CHAPTER V

DISCUSSION, CONCLUSION AND RECOMMENDATION

In this chapter the researcher presents three different topics. They are discussion, conclusions, limitations and recommendation. Each point of this chapter is presented as follow:

Discussion

Students' low performance in mathematics and poor social skills was the main reason behind conducting this research. According to the past research cooperative learning has been one of the most successful strategy to improve mathematics achievement of the students. Therefore, the researcher conducted the experimental research to find out the effects of cooperative learning on students' mathematics achievement and social skills in Bhutan.

The finding emerging from statistical analysis of the data collected by using t-test were analyzed by paired sample t-test and independent sample t-test to determine the effects of cooperative learning on the students' mathematics achievement and social skills. The various techniques of cooperative learning were used as treatment to the experimental group that is class VI A (n=23) for 24 lesson periods (1 month). On the other hand the control group, that is class VI B (n=23) was taught by direct instruction method for the same duration as experimental group. Mathematics achievement test and social skills check list were administered by experimental and control group as pre-test and post-test.

The result of the study clearly indicated the positive effect of cooperative learning on students' mathematics achievement and social skills. The result of the study is discussed below:

1. **The first research objective**

Pre-test of experimental and control group were compared according to the first objective. The result of the comparison of pre-test of experimental and control group showed that there is no significant difference in the score of pre-test of experimental and control group which was the clear indication that the students of

both the groups were of same background. Thus there was no bias in assigning class VI 'A' into the experimental group and class VI 'B' into control. It also means that when the students' are recruited for the respective classes in Bhutan, it is made sure that the background (the classes contains the students of all ability group) of the students are same in the respective classes.

2. The second research objective

The second research objective compared the pre-test and post test of the experimental group. After the implementation of cooperative learning, the students' mathematics achievement improved significantly then that of before the implementation of the cooperative learning.

This is consistent with the findings of Slavin [23, 20, 11, 12]. These entire researchers have conducted research to study the effect of cooperative learning on students' achievement on various content areas. The result of their study showed that the cooperative learning has positive effect on students' achievement.

In addition, the current research is more consistent with the Whicker [17, 98, 116, 7, 14, 15]. All of these researchers have studied the effect of cooperative learning on students' mathematics achievement. The result of these studies indicated that mathematics achievement of the students' increases after cooperative learning. These provided further evidence that the cooperative learning improves the students' mathematics achievements.

There are various factors which support the positive effect of cooperative learning on the improvement of students' achievement, such as students willingness to learn [20, 21, 22] students' attitude [11] interactive environment [12]. Gillies [95] agreed that the positive effect of cooperative learning on the students' achievement is the attribute of students' willingness to do the assigned work as they get more elaborated help and assistance to each other. Ajaja [11] supported that positive effect of cooperative learning on students achievement is the attribute of students' positive attitude towards the respective subject. Iyer [12] found the positive effect of cooperative learning is the attribute of thought provoking and interactive environment and student learned to find the answer from within them. Therefore, all these researchers agreed that the positive effect of cooperative learning is the attribute of children willing to work with other on the assigned work, get more elaborate help, get more opportunity to work together; they develop a stronger perception and social responsibility.

Traylor [21] has mentioned many factors that effects students' learning such as socio economic factor, parent's involvement, school structure and resources, safety, learning disabilities, language barriers, teacher and administration and students' willingness to learn. He further added that even if one factor is missing, he or she will be able to learn. However, the willingness to learn trumps all other factors. In the cooperative learning students will have higher sense of efficacy in learning and performing the given tasks. In the cooperative learning, students are motivated to learn [22]. In the other word we can say that students in the cooperative learning have the willingness to work which results better performance.

The study of mathematics equips students with a powerful set of tools. It allows for logical, rational, abstract and strategic thinking. Students develop the ability to think in a clear-cut, structured fashion, apply reasoning, formulate problems and find solutions to them. It hones higher order problem-solving and analytical skills and the ability to think in 'out-of-the-box' ways. Statistics focus on the use of patterns and finding relationships in data. Both help in interpreting and making sense of the world around, in everyday situations, the workplace and real-life contexts. A universal subject, mathematics transcends boundaries of culture and language, promotes students' intellectual growth and makes them, more complete and well-rounded persons. At the professional level, basic mathematical skills with their close link to ICT equip the individual with the capability to focus on problems, to have the discipline to persist and prevail in the task at hand, and to strategise [31]. However it has been always observed that the achievement levels of students', particularly in mathematics, at the end of the primary education were disappointingly low [31].

According to Beonero [94] students' mathematics achievement can be improved by the cooperative learning, due to the following advantages of cooperative learning:

1. Addressing the scientific concepts through different activities makes students more interesting, more exciting and more participating.

2. Direct reinforcement was considered during the process of implementing various activities for learning principals, concept and skills.

3. Providing opportunities for dialogue and free debate gave special consideration to the intelligence, ability and inclination of students at primary stage.

4. Providing an opportunity for group member to learn from each other.

5. Generating more interest in mathematics and making it more enjoyable.

Learning will be more successful if students are given an opportunity to explain and clarify the idea [8] Students in the cooperative learning setting, improves their problem solving skills and mathematical understanding. In the cooperative learning, the implementation of the exchange of knowledge setting students promotes active exploration. Students receive verbal explanation in the pre dominant type of help. The students' attitude toward the exchange of knowledge will be positive. All these ultimately lead to higher mathematics achievement [119].

In addition, the researcher also observed that the students in the experimental group were communicating effectively, they have learnt to maintain eye contact when they talked with their group members; they could solve conflicts in a peaceful way by discussing with their friend; they took turn to share their idea/s to their friends; they could share, discuss and explain the content to their friend; they maintained appropriate personal space with their friends; they also trusted, cared and helped their friends in the group; they also monitored their own learning and they felt free to makes choices to solve problems. Thus, the result of the study revealed the improvement in the students' mathematics achievement. The researcher strongly supported that although mathematics learning is personal investment, when students received help and support they could learn even better and when student learnt mathematics by sharing, discussing and explaining with good communication skills they understood and could solve the problem better.

3. The third research objective.

Furthermore, the post-test score of the experimental group was compared with the post-test score of the control group in the third objective. The result clearly indicated significant difference in the score of post-test of experimental group and control group. It indicated that post test score of experimental group is comparatively better than that of control group. According to the third objective, the researcher have also compared between the mathematics achievement of the students who are taught by cooperative learning and direct instruction as the mathematics achievement of the post-test of the control group and the post-test of experimental group was compared according to the second objective. The result of this research clearly indicated that the

students who were taught by cooperative learning (post-test of experimental group) performed better than the students who were taught by direct method.

During treatment period, the researcher observed that the students in the cooperative learning group were more interested and encouraged in learning mathematics in the classroom. They were able to clear their doubts and problems with their group member. They tried to help and share their ideas with the other in the cooperative learning. Whereas in direct instruction group, students were very shy. The students in the control group were unable to clear their doubts as they lack courage to clear the doubts to their friend or the teacher. Furthermore, in the direct instruction, the student did not feel the responsibly to help the other students in the class, rather they had developed sense of competition with other.

The researcher observed the reason for direct instruction to be less effective could be due to following reasons:

1. In the direct instruction learning, students hardly get an opportunity to show their creativity. Students are supposed to solve the problems in the steps that are explained by the teacher or they have to follow the procedure taught by teacher.

2. Students get very less opportunity to critic, discuss, share, and explain while learning mathematics. Thus student tend to forget what they have learnt very easily.

3. Student enjoys learning when they get involved in the activities rather than learning individually. But, direct learning is teacher centered.

The findings for this research also recommend implementing cooperative learning in teaching and learning rather than direct instruction. As with the result of this research it is very clear that cooperative learning is very effective in helping students learn better and improve achievement.

4. The fourth research objective

The fourth research objective compared the social skills of the students before and after cooperative learning. Paired sample t-test was used to determine the difference in the social skills. The check list as instrument in this research was developed based on the literature provided by Canney and Byrne [30].

The third research objective result clearly indicated that social skills of the students are better in the post test than in the pre test. More specifically, the students' social skills increased after the implementation of the cooperative learning than before the implementation of cooperative learning.

The result of this study strengthened the respective findings reported by Ebrahim [20, 113, 116] regarding the positive effect of cooperative learning on social skills. The cooperative learning has the positive effects on the students' social skills [113, 20] The reasons behind the effectiveness of cooperative learning for improving students' social skills are as follow:

1. In the cooperative learning students feel the responsibility for each other's learning [37].
2. Cooperative learning improves the overall communication skills in the students [33].
3. Cooperative learning makes the students more socialized [116].
4. Cooperative learning promotes learning and cognitive development [42].
5. There are certain skills in cooperative learning which actually compose social skills. They are goal setting, leadership skills, forming skills, functional skills, formulating skills and synthesizing skills [83].

The current study was developed on the premise that social skills can be valuable curricular target in the wholesome education. Indeed, there have been claims in the education system of Bhutan that the education should develop social and human values needed for enhancing one's life-long well-being, functioning as responsible citizen, contributing to Bhutan's economic prosperity and to the social and cultural life of the community in which they live [30].

Effective social problem solving requires reading one's own and others' feelings, and being able to accurately label and express those feelings. Such skills are aspects of social and emotional learning [101, 103] stated that well-developed social skills can help youth with disabilities develop strong and positive peer relationships, succeed in school, and begin to successfully explore adult roles such as employee, co-worker/colleague, and community member. Social skills also support the positive development of healthy adult relationships with family members and peers.

Hair, Jager and Garrett [102] observed that adolescents, who have strong social skills, particularly in the areas of conflict resolution, emotional intimacy, and the use of pro-social behaviors, are more likely to be accepted by peers, develop friendships, maintain stronger relationships with parents and peers, be viewed as effective problem solvers, cultivate greater interest in school, and perform better academically.

Adequate social skills need to be acquired while students are still enrolled in school and further supported and refined in postsecondary, community, and work settings. Gresham, Sugai and Horner [104] noted that deficits in social skills are key criteria in defining many high-incidence disabilities that hinder students' academic progress, such as specific learning disabilities, attention deficit/hyperactivity disorder (ADHD), mental retardation, and emotional disturbance. Therefore, helping students learn social skills is a proactive approach to minimizing the impact of these types of disabilities on school success.

This result provides evidence that the development of social skills is an achievable goal for the students, provided we implement cooperative learning as teaching and learning strategy.

5. Comparison of cooperative learning techniques

Besides paired samples t-test and independent samples t-test the researcher also compared pre-test and post-test score of think pair share, group investigation, TAI, 3 minute review, jig saw, round robin brainstorming and STAD. The result showed that the percentage of improvement between pre-test and post-test score as, 10.90909 % between the pre-test and post- test score in think pair share, 19.5122 % between the pre-test and post test score in TAI, 77.77778 % between the pre test and post test score in jigsaw, % 6.25 % between the pre-test and post-test in STAD, 57.89474 % between pre-test and post-test in group investigation, 16.22% between pre-test and post-test of in round robin brain storming and 12.12 % between pre-test and post test in 3 minute review. It indicated that amongst the techniques of cooperative learning (think pair share, TAI, Jig saw, group investigation, STAD, round robin brain storming and 3 minute review) jigsaw is the best technique which showed the largest amount of improvement (77.77778 %) between pre-test and post-test. It is illustrated below in the table.

Table 30 Comparison of the mathematics score of pre-test and post-test of each technique of cooperative learning (experimental group)

Participants	Think Pair Share (5 questions)		TAI (3 questions)		Jig saw (9questions)	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
1	3	3	2	2	1	6
2	2	1	2	3	3	6
3	2	4	2	2	5	7
4	2	2	2	1	4	7
5	2	0	1	2	1	6
6	3	3	1	2	4	6
7	2	3	1	1	3	7
8	2	2	1	3	5	7
9	4	3	3	3	4	9
10	3	3	3	2	4	8
11	1	2	1	1	4	5
12	2	3	0	3	2	4
13	3	2	2	2	3	7
14	3	3	2	3	7	8
15	2	4	2	2	3	7
16	2	3	2	2	4	6
17	2	4	2	1	4	9
18	3	3	3	3	3	6
19	2	3	2	1	5	7
20	2	2	2	3	3	1
21	2	2	2	2	4	7
22	3	4	1	2	2	6
23	3	2	2	3	3	2
Total	**55**	**61**	**41**	**49**	**81**	**144**
Percentage of improvement between pre-test and post-test in each technique	**10.90909**		**19.5122**		**77.77778**	

Table 30 (cont.)

Participants	Group Investigations (2questions)		STAD (4 questions)		3 minutes review (4questions)		Round robin brain storming (3 questions)	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post- test	Pre-test	Post- test
1	1	2	1	2	2	1	0	0
2	0	2	1	3	0	2	1	3
3	1	1	2	3	1	2	1	2
4	0	1	2	4	0	3	0	1
5	0	1	2	2	2	1	2	3
6	1	0	1	2	1	2	1	2
7	1	1	1	3	1	2	1	3
8	0	2	3	2	1	2	1	3
9	1	2	3	3	2	2	2	2
10	1	2	2	1	1	3	2	2
11	0	1	2	2	3	1	1	1
12	2	1	2	1	3	2	1	2
13	0	1	3	2	2	2	3	2
14	2	2	2	3	2	0	2	2
15	2	2	1	3	1	2	2	3
16	1	1	2	2	2	2	2	0
17	0	2	3	2	1	2	3	0
18	1	1	1	1	1	2	2	1
19	1	1	3	2	1	0	2	1
20	1	1	3	3	2	0	2	2
21	1	1	2	2	1	2	2	3
22	1	2	3	2	1	2	2	3
23	1	0	3	1	2	0	2	2
Total correct answers in each group	**19**	**30**	**48**	**51**	**33**	**37**	**37**	**43**
Percentage of improvement between pre-test and post-test in each technique	**57.89474**		**6.25**		**12. 12**		**16.22**	

The effectiveness of jigsaw, observed by the researcher during the cooperative learning classroom (during the experiment) is shown below:

1. Students' reluctance to participate in the activity was reduced.
2. Each student's part was essential for the production of the final product.
3. Students were so cooperative to produce the final product.
4. There was active learning environment.

Furthermore the researcher also compared the mathematics score of control group and experimental group in each technique. The result showed that the mathematics score of all the techniques (post-test) is higher in terms of experimental group than control group. It clearly indicated that cooperative learning such as think pair share, TAI, Jig saw, group investigation, STAD, round robin brain storming and 3 minute review are effective in mathematics. It is illustrated below in the table.

Table 31 Comparison of the mathematics score of each technique of cooperative learning (experimental group) with the mathematics scores of control group

Think Pair share			Group investigation			TAI			3 minute review			Jigsaw			STAD			Round robin brainstorming		
Question Number	Control Group	Experimental Group	Question Number	Control Group	Experimental Group	Question Number	Control Group	Experimental Group	Question Number	Control Group	Experimental Group	Question Number	Control Group	Experimental Group	Question Number	Control Group	Experimental Group	Question number	Control group	Experiment-al group
1	11	18	12	16	18	29	15	16	2	10	12	8	17	19	10	19	21	16	18	14
5	4	5	13	4	12	30	18	18	6	4	5	21	6	9	14	0	3	18	8	13
20	5	9				11	7	15	17	14	16	24	6	13	22	7	12	19	15	16
4	10	6							28	1	4	26	8	18	23	10	15			
7	18	23										25	2	15						
												3	20	21						
												27	8	13						
												15	20	16						
												9	17	20						
Total number of correct answer	**48**	**61**		**20**	**30**		**40**	**49**		**29**	**37**		**104**	**144**		**36**	**51**		**41**	**43**

Conclusions

The conclusions of this study based on the data analysis are as follow:

1. There was no significant difference in the students' mathematics achievement between the pre-test of experimental and control group. The value of significant (2 tailed) was 0.862 thus the H_0 (student's mathematics achievement of pre-test of experimental and control group will be significantly different) was rejected and H_1 (student's mathematics achievement of pre-test of experimental and control group will not be significantly different) was accepted.

2. There was significant difference in the students' mathematic achievement between the pre-test and post test of the experimental group. The value of significant (2 tailed) was 0.000 thus the H_0 (students mathematics achievement of the experimental group will not be higher in the post-test than pre-test) was rejected and H_1 (students mathematics achievement of the experimental group will be higher in the post-test than pre-test) was accepted.

3. There was significant difference in the students' mathematic achievement between post test of control group and post test of the experimental group. The value of significant (2 tailed) was 0.000 thus the H_0 (students mathematics achievement of the post-test of experimental group will not be higher than the post-test control group was rejected and H_1 (students mathematics achievement of the post-test of experimental group will be higher than the post-test of control group) was accepted.

4. There was significant difference in the social skills of the students between pre-test and post-test. The value of significant (2 tailed) was 0.000 thus H_0 (students' social skills of the experimental group will not be higher in the post test than pre-test) was rejected and H_1 (students' social skills of the experimental group will be higher in the post test than pre-test) was accepted.

Limitation

The limitation of the study was found when research was conducted and might have effect on the interpretation or the result of this study. They are as shown below:

1. The research was conducted on the smaller number of sample.
2. The research used only quantitative research method but it would be better if both the quantitative and qualitative research method.

Recommendation

Referring to the results of the study some recommendations and proposals could come up as follows:

1. The mathematics syllabus of Bhutan needs to be planned and organized in such a way that it facilitates many activities of cooperative learning.
2. All the teachers of Bhutan should be well trained about the implementation of the cooperative learning so that they can incorporate it in their teaching to improve students' achievement and social skills.
3. The result of the few studies are in sufficient to decide about the maximum use of cooperative learning in our culture, thus a series of action researches on cooperative learning such as rural, urban, male, female students and different levels should be carried out.
4. Need to conduct similar studies on a larger sample than current study sample so as to reach better results.
5. Conduct studies in the following areas:

5.1 The impact of the use of cooperative learning in mathematics on the critical thinking and problem solving skills in all stages of basic education.

5.2 What are the types of social skills that can be improved by cooperative learning?

5.3 Challenges of incorporating cooperative learning in teaching various subjects.