout the world especially in United States (Johnson and Johnson, 2000). Johnson and Johnson et. al. (1991) proposed a five elements are essential for increasing the likelihood of success of the cooperative-learning endeavor:

- Positive Interdependence
- Face to face promotive interaction
- Individual accountability
- Social skills
- Group Processing

Present study is an attempt to study the effectiveness of Student Teams-Achievement Divisions (STAD) adaptable to most subjects and grade levels. In STAD (Slavin, 1986), students are assigned to four-member learning teams that are mixed in performance level. The teacher presents a lesson, and then students work within their teams to make sure that all team members have mastered the lesson. Finally, all students take individual quizzes on the material, at which time they may not help one another and their quiz score are summed to form team scores and team which achieve certain standards may earn rewards.
A lot of studies have been conducted in cooperative learning with respect to achievement and attitudes but a review of related literature indicated that very few studies have been conducted to study the effectiveness of cooperative learning with respect to achievement, attitudes, retention and social skills in the context of cognitive styles. Besides this, research needs to be conducted to determine the effectiveness of cooperative learning on seventh graders for teaching subjects such as mathematics.

In the past two decades, research studies have been conducted on achievement in mathematics at different grades (Webb, 1982; Williams, 1988; Mulryan, 1989; Berg, 1992; Coston, 1994; Morgan, 1994; Karnasih, 1995; Nowak, 1996; Whicker, Bol and Nunnery, 1997; Chang, 1998), in English (Adams, 1995; Geed, Passi and Dube, 2003; Chen, 2004; Ali, 1999), in Science (Ahuja, 1994; Stepka, 1999), in Electronics Diploma (Yaibua, 2005), on attitudes (Cook, 1993; Ahuja, 1994; Morgan, 1994; Karnasih, 1995; Armstrong, 1997; Whicker, Bol and Nunnery, 1997; Vaughan, 2002).

A perusal of these studies leads us to inference that cooperative learning is more effective in teaching different subjects at different grades them conventional group learning in terms of achievement and attitudes.

The present study is an attempt to study the effectiveness of cooperative learning on achievement, attitudes and social skills of Seventh graders by teaching mathematics, in India. The results of the present study are expected to benefit the teacher, teacher educators and students’ keeping in view the impotence of mathematics, the present study was planned. Mathematics was selected, as it is one of the most important subjects in the school curriculum.
7.2 NEED OF THE STUDY

Research on student thought processes is based on the belief that teaching is mediated by student thought processes and that teachers influence student achievement, not directly, but by causing students to think and behave in certain ways (Wittrock, 1986). Cooperative learning is one of the teaching learning strategies which is not expensive, makes learning easier and more enjoyable for the student. It is an easy technique to implement in the classroom, particularly in a block scheduled time table. The rationale for using cooperative learning techniques is that the principles on which they are grounded are important not only for helping people to work together better, but also for recognizing everyone’s gifts and strengths. Experimental studies show that cooperative learning strategy has positive benefits to students (enhanced academic achievement, improved self-esteem, greater motivation and better interpersonal relations), questions continue to surface about students’ performance in small group settings. It seems that not all students receive the same benefits from participation in heterogeneous cooperative learning groups.

Mathematics is considered to be an exceptionally difficult subject by various students. The pass percentage of middle and high school examination in this subject is low in comparison to other subjects of the school curriculum. This backwardness in subject is may be due to the lack of interest and wrong methods of learning.

In cooperative learning settings, group of students of mixed abilities help each other to learn by discussing the things which include self-effort and understanding.

Cooperative interdependence in classroom settings is the basis of many interventions designed to improve both academic
achievement and social relations in schools and as such has been a primary focus in educational and social psychological literature for more than three decades.

The investigator believes that it is natural tendency of children to grow and learn through social interaction and that understanding cooperative interactions within school contents will not only help children achieve educational goals but also create more long term benefits for human kind.

Though number of studies have been conducted abroad with students at middle school level regarding mathematics achievement but fewer have focused in India on individual differences like cognitive styles and development of social skills among students. Our purpose in this study was to help bridge this gap in the research literature by investigating the effects of cooperative learning on students’ attitudes, achievement and social skills in the mathematics classroom of seventh class students with different cognitive styles.

7.3 STATEMENT OF THE PROBLEM

EFFECT OF COOPERATIVE LEARNING ON ATTITUDES ACHIEVEMENT AND SOCIAL SKILLS OF SEVENTH GRADERS WITH DIFFERENT COGNITIVE STYLES

7.4 OBJECTIVES OF THE STUDY

1. To develop instructional material based on cooperative learning for teaching class VII students.

2. To study the effectiveness of instructional treatments (cooperative learning and conventional group learning) for field-independent and field-dependent students with respect to their attitudes towards mathematics.
3. To compare the mean gain on achievement scores in mathematics of the students taught through different instructional treatments (cooperative learning and conventional group learning).

4. To study the effectiveness of the two instructional treatments for the field-independent and field-dependent students.

5. To study the effectiveness of the two instructional treatments for field-independent and field-dependent group of students at knowledge, comprehension and application categories of objectives.

6. To compare the retention scores of students exposed to different instructional treatments.

7. To study the effectiveness of the two instructional treatments for field-independent and field-dependent group of students with respect to retention.

8. To study the effects of two instructional treatments for field-independent and field-dependent groups at knowledge, comprehension and application categories of objectives on retention scores.

9. To study the attitudes of students towards cooperative learning.

10. To study the effects of two instructional treatments for field-independent and field-dependent group of students with respect to social skill scores.

7.5 HYPOTHESES

Hypotheses for analysis of mean difference scores on attitudes towards mathematics.

H₁ The two instructional treatments yield comparable mean difference scores on attitudes towards mathematics.
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H2  There is no significant difference in mean difference in mean difference scores of attitudes towards mathematics of field-independent and field-dependent group of students.

H3  There is no significant interaction between instructional treatments and types of cognitive style.

**Hypotheses for analysis of gain scores on achievement in mathematics**

H4  The two instructional treatments yield comparable mean gains on achievement scores in mathematics.

H5  There is no significant difference in mean gains on achievement scores field-independent and field-dependent group of students.

H6  Comparable mean gains on achievement scores are yielded by students at knowledge, comprehension and application categories of objectives.

H7  There is no significant interaction between instructional treatments and types of cognitive style.

H8  There is no significant interaction between instructional treatments and categories of objectives.

H9  There is no significant interaction between types of cognitive style and categories of objectives.

H10 The two instructional treatments attain comparable mean gain on achievement scores with both types of cognitive style at knowledge, comprehension and application categories of objectives.

**Hypotheses for analysis of retention scores**

H11 Retention is independent of instructional treatments.
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H12 Retention is independent of types of cognitive style.
H13 Retention is independent of categories of objectives.
H14 Field-independent and field-dependent students retain comparably when exposed to different instructional treatments.
H15 Students when exposed to different instructional treatments retain comparably at knowledge, comprehension and application categories of objectives.
H16 Field-independent and field-dependent students retain comparably at knowledge, comprehension and application categories of objectives.
H17 Field-independent and field-dependent students retain comparably at knowledge, comprehension and application categories when exposed to different instructional treatments.

Hypothesis for analysis of scores on attitudes towards cooperative learning

H18 Field-independent and field-dependent group of students exposed to cooperative learning exhibit comparable attitudes towards cooperative learning.

Hypotheses for analysis of mean difference scores on social skills

H19 The two instructional treatments yield comparable mean difference scores on social skills.
H20 Field-independent and field-dependent group of students yield comparable mean difference scores on social skills.
H21 There is no significant interaction between instructional treatments and types of cognitive style.
7.6 DELIMITATIONS

- The study was conducted on class VII students of two schools of Chandigarh, Government Model Senior Secondary School, Sector 19-C and Government Model Senior Secondary School, Sector 10-A Chandigarh.

- The study was conducted only on mathematics syllabus of class VII as prescribed by N.C.E.R.T., New Delhi, 2003.

- Only ten chapters were selected for instructional treatment.

- The experiment was limited to 60 days of the academic session.

7.7 DESIGN OF THE STUDY

Educational research is described as experimental when the researcher has firstly, specified a set of researchable hypotheses and secondly, has established a systematic program of data gathering under precisely defined conditions in an effort to test these hypotheses. The hypotheses provide a network of statements relating the impact of an independent variable or a set of independent variables on some outcome variable or dependent variable(s) (Ingersoll, 1982).

Weiner (1977) has rightly remarked that the experimental method which is suitable for testing hypotheses, is the strongest method for developing and understanding psychological concepts. Any experimental problem has two interrelated aspects, the design of the experiment and statistical analysis of the data. The latter aspect is directly dependent upon the former aspect. Statistical methods can greatly increase the efficiency of an experiment and also strengthen the conclusions so obtained (Montgomery, 1984).
The first 2x2 factorial design was analysed with the help of ANOVA for difference scores on scale of attitudes towards mathematics. Here instructional treatments and types of cognitive style were independent variables and difference scores on scale of attitudes towards mathematics was the dependent variables. The variables of instructional treatment was studied at two levels viz., experimental group ($T_1$) which was taught by teacher directed instruction followed by cooperative learning settings and control group ($T_2$) which was taught by traditional instruction. The variable of cognitive style was studied at two levels, viz., field-independence ($C_1$) and field-dependence ($C_2$).

The second 2x2x3 factorial design with repeated measures ANOVA was employed for analysis of mean gain scores on achievement. The variable of instructional treatment was studied at two levels namely experimental group ($T_1$) which was taught namely experimental by teacher directed instruction followed by cooperative learning settings and control group ($T_2$) which was taught by traditional instruction. The variable of cognitive style was studied at was levels viz., field-independent ($C_1$) and field-dependent ($C_2$). The third variable of categories of objectives was studied at knowledge ($O_1$) category, comprehension ($O_2$) category and application ($O_3$) category.

The factorial design was used as it permits to evaluate the combined effect of two or more experimental variables when used simultaneously. The design of the investigation is termed repeated measures, because the same individuals are measured on three occasions corresponding to each treatment level.

The third 2x2x3 factorial design was employed for analysing retention scores in mathematics. The variable of instructional treatment was studied at two levels, namely experimental group
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(T_1) and control group (T_2). The variable of cognitive style was studied at two levels viz., field-independence (C_1) and field-dependence (C_2). The variable of categories of objectives was studied at three levels, viz. knowledge category (O_1), comprehension category (O_2) and application category (O_3).

The fourth 2x2 factorial design was analyzed with the help of ANOVA for difference scores on social skills questionnaire. Here instructional treatments and types of cognitive style were independent variables and gain scores on social skills questionnaire was the dependent variable. The variable of instructional treatment was studied at two levels viz., experimental group (T_1) and control group (T_2). The variable of cognitive style was studied at two levels, viz. field-independence (C_1) and field-dependence (C_2).

7.8 SAMPLE

Sampling is a technique by which a relatively small number of individuals or measures of individuals, objects, or events is selected and analysed in order to find out something about the entire population from which it was selected. Sampling technique reduces the expenditure, saves time and energy, permits measurement of greater scope, or produces greater precision and accuracy.

In all types of researches, there are some inferences regarding a well specified and identifiable group known as population and the selected number of persons or objects is known as sample. Sample is the representative proportion of the population.
Firstly, the schools were selected based on the Principals’ permission and cooperation. So, the two schools whose principals agreed to help in the investigation were:

- Government Model Senior Secondary School, Sector 10-A, Chandigarh.

As per the requirement of the present investigation students had to be classified on the basis of cognitive style.

So, Group Embedded Figures Test (GEFT) was administered to 100 students of class VII from Government Model Senior Secondary School, Sector 19-C and 100 students of class VII from Government Model Senior Secondary School, Sector 10-A, Chandigarh on 1st July, 2004, as per instructions given in the manual. Time limit for the test was 40 minutes. Scoring was done with the help of scoring key. The raw scores obtained were used as such in the study.

The students who scored 13 or above were kept in field independent group. The students who scored 8 or below were kept in field-dependent group, whereas students who scored between 9 and 12 were dropped.

Thus, on the basis of the scores obtained by the students the Group Embedded Figures Test, the students were divided into two groups of field-independent and field-dependent students. Next, the field-independent and field-dependent students were randomly allocated to experimental and control group. There were 56 students experimental group and 56 students in control group. The average age of students was 12 years.
7.9 TOOLS USED

For the present investigation following tools were used.

1. Development of attitudes towards mathematics (developed by the investigator)
2. Development of material for instructional treatment (Developed by the investigator).
3. Development of worksheets (Developed by the investigator).
4. Development of formative criterion tests (developed by the investigator)
5. Development of criterion Test (developed by the investigator)
6. Development of achievement test (developed by the investigator)
7. Scale of attitudes towards cooperative learning (developed by the investigator)
8. Social skills Questionnaire-Pupil (Spence, 1995).

All the above tools have been explained in Chapter IV.

7.10 PROCEDURE

Procedure of the experiment comprised of two main stages, which are selection of the sample and conducting the experiment.

Stage 1: Selection of the Sample

The present study was conducted on 112 class VII students from the Government Model Senior Secondary School, Sector 19-C, Chandigarh and Government Model Senior Secondary School, Sector 10-A, Chandigarh. Students were selected for experimentation after administration of Group
Embedded Figures Test (GEFT) to class VII students, 100 each in both the schools (as explained under the subheading sample in the chapter V). Each group (both schools) consisted of equal number of field-independent and field-dependent students.

Stage 2: Conducting the Experiment

The experiment was conducted in four phases as given below:

Phase 1: Administration of Pre-test
Phase 2: Conducting the instructional program
Phase 3: Administration of the post-test
Phase 4: Administration of the retention test

Phase 1: Administration of Pre-tests

The phase involved the administration of the following test to the students of the experimental group and control group i.e.

i. Criterion Test

ii. Scale of attitudes towards mathematics

iii. Social skills questionnaire (Pupil version)

Separate response sheets were provided. The answer sheets were scored with the help of scoring key. The scores indicated the previous knowledge possessed by the students, their attitudes towards mathematics and their level of social skills.

Phase II: Conducting the instructional program

To find out the efficacy of the treatment variables, the instructional treatment was manipulated in the form of teacher directed instruction followed by cooperative learning settings.

The instructional treatment was given for about 62 days which included 45 lessons and 17 formative criterion tests to the
experimental group whereas the control group was taught by the conventional method. Same content was taught to both the groups. An effective cooperative learning method called Student Team-Achievement Divisions or STAD was used (as explained under the sub-heading conducted the experiment in Chapter V).

**Phase III : Administration of the Post-Test**

Immediately after the instructional treatment was over, the subjects, were assessed on criterion measures to know the effect of the treatment. The following tests were administered to both the experimental and control groups.

- Criterion Test
- Scale to measure attitudes towards mathematics
- Social skills (Pupil version)
- Scale to measure attitudes towards cooperative learning (only to students of experimental group)
- Interview taken regarding the perceptions of students towards the instructional program (only of the students of experimental groups).

**Phase IV : Administration of the Retention Test**

Twenty days later, following test was again administered to both experimental and control group.

1. Criterion Test – It was administered to get the measure of retention.

   The obtained answer sheets were scored with the help of scoring key.
7.11 STATISTICAL TECHNIQUES

The following statistical techniques were employed to analyse the data obtained from the experiment to test the hypotheses.

- Graphical representations
- Qualitative analysis of criterion scores
- Descriptive statistical techniques like Means, SD’s, Skewness and Kurtosis of the attitudes difference scores, achievement gain scores and social skills difference scores.
- Factorial design 2x2, analysis of variance for mean difference scores on scale of attitudes towards mathematics.
- Factorial design 2x2x3 ANOVA with repeated measures on one factor for mean gain on achievement scores.
- Factorial design 2x2x3 ANOVA with repeated measures on one factor for retention scores.
- One-way ANOVA was employed for the scores on attitudes towards cooperative learning.
- Percentages were computed to analyze the findings regarding interviews.
- Factorial design 2x2, ANOVA for difference scores on social skills questionnaire.

For further investigation, t-test was employed wherever F-ratios were found to be significant.

7.12 MAJOR FINDINGS

The findings of the study, pertaining to learning outcomes in mathematics among seventh graders, have been given in the following paragraphs.
Findings pertaining to attitudes towards mathematics

- There was difference in the attitudes exhibited by students when exposed to different instructional treatments. Students exposed to cooperative learning exhibited better attitudes than those in conventional group learning.

- Through cooperative learning and through conventional group learning, students exhibited comparable attitudes on towards:
  - mathematics as a curricular area (domain I)
  - mathematics teacher (domain III)
  - mathematics learning (domain IV)
  - mathematics as a future vocation (domain V)

- Students exposed to cooperative learning exhibited better attitudes towards curriculum transaction (domain II) than those in conventional group learning.

- There was difference in the attitudes exhibited by the two cognitive style group of students.

- Field-independent students exhibited better attitudes towards mathematics than the field-dependent students.

- Field-independent and field-dependents students exhibited comparable attitudes on/towards:
  - mathematics as a curricular area (domain I)
  - curriculum transaction (domain II)
  - mathematics teacher (domain III)
  - mathematics learning (domain IV)
  - mathematics as a future vocation (domain V)
Summary, Findings and Educational Implications

- Treatment and cognitive style did not interact with each other on the whole and with respect to five domains of attitudes towards mathematics scale.

Findings pertaining to achievement in mathematics

- There was a difference in the mean gains of students exposed to different instructional treatments.
- Students yielded better mean gains through cooperative learning than in conventional group learning.
- Field-independent and field-dependent students yielded comparable mean gains.
- There was a difference in mean gains of students at different categories of objectives.
- Students yielded better mean gain scores at knowledge category than at comprehension category of objectives.
- Students yielded better mean gain scores at knowledge category than at application category of objectives.
- Students yielded comparable mean gains at comprehension and application categories of objectives.
- Treatment and cognitive style interacted with each other.
- Through cooperative learning field-independent students yielded better mean gains on achievement scores than field-dependent students.
- Through conventional group learning field-independent and field-dependent students yielded comparable mean gains.
- Field-independent students yielded better mean gains through cooperative learning than in conventional group learning.
Summary, Findings and Educational Implications

- Field-dependent students yielded better mean gains through cooperative learning than in conventional group learning.
- Field-independent students yielded better mean gains through cooperative learning than field-dependent students in conventional group learning.
- Field-dependent students yielded better mean gains through cooperative learning than field-independent students in conventional group learning.
- Treatment and categories of objectives interacted with each other.
- Through cooperative learning, students yielded
  - better mean gains at knowledge category than at comprehension category of objectives.
  - better mean gains at knowledge category than at application category of objectives.
  - better mean gains at application category than at comprehension category of objectives.
- Through conventional group learning, students yielded
  - comparable mean gains at knowledge and comprehension categories of objectives.
  - comparable mean gains at knowledge and application categories of objectives.
  - comparable mean gains at comprehension and application categories of objectives.
- At knowledge category of objectives students exposed to cooperative learning yielded better mean gains than conventional group learning.
At comprehension category of objectives students exposed to cooperative learning yielded better mean gains than conventional group learning.

At application category of objectives students through cooperative learning yielded better mean gains than conventional group learning.

Cognitive style and categories of objectives did not interact with each other.

Treatment, cognitive style and categories of objectives interacted with each other.

**Through cooperative learning**

Field-independent students yielded

- comparable mean gains at knowledge and comprehension categories of objectives.
- comparable mean gains at knowledge and application categories of objectives.
- comparable mean gains at comprehension and application categories of objectives.

Field-dependent students yielded

- better mean gains at knowledge category than at comprehension category of objectives.
- comparable mean gains at knowledge and application categories of objectives.
- better mean gains at application category than at comprehension category of objectives.

At knowledge category of objectives field-independent and field-dependent students yielded comparable mean gains.
Summary, Findings and Educational Implications

- At comprehension category of objectives field-independent and field-dependent students yielded comparable mean gains.
- At application category of objectives field-independent and field-dependent students yielded comparable mean gains.

Through conventional group learning

- Field-independent students yielded
  - comparable mean gains at knowledge and comprehension categories of objectives.
  - better mean gains at knowledge category than at application category of objectives.
  - better mean gains at comprehension category than at application category of objectives.
- Field-dependent students yielded
  - comparable mean gains at knowledge and comprehension category of objectives
  - comparable mean gains at knowledge and application category of objectives
  - comparable mean gains at comprehension and application category of objectives.
- At knowledge category of objectives field-independent and field-dependent students yielded comparable mean gains.
- At comprehension category of objectives field-independent and field-dependent students yielded comparable mean gains.
Summary, Findings and Educational Implications

• At application category of objectives field-dependent students yielded better mean gains than field-independent students.

Findings pertaining to retention in mathematics

• There was difference in the retention scores of students exposed to different instructional treatments. Students retained better through cooperative learning than conventional group learning.

• There was difference in the retention scores of different cognitive style groups. Field-independent students retained better than field-dependent students.

• There was difference in the retention scores of students at different categories of objectives.

• Students retained better at knowledge category than at comprehension category of objectives.

• Students retained better at knowledge category than at application category of objectives.

• Students retained comparably at comprehension and application categories of objectives.

• Treatment and cognitive style interacted with each other.

• Through cooperative learning field-independent students retained better than field-dependent students.

• Through conventional group learning field-independent and field-dependent students retained comparably.

• Field-independent students retained better through cooperative learning than conventional group learning.
Summary, Findings and Educational Implications

- Field-dependent students retained better through cooperative learning than conventional group learning.
- Field-independent students retained better through cooperative learning than field-dependent students of conventional group learning.
- Field-dependent students retained better through cooperative learning than field-dependent students of conventional group learning.
- Treatment and categories of objectives did not interact with each other.
- Cognitive style and categories of objectives did not interact with each other.
- Treatment, cognitive style and categories of objectives interacted with each other.

Through cooperative learning

- Field-independent students retained
  - comparably at knowledge and comprehension categories of objectives.
  - comparably at knowledge and application categories of objectives.
  - comparably at comprehension and application categories of objectives

- Field-dependent students retained
  - better at knowledge category than at comprehension category of objectives
  - better at knowledge category than at application category of objectives
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- comparably at comprehension and application categories of objectives

- At knowledge category of objectives field-independent students retained better than field-dependent students.

- At comprehension category of objectives field-independent students retained better than field-dependent students.

- At application category of objectives field-independent students retained better than field-dependent students.

Through conventional group learning

- Field-independent students retained
  - better at knowledge category than at comprehension category of objectives.
  - better at knowledge category than at application category of objectives.
  - comparably at comprehension and application category of objectives

- Field dependent students retained
  - comparably at knowledge and comprehension categories of objectives
  - comparably at knowledge and application categories of objectives
  - better at application category than at comprehension category of objectives

- At knowledge category of objectives field-independent and field-dependent students retained comparably.

- At comprehension category of objectives field-independent and field-dependent students retained comparably.
Summary, Findings and Educational Implications

- At application category of objectives field-dependent students retained better than field-independent students.

Findings pertaining to attitudes towards cooperative learning

- There was no difference in attitudes towards cooperative learning of two different cognitive style groups of the experimental group.
- Field-independent and field-dependent students exposed to cooperative learning exhibited comparable attitudes towards cooperative learning.

Findings pertaining to interviews (of experimental group)

- Students exposed to cooperative learning were highly benefited on both academic and social dimensions.
- Regarding what did they like about cooperative learning, students responded positively on all the response categories.
- Majority of the students (92 per cent) were in favour of:
  - getting help from each other
  - learning from each other if they don’t know
  - getting to work with other students
  - discussing and sharing ideas
  - getting better grades
  - learning easily this way
  - doing harder work
  - getting to know each other.
- There was not much difference in the occurrence of responses of field-independent and field-dependent students.
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Regarding the responses for what they did not like about cooperative learning, students responded:

- 53.6% for liking it all
- 33.9% for uncooperative group members
- 17.85% for feeling left behind
- 12.5% for not knowing what to do in a group
- 30.35% for alternate group membership
- 1.78% for finding solving of worksheets as hectic.

None of the students found that cooperative learning is time consuming.

Regarding the kind of concepts in mathematics which were easier to understand responded learn in a groups, students responded:

- 92.48% for all kinds of topics
- 1.78% for only complex, difficult problems (hard to solve on own)
- 5.35% for Geometrical Constructions

There was not much difference in the responses of field-independent and field-dependent students.

Regarding teacher involvement, 25% students responded for more teacher involvement, 71.4% for less teacher involvement, and 76.78% for monitoring the groups and asking them from time to time.

Regarding rewards, 80.35 percent of students were in favour of rewarding groups, 23.21% for rewarding only individuals and 16.07% felt that recognition to high achievers is ignored.
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• Regarding their perceptions about the good groups in cooperative learning settings, as below:
  - 64.28% felt that group members like each other
  - 41.07% opined that group members know each other
  - 91.07% felt that everybody does equal work.
  - 12.5% felt that only those people who are good in mathematics can improve in a group.
  - 96.64% felt that there should be no fighting in the group
  - 100% were for no fooling about in the gross
  - 73.21% felt that no time should be wasted in gossiping and
  - 100% felt that in a group people should share and listen to each other.

• Regarding what they would like to change about the cooperative learning groups, students responded as below:
  - 26.78% felt that nothing needs to be changed
  - only 17.85% were in favour of permanent group members
  - only 17.85% felt that only friends should be in a group
  - 12.5% felt that there should be only two members in a group.

Whereas majority of the students of the experimental group were in favour of change in group members, only friends need not be in a group and there should be more at least four members in a group (which was the case in the present study).
Findings pertaining to Social Skills

- There was no difference in enhancement of social skills of students exposed to different instructional treatments.
- Students exposed to cooperative learning and those in conventional group learning exhibited comparable social skills.
- Field-independent and field-dependent students exhibited comparable social skills.
- Treatment and cognitive style did not interact with each other.

7.13 EDUCATIONAL IMPLICATIONS

The present research has clearly shown that changing from a traditional competitive classroom to a cooperative one does not diminish student achievement; it significantly improves achievement. In the present research, groups were rewarded based on their member’s learning and also students were individually accountable for their academic performance. Thus, positive effect on achievement and retention in mathematics was found. The research supports the usefulness of cooperative learning for improving students attitudes towards mathematics. But, social skills were not enhanced as a result of instructional treatment for 62 days.

The interviews findings show that cooperative learning was like with by almost all the students and they expressed their desire to be taught in the same way by other teachers. Most of the students liked working and interacting with other students and enjoyed the cooperative learning sessions.
Research on cooperative learning supports student achievement at a variety of grade levels and in many subjects, interpersonal relations, attitudes and student self-esteem.

There are still many unanswered questions in the research, but at this point it is possible to say that cooperative learning has proven its effectiveness on achievement, attitudes and general positive relations between students while also offering benefits to the teachers. Cooperative learning has proven to be practical, inexpensive and widely acceptable to students.

When students are not able to understand teacher's explanation, group members are able to explain in simpler words that are more easily understood. In this way, it improves students' perception about learning and decrease the feeling of alienation.

In the present study reveals that field-independent and field-dependent students attained comparably on achievement which shows that cooperative learning reduces individual differences and enables all types of students perform to better.

- Cooperative learning can be used as a supplement to large group classroom teaching. It is easier to monitor 12 or 13 groups than 55 or 60 individuals.
- Cooperative learning may take sometime to get used to. A teacher who is accustomed to being the sole source of information and learning in the classroom should actively encourage the students to
  - help each other and learn from each other.
  - participate in discussions.
  - facilitate each other's learning.
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- engage in problem solving.

- The teacher should closely monitor the involvement of all kinds of students especially the low achieving students in their learning activities.

- Cooperative learning sessions should include games, recreational activities like solving puzzles and riddles, holding group discussions on some general topic related to current affairs to create more interest among students. Ultimately, the participants of cooperative learning sessions or the members of the group begin to take control of their own learning.

- Group tasks should be designed and communicated to students in ways that make them believe that they are linked in such a way that one cannot succeed unless everyone succeeds. The tasks should engage students more actively in their learning experiences.

- The topics in different subjects to be taught by cooperative learning should be so decided that they should require use of skills that students feel capable of using to maximize their involvement in tasks.

- Even the less structured subjects like language, arts can be taught with this method like the problem-solving topics (grammar, comprehension, composition, maps).

- Teachers need to structure existing lessons, curricula cooperatively. The lesson plans should be tailored to meet the needs of the curricula, subject areas and students.

- Important skills such as critical thinking, creative problem solving and the synthesis of knowledge can easily be
accomplished through cooperative group activities in the inclusive classroom.

- Meaningful content in cooperative lessons is critical for the success of all students. For students to succeed within their groups, careful consideration regarding group heterogeneity must be in conjunction with roles that ensure active, equal participations.

- The study has important implications for teacher education. Given the current widespread use of cooperative learning at all levels, it is imperative that pre-service teachers understand how to structure and monitor meaningful learning experiences for students.

- Students in heterogeneous classrooms learn to solve complex cognitive tasks and the progress of the lower achieving students does not occur at the expense of the higher achievers or vice versa. So cooperative learning is recommended for fostering students’ mathematical reasoning and communication.

**7.14 SUGGESTIONS FOR FURTHER RESEARCH**

- The study should be repeated to explore how cooperative learning affects the students of various abilities on cognitive, emotional and motivational dimensions.

- There is need to compare cooperative learning with other methods of instruction at different grade levels.

- There is need to explore the relation of cooperative learning with other emotional and motivational variables.

- The same study can be repeated on a large sample for validation.
Summary, Findings and Educational Implications

- The same study can be repeated for a longer duration to examine the effects on non-cognitive variables like social skills or some personality variable which take more time to bring about a change.
- Research is needed to compare other methods of cooperative learning in various subjects i.e. upto what extent one method is superior to other.
- There is need to study the integrated effect of cooperative learning with other instructional treatments.
- Research is needed to study the effect of cooperative learning on special children either gifted or learning disabled and other mildly handicapped students.