CHAPTER - V

5. FINDINGS, INTERPRETATIONS, IMPLICATIONS AND
SUGGESTIONS

5.1 OVERVIEW

This chapter has got eight sections. It begins with an overview. The second section summarises the findings of the study. Interpretation is briefly explained in the third section. The fourth section deals with the discussion of the findings. The fifth section presents the educational implications of the study. The sixth section brings out the recommendations and the seventh section presents the limitations of the study. The last section deals with the suggestions for further research.

5.2 FINDINGS

Critical Thinking Ability of the Co-operative Learning Approach group and the Traditional Method group at the pre-test level.

There was no significant difference between the students of the co-operative learning approach group and the traditional method group in their critical thinking ability in the pre test level. Also boys and girls, rural and urban, and high, middle and low achievers of the experimental and the control groups did not differ significantly in their critical thinking ability in the pre test level.

Effectiveness of the Co-operative Learning Approach on Critical Thinking Ability for the total sample in the post test level.

The post test t value on critical thinking ability of the higher secondary
students showed remarkable difference between the co-operative learning approach group and the traditional method group (t=16.45, p<0.01). The ANCOVA analysis showed that the critical thinking ability of the students of the co-operative learning approach group was higher than the students of the traditional method group (F = 420.02, P<0.01). Hence the co-operative learning approach was more effective than the traditional method in developing critical thinking ability among the higher secondary students.

**Effectiveness of the Co-operative Learning Approach on Critical Thinking Ability with respect to gender in the post test level.**

The post test t value for critical thinking ability for boys showed remarkable difference between the two groups (t =8.96, P<0.01). The ANCOVA analysis showed that the boys of the co-operative learning group possessed higher critical thinking ability than that of the traditional group method (F=112.572, p<0.01). And the post test t value for critical thinking ability of girls who studied through co-operative learning approach was higher than that of the traditional method group (t =14.77, p<0.01). Analysis of covariance revealed that F value was statistically significant at 0.01 level (F =438.913, p<0.01). Thus the co-operative learning approach was more effective than the traditional method in developing the critical thinking ability of both the boys and the girls.

**Effectiveness of the Co-operative Learning Approach on Critical Thinking Ability with respect to locality in the post test level.**

The co-operative learning approach group and the traditional method
group differed significantly in critical thinking ability among the urban students (t =11.66, p<0.01). From the analysis of covariance, it was evident that the critical thinking ability of the urban students was significantly higher in the co-operative learning approach group than in the traditional method group (F = 184.079, p<0.01). Rural students also differed significantly in their critical thinking ability in the co-operative learning group and the traditional method group (t = 11.85, p<0.01). The analysis of covariance revealed that the critical thinking ability of the rural students was significantly higher in the co-operative learning approach than in the traditional method group (F = 239.802, p<0.01). Hence the co-operative learning approach was more effective than the traditional method in developing the critical thinking ability among the urban and the rural students.

Effectiveness of the Co-operative Learning Approach on Critical Thinking Ability among high, middle and low achievers in the post test level.

The t value for the high achievers on critical thinking ability showed remarkable difference between the two groups (t =10.74, p<0.01). The ANCOVA analysis showed that the high achievers of co-operative learning group were better than that of traditional group in their critical thinking ability (F =160.360, p<0.01). The t value for the middle achievers on critical thinking ability showed remarkable difference between the two groups
(t =15.16, P<0.01). ANCOVA analysis showed that the middle achievers of co-operative learning group were better in their critical thinking ability than that of the traditional method group (F =326.166, p<0.01). And the t value for low achievers on critical thinking ability showed remarkable difference between the two groups (t =5.65, p<0.01). The ANCOVA analysis showed that the low achievers of the co-operative learning group were better in their critical thinking ability than the students of the traditional method group (F =77.149, p<0.01). Thus it was concluded that the co-operative learning approach was more effective than the traditional method in developing critical thinking ability among the high, the middle and the low achievers.

**Gap Closure of the Co-operative Learning Approach group and the Traditional Method group.**

The gap closure on critical thinking ability for the co-operative learning approach group students was higher than those of the traditional method group students.

**Problem Solving Ability in Mathematics between the Co-operative Learning Approach and the Traditional Method at the pre-test level.**

There was no significant difference between the students of the co-operative learning approach group and the traditional method group in their problem solving ability at the pre test level. Also boys and girls, rural and urban, and high, middle and low achievers of the co-operative learning approach group and the traditional method group did not differ significantly in their problem solving ability in Mathematics at the pre test level.
Effectiveness of the Co-operative Learning Approach on Problem Solving Ability in Mathematics for the total sample at the post test level.

It was evident from the post test t value, scores on problem solving ability in Mathematics of higher secondary students showed a remarkable difference between the two groups (t =13.12, p<0.01). The ANCOVA analysis showed that the problem solving ability in Mathematics of students of the co-operative learning approach group was better than that of the traditional method group (F=368.11, p<0.01). Thus it was concluded that the problem solving ability in Mathematics of the students of the co-operative learning approach group was greater than the traditional method group.

Effectiveness of the Co-operative Learning Approach on Problem Solving Ability with respect to gender in the post test level.

The t value for the problem solving ability of the boys showed a remarkable difference between the two groups in the post test level (t =7.56, p<0.01). The ANCOVA analysis showed that the problem solving ability of the co-operative learning approach group was higher than that of the traditional method group for boys (F=151.343). Thus it was proved that the co-operative learning approach was more effective than the traditional method in developing problem solving ability of the boys.

The t value, for problem solving ability of the girls showed a significant difference between the two groups (t =11.35, p<0.01). The ANCOVA analysis showed that the problem solving ability of the girls of the
co-operative learning approach was better than the girls of the traditional method group (F =208.551, p<0.01). Thus it was proved that co-operative learning approach was more effective than the traditional method in developing the problem solving ability of girls.

Effectiveness of the Co-operative Learning Approach on Problem Solving Ability with respect to locality in the post test level.

The post test t value of problem solving ability for the urban students showed a remarkable difference between the co-operative learning approach group and the traditional method groups (t =8.64, p<0.01). The ANCOVA analysis showed that the problem solving ability scores in Mathematics of the urban students in the co-operative learning approach group was better than the students of the traditional method group (F = 160.389, p<0.01). Hence it was evident that the co-operative learning approach was more effective than that of the traditional method in developing problem solving ability among the urban students.

The post test t value for rural students on problem solving ability in Mathematics showed a remarkable difference between the two groups (t =10.14, p<0.01). The ANCOVA analysis showed that the problem solving ability of rural students of the co-operative learning approach was higher than that of the traditional method group (F = 226.053, p<0.01). Hence the co-operative learning approach was more effective than the traditional method in developing the problem solving ability in Mathematics among the rural students.
Effectiveness of the Co-operative Learning Approach on Problem Solving Ability with respect to achievement level in the post test level.

The post test t value indicated that the co-operative learning approach group and the traditional method group differed significantly in developing the problem solving ability for the high achievers (t =6.19, p<0.01). The ANCOVA analysis showed that, the high achievers of the co-operative learning approach had better problem solving ability than that of the traditional method group (F =45.359, p<0.01). Hence the co-operative learning approach was more effective than that of the traditional method in developing problem solving ability among the high achievers.

There was significant difference between the co-operative learning approach group and the traditional method group in their problem solving ability of the middle achievers (t = 11.36, p<0.01). The ANCOVA analysis showed that the middle achievers in the co-operative learning approach showed better problem solving ability than the traditional method group (F=200.433, p<0.01). Hence, the co-operative learning approach was more effective than that of the traditional method in developing problem solving ability in Mathematics among the middle achievers.

There was significant difference between the co-operative learning approach group and the traditional method group in the problem solving ability of the low achievers (t =6.91, p<0.01). The ANCOVA analysis showed that the low achievers in the co-operative learning approach showed
better problem solving ability than the traditional method group (F=97.487, p<0.01). Hence the co-operative learning approach was more effective than the traditional method in developing the problem solving ability in Mathematics of the low achievers.

**Gap Closure of the Co-operative Learning Approach group and the Traditional Method group**

The gap closure for the problem solving ability of the experimental group students was greater than the control group students.

**Attitude towards Co-operative Learning between the Experimental group and the Control group at the pre-test level.**

There was no significant difference between the students of the co-operative learning approach group and the traditional method group in their attitude towards co-operative learning at the pretest level. Also boys and girls, rural and urban, and high, middle and low achievers of the experimental and the control group did not differ significantly in their attitude towards co-operative learning. Both the co-operative learning approach group and the traditional method group were similar in their attitude.

**Change in Attitude towards Co-operative Learning Approach for the total sample.**

The post test attitude scores of the cooperative learning approach group differed significantly at 0.01 level (t=53.96, p<0.01). Thus there was significant change in attitude of the experimental group after the experiment.
The change was in a positive direction towards the cooperative learning approach.

**Change in Attitude towards Cooperative Learning Approach with respect to gender**

There was a significant difference between the pre and the post test mean scores of attitude towards co-operative learning of the experimental group boys. The t value was significant at 0.01 level (t=41.24, p<0.01), and it was in favour of the post test. It showed a positive change in attitude towards the co-operative learning among the experimental group boys.

There was a significant difference between the pre and the post test mean scores of attitude towards co-operative learning of the experimental group girls. The t value was significant at 0.01 level (t=36.02, p<0.01) and it was in favour of the post test. It showed a positive change in attitude towards co-operative learning among the experimental group girls.

**Change in Attitude towards the Co-operative Learning Approach with respect to locality.**

There was a significant difference between the pre and the post test mean scores of the experimental group urban students in their attitude towards co-operative learning. The t value was significant at 0.01 level (t=33.19, p<0.01), and it was in favour of the post test. It showed that the urban students had a positive change in attitude towards the co-operative learning.

There was a significant difference between the pre and the post test attitude scores of the experimental group rural students. The t value was
significant at 0.01 level (t=47.98, p<0.01), and it was in favour of the post test. It showed that the rural students of the experimental group had a positive change in attitude towards the co-operative learning.

**Change in Attitude towards Co-operative Learning with respect to achievement level.**

There was a significant difference between the pre and the post test attitude scores of the high achievers of the experimental group. The t value was significant at 0.01 level (t=29.42, p<0.01), and it was in favour of the post test. It showed that the high achievers of the experimental group had a positive change in attitude towards co-operative learning approach.

There was a significant difference between the pre and the post test attitude scores of middle achievers of the experimental group. The t value was significant at 0.01 level (t=40.58, p<0.01) and it was in favour of the post test. It showed that the middle achievers of the experimental group had a positive change in attitude towards cooperative learning.

There was a significant difference between the pre and the post test attitude scores of the experimental group low achievers. The t value was significant at 0.01 level (t=22.32, p<0.01) and it was in favour of the post test. It showed that the low achievers of the experimental group had a positive change in their attitude towards co-operative learning.

**Attitude of the Control group students towards Co-operative Learning.**

There was no significant difference between the pre and the post test attitude scores of the control group. The t value was not significant at 0.01
level (t=1.76, p>0.05). It showed that there was no change in attitude of the control group students (total as well as sub samples namely gender, locality and achievement level) towards co-operative learning.

**Ratings of Teachers on the Comparative Efficacy of the Co-operative Learning Approach and the Traditional Method in Realizing Educational Outcomes.**

From the ratings of the teachers it was evident that the co-operative learning approach was significantly higher than that of the traditional method in realizing all the educational outcomes (t=13.95, p<0.01). It indicated that the co-operative learning approach was superior in developing educational outcomes with respect to the cognitive, affective and psycho motor aspects of learning in Mathematics.

**Ratings of Students on the comparative efficacy of the Cooperative Learning Approach and the Traditional Method in realizing educational outcomes.**

From the ratings of the students it was evident that the co-operative learning approach was significantly higher than that of the traditional method in realizing all the educational outcomes (t=28.16, p<0.01). It indicated that the co-operative learning approach was superior in developing educational outcomes with respect to the cognitive, affective and psycho motor aspects of learning in Mathematics.
Opinion on the Extent of using the Co-operative Learning Approach

Regarding the extent of using co-operative learning approach in teaching, 84% of the teachers reported that they never used the co-operative learning approach in their teaching – learning process. And 16% of the teachers used sometimes (for some particular topics) in their teaching – learning process.

Opinion on the Suitability of using the Co-operative Learning Approach in teaching Mathematics.

Regarding the suitability of the existing time table, a great majority, i.e. 76% of the teachers reported that the existing time table is not at all suitable for implementing the co-operative learning approach in schools. 60% of the teachers reported that the present syllabus is suitable only to some extend for implementing the co-operative learning approach in schools and 52% of the teachers reported that the present system of examination is not at all suitable for implementing the co-operative learning approach in schools.

Opinion on the Reasons for not using the Co-operative Learning Approach in teaching Mathematics.

With respect to the reasons for not using the co-operative learning approach, 84% of the teachers reported that due to lack of training in the co-operative learning approach, they were not using it in their teaching – learning process. 76% reported that due to lack of time they were not using this in their teaching – learning process. 56% of the teachers reported that due
to lack of suitable reference materials they were not able to use it in their teaching learning process and 40% of the teachers reported that implementing co-operative learning was a laborious work for them to a great extent.

**Opinion on the Practical difficulties encountered while using Cooperative Learning Approach in teaching Mathematics**

With regard to the practical difficulties likely to be encountered, 80% of the teachers viewed that the main practical difficulty encountered was inadequate knowledge about this approach. 60% of the teachers reported that the practical difficulty encountered to a great extend was the rigid time table. 10% felt that to a some extend difficulty in maintaining discipline, 36% of teachers reported that to a some extend the overcrowded class room, and 10% of the teachers opined that to a great extend it affected the examination oriented teaching.

**Opinion on Attaining the objectives in teaching Mathematics while using Co-operative Learning Approach.**

As regards attaining of the objectives in teaching and learning and Mathematics a great majority of the teachers i.e., 88% reported that the co-operative learning approach was effective and suitable method for attaining the objectives namely to develop interest in Mathematics. 92% of the teachers reported that it helped to develop scientific attitude. 80% of the teachers viewed that it helped to develop skill in doing mathematical problems. 68% of the teachers reported that it helped to develop speed and accuracy. 60% of the teachers reported that it provided better achievement.
76% of the teachers mentioned that it helped to develop higher order thinking. 72% of the teachers reported that it helped to develop scientific approach in problem solving. 64% of the teachers reported that it helped to solve daily life problems. 76% of the teachers reported that it helped to inculcate scientific values. And 84% of the teachers reported that it provided a better co-operation among the students.

**Suggestions for implementing the Co-operative Learning Approach.**

The following suggestions were given by the teachers for the successful implementation of the cooperative learning approach in schools.

viii. Provide adequate training in co-operative learning approach.

ix. Provide adequate reference materials related to this approach.

x. Reduce teacher-pupil ratio.

xi. Reduce the content.

xii. Revise the curriculum to suit this approach.

xiii. Modify the timetable.

xiv. Reform the Examination system.

**5.3. INTERPRETATION**

**Critical Thinking Ability of the Co-operative Learning Approach group and the Traditional Method group at the pre test level.**

There was no significant difference between the students of the co-operative learning approach group and the traditional method group in their critical thinking ability at the pre test level. Also boys and girls, rural and
urban, and high, middle and low achievers of the co-operative learning approach group and the traditional method groups did not differ significantly in their critical thinking ability. This indicated that there was a strong evidence to prove that there was a balance between the two groups namely the experimental and the control group in their critical thinking ability at the pre test level.

**Critical Thinking Ability of the Co-operative Learning Approach group and the Traditional Method group at the post test level**

From the findings of the study it was clear that the co-operative learning approach was more effective than the traditional method in developing critical thinking ability among the higher secondary students. The flexible environment of the co-operative learning approach helped the students to observe, explore, think divergently and share ideas with their friends.

Boys and girls of the co-operative learning group possessed higher critical thinking ability than that of the traditional group. Thus the co-operative learning approach was more effective in developing critical thinking ability than the traditional method among boys and girls. As the relationship became more positive there was a corresponding increase in productivity and responsibility to do the assigned work, willingness to take on and persist in completing difficult tasks and commitment to peer success and growth.
Co-operative learning approach was found to be more effective in developing critical thinking ability among the urban and the rural students. This was because the students got more social relationship and social interaction with the peers. Also this teaching approach developed their content knowledge and higher level thinking skills. This approach, of course increased confidence in the urban and the rural students’ ability as well as feelings of competence in specific subjects.

It was understood from the findings that the high, the middle and the low achievers of the co-operative learning approach group were better than that of the traditional method group in their critical thinking ability. Because all students felt the need to work together and encouraged their group to work in the other group members to learn the material well. Also the low achievers clarified their doubts and learned with their classmates when they were in a small group. In co-operative learning teams, low achieving students were able to make contributions and experience success. On the whole the understanding level of the subject matter went up in all the students since each one was explaining the others what they learnt in other groups.

**Gap Closure of the Co-operative Learning Approach group and the Traditional Method group**

The gap closure on critical thinking ability of the co-operative learning approach group students was greater than that of the traditional method group students. It was due to the effectiveness of the co-operative learning approach.
Problem Solving Ability of the Co-operative Learning Approach group and the Traditional Method group at the pre test level.

There was no significant difference between the students of the experimental group and the control group in their problem solving ability at the pre test level. Also boys and girls, rural and urban, and high, middle and low achievers of the experimental and the control group did not differ significantly in their problem solving ability. Both the experimental group and the control group were similar.

Problem Solving Ability of the Co-operative Learning Approach group and the Traditional Method group at the post test level.

It was concluded that the problem solving ability of the students of the co-operative learning approach group was greater than the traditional method learning group in the post test level. Working co-operatively, students completed their tasks more accurately and quickly than individually. By working in teams, the students were able to learn to socially negotiate with one another and to learn from each other to achieve their common goal, thus providing evidence to the fact that that learning is a social activity.

Also it was proved that the co-operative learning approach was more effective than the traditional method in developing problem solving ability of the boys and the girls. Co-operative learning approach has become very effective in developing students’ higher level thinking strategies and abilities to solve complex problems.
It was evident from the findings that the co-operative learning approach was more effective than that of the traditional method in developing problem solving ability among the urban and the rural students. The students explained and taught concepts to each other, irrespective of their backgrounds and thus the retention of those concepts improved. Explanation also helped the students to connect their prior knowledge with the new information to solve the problems.

From the analysis of the post test scores, it was clear that the high, the middle and the low achievers in the co-operative learning approach group showed better problem solving ability than the traditional method group. Hence, the co-operative learning approach was more effective than that of the traditional method in developing problem solving ability in Mathematics among the high, the middle and the low achievers. This was because of their active participation, peer teaching and group interaction.

**Gap Closure of the Co-operative Learning Approach group and the Traditional Method group.**

The gap closure for the problem solving ability of the experimental group students was greater than the control group students. It was due to the effectiveness of the cooperative learning approach.

**Attitude towards the Co-operative Learning Approach at the pre test level.**

There was no significant difference between the students of the experimental group and the control group in their attitude towards the
co-operative learning approach at pretest level. Also boys and girls, rural and urban, and high, middle and low achievers of the experimental and the control groups did not differ significantly in their attitude towards co-operative learning approach. Both the experimental group and control group were similar in their attitude.

Change in Attitude Towards Co-operative Learning Approach

There was a significant difference between the pre and the post test mean scores of attitude towards co-operative learning approach of the experimental group students. They showed a positive change in their attitude towards co-operative learning. From the t test analysis it was evident that boys and girls, urban and rural students, high, middle and low achievers of the co-operative learning approach group showed positive change in their attitude towards co-operative learning. It was mainly because the co-operative learning approach fosters higher level thinking through discussion, clarification of ideas and evaluation of other ideas. Also it enhances the interest of the students and develops self confidence in them.

But there was no significant difference between the pre and the post test mean scores of attitude towards cooperative learning approach of the control group students. The attitude of control group students remained same in the pre and the post levels.

Opinion of the Mathematics teachers regarding the implementation Co-operative Learning Approach.

As regards to the extent of using co-operative learning approach, 84%
of the teachers reported that they did not use co-operative learning approach in their teaching learning process. It was mainly because they were not aware of this approach.

Regarding the suitability of this approach in teaching majority of the teachers reported that the existing time table, the present syllabus and the present system of examination were not at all suitable for implementing this approach in schools.

The major reasons for not using co-operative learning approach were lack of training, lack of time, lack of suitable reference material, and also it was a laborious task for them. An important factor was that they many of the teachers were not at all aware of such an approach. Those teachers who were aware of it, and those who knew its importance and use, were of the opinion that cooperative learning approach really helped to develop the skills of learning Mathematics.

5.4 DISCUSSION

In this research the effects of the co-operative learning approach on the Higher secondary students’ critical thinking ability and problem solving ability in Mathematics were searched. For this an experimental group and a control group were formed, and the equivalent group pre test – post test design was adopted. The Jigsaw method developed by Aronson (1970) was applied to teach the experimental group. The control group was taught through the traditional method. Lesson plans were prepared using Jigsaw
method and traditional method to teach the units ‘Functions and Graphs’ and ‘Analytical Geometry’ in higher secondary first year Mathematics. Critical thinking ability test and problem solving ability test in Mathematics were constructed and validated by the investigator and administered as pre test and post test. An attitude scale towards co-operative learning approach to find out the change in attitude of the students towards co-operative learning approach after the experiment was done.

The findings of this research have indicated that the Jigsaw method of co-operative learning approach improved the critical thinking ability and problem solving ability in Mathematics of the higher secondary students. The study has further revealed that the students working together (co-operative learning) significantly outscored those working alone traditional method learning). These findings supported the large body of already available literature concerning co-operative learning approach and traditional learning environments as advocated by Hooper, (1992), Johnson and Johnson (1993), Slavin (1995), Klein and Doran (1999) and Webb, (1982).

Furthermore, the study has revealed that the benefits of co-operative learning approach have reached and affected positively not only the high achievers but also the low achievers equally. Both the high and the low ability students scored higher since they were working in groups than working alone. Also the students have benefited from heterogeneous co-operative groups and the interaction among them has not lowered the
performance of high ability students. This result is in consistent with the established findings of research on co-operative group composition as given by Johnson and Johnson, (1993). Simisek and Tsai, (1992), Paraston (1994), and Armstrong (1994) and also it is in line with Slavin (1991) who told that the gifted students gained just as much from co-operative groups as the average or the low achieving students in all areas. The students who learned through the co-operative learning approach developed their critical thinking ability to higher level than that of the students who learned through the traditional method of teaching. Both, the urban and the rural, the middle and the low achievers benefited more from the co-operative learning approach in developing their critical thinking ability.

Co-operative learning approach remains one of the most effective approaches in developing problem solving ability in Mathematics among the Higher Secondary Students. As regards the problem solving ability of boys and girls, rural and urban, high, middle and low achievers, when exposed to the different treatments like the co-operative learning approach and the traditional method, students of co-operative learning group possessed higher problem solving ability than the traditional method group. The investigator thus, considers that the use of co-operative learning approach is one of the most suitable approaches for teaching Mathematics, developing critical thinking ability and also for developing problem solving ability in Mathematics. It is also obvious from the results of the study that, it has improved the problem solving ability of boys and girls, rural and urban, and high, middle and low
achievers depending on their exposure to the co-operative learning approach. Therefore if we want to improve the problem solving ability in Mathematics of the higher secondary students, we have to embrace the co-operative learning approach in our schools. Teachers could encourage teamwork among students in order to make them work together co-operatively.

It was observed that the students of the experimental group showed a positive attitude towards co-operative learning approach. Most of the students in the experimental group preferred co-operative learning approach as a teaching method in learning Mathematics. Johnson, Johnson and Smith (1991) suggested that poorly designed group learning could produce worse results than competitive approaches. Actually, the co-operative learning approach required that all members of the group agree on the team goals and each member must attribute his or her own success to the success of the group to maximize the learning potential of the whole group as told by Cooper et al., (1994).

Though majority of the teachers did not have the awareness about co-operative learning approach, they have shown a positive attitude towards it. If they are given proper training and reference materials, they would implement this approach in their teaching learning process. Therefore, if co-operative learning approach is employed in teaching Mathematics certainly it would help to enhance critical thinking ability and problem solving ability in Mathematics among the students.
5.5 EDUCATIONAL IMPLICATIONS

The results of this research got from the limited sample, with regard to the effect of co-operative learning approach on the variables, critical thinking ability and problem solving ability in Mathematics, gave the following implications:

From the results found out in this study, the co-operative learning approach remains to be more effective one to enhance critical thinking and problem solving ability in Mathematics among Higher Secondary students.

Developing critical thinking skill and problem solving ability requires, on the one hand, adequate pedagogical treatment (co-operative learning approach) and on the other hand encouragement (educational philosophy), in addition to a suitable and tolerant intervention (teaching mentality and attitude). Hence, teachers should have a positive attitude towards cooperative learning approach and the students should be given chances to do group works, discussions, and presentations and peer learning in the day to day regular teaching-learning process.

Co-operative learning approach brings out all human potentialities such as motivation, sharing, and full self expression. These potentialities in turn have brought out positive changes in their learning process and in performance. Therefore the teaching learning process should always include proper motivation by the teachers for learning. It also should include encouragement to the students to share their ideas with their peers and they should also be given ample opportunities to express themselves.
Critical thinking is important for situations where logic needs to be used to solve a problem. So schools should place higher emphasis on developing critical thinking ability of the students instead of encouraging rote memorization.

Another implication of this study is that the encouragement of co-operation in group work. Interaction in co-operative groups develops team spirit, brotherhood and individual accountability that lead to a better socio-cultural environment.

It is very clear that the co-operative learning approach shares many of the theoretical postulates brought forth by Vygotsky’s Socio-Constructivism, Constructivist principles of Piaget’s Psychogenetic theory as well as Asubel’s theory of Significance Learning that leads to self structuring of knowledge among students. Thus the students turn out to be the true agents and the ones ultimately responsible for their own learning process and constructors of knowledge.

A much deeper implication of this study is that it contributes greatly towards Constructivist principles and thus students are taught to think and to create and not to repeat and accept what is already established.

We can very well infer from the results of this research, that the teachers experience some practical difficulties to implement co-operative learning approach in their teaching learning process. Further they feel that they are not capacitated, not aware of the roles, and the related resources available. It implies that necessary steps are needed to be taken to give
orientation and training programmes to the teachers to make them aware of the importance and benefits of the co-operative learning approach.

The research implies that co-operative learning approach has positive effects on pupils’ empathy, tolerance, and feelings of acceptance, friendship, and self confidence. Sustenance of these values among the students has been considered as one of the most important aims of education.

Co-operative learning environment is conducive for children to learn better and faster from children of their own age than from a teacher. The students who are weak and not able to follow the teachers in the classroom often learn from their peers and such a practice need to be encouraged in all educational contexts.

It is also implied that co-operative learning improves the pupil’s sense of duty as each participant has to carry some responsibility on his own learning as well as that of the other participants. This reflects a transfer from focusing on the self to taking others also into consideration as well. Thus the classroom activities that are conducted following the principles of co-operative learning approach would help to empower the students with duty consciousness, sense of responsibility and a concern for others.

The research has revealed the relationship between co-operative learning approach and critical thinking. Students, who mastered the co-operative learning approach, mastered the skills of critical thinking as well. Thus co-operative learning is a valuable tool for developing critical thinking, high self confidence, empathic approach, communication skills, problem
solving, creative thinking, social skills and more than that learning to live together for it creates the most desirable classroom environment where the learners experience psychological safety, intellectual freedom, and respect for one another as persons of worth.

5.6 RECOMMENDATIONS

i. Co-operative learning approach increases critical thinking ability and the mental ability of the students, which tends to resolve problems associated with life. Therefore suitable steps may be provided to learn Mathematics through the co-operative learning approach.

ii. Co-operative learning approach strengthens the learners’ cognitive structure by building up new ideas to solve critical problems. So it is advisable for the teachers to adopt co-operative learning approach in their teaching learning process. It helps the teacher to avoid maladjustment among the students.

iii. This study highlights the need for arranging suitable training programme in the preparation and use of co-operative learning approach for teaching Mathematics. Faculty improvement programmes namely orientation courses, refresher courses, seminars and workshops could be organized for teachers to familiarize them with the various aspects and techniques of co-operative learning approach.

iv. Co-operative learning approach can be used in teaching Mathematics at the elementary level onwards.
v. More comprehensive researches could be undertaken to determine the effect of co-operative learning approach in Mathematics teaching.

vi. Problem solving ability situations could be encouraged so as to develop the life skills of the students and manage their lives in healthy and productive manner.

vii. Necessary arrangements could be made to provide training to teachers about using available resources to teach Mathematics using co-operative learning approach and to overcome administrative and curricular problems.

viii. Curriculum could be reconstructed from examination centric practices to experience based learning.

ix. This study highlights the need for making changes in the present syllabus and existing examination system for the effective implementation of approaches like cooperative learning.

x. Flexible time table for implementing co-operative learning approach effectively may be designed in schools.

xi. For implementing co-operative learning approach, every school and college may be equipped with suitable contents, literature related to it and other reference materials to familiarize the teachers with this approach.

xii. Government and other agencies, the central and states have the responsibility to take remedial measures and give encouragement to teachers to promote co-operative learning approach in schools.
xiii. The present B.Ed and M.Ed curriculum could be reconstructed so as to include the importance, use and practice of co-operative learning approach in it.

xiv. The teacher pupil ratio may be reduced for providing individual attention when the students are working in groups.

xv. Ample time could be allotted for students for discussion, doing exercises, reflection and planning critical thinking and problem solving strategies.

xvi. Students could be given favorable atmosphere, reinforcement, and motivation at the right time to develop their critical thinking and problem solving abilities. Also more opportunities could be provided to students to organize and analyze situations related to their learning.

xvii. It is strongly recommended that the co-operative learning approach could be a part of the daily instructional programme used in all classes in general and in Mathematics classes in particular.

xviii. Though the study reveals that majority of the teachers have the inclination to adopt co-operative learning approach in their classroom, how far this preference would be put into action needs further investigation. However, co-operative learning approach provides a positive note on their readiness to take up responsibilities to move ahead in the desired direction. Even while the entire system of education works on a competitive mode, co-operative learning
climate in the classroom can be created. In order to turn this into action, teachers need training in co-operative learning approach and its strategies through in-service programmes.

5.7 LIMITATIONS OF THE STUDY

i. In the preliminary stage, the investigator thought of conducting the study for six months including all the lessons in plus one higher secondary Mathematics. But the school authorities did not allow to conduct the experiment for a long period.

ii. The lesson plans developed for teaching Mathematics using Jigsaw method, may have its own limitations, since the investigator is not a pioneer in this area. But while developing the learning materials due care was taken to seek the expert opinions whenever necessary.

5.8 SUGGESTIONS FOR FURTHER RESEARCH

i. Effectiveness of Co-operative learning approach can be studied in comparison to other approaches of teaching.

ii. The effectiveness of Co-operative learning approach can be tested with more topics in Mathematics for accurate results.

iii. Similar studies can be conducted in other school subjects like Science, English, Social science, etc.

iv. Experimentation can be undertaken at elementary, primary and high school levels.

v. Similar studies can be conducted in teacher education and other professional courses.