CHAPTER I

INTRODUCTION

Background

The demography of our mathematics classrooms is changing and reflects more diversity in cultures, ethnic groups, and languages. At the same time, mathematics education is also changing as teachers emphasize on more problems solving, hands-on activities, interactive learning experiences, the use of a variety of technological tools, and newly introduced assessment systems. The NCTM (1998) curriculum and evaluation standards call for an "Opportunity for all students to public schools pointed out that instead of diversity being viewed as a challenge, it can now be seen as a gift". Along with the gift of diversity it has brought more responsibilities. Empowering mathematics programs are inclusive since they use different languages, culturally diverse situations, different teaching materials and methodologies that make mathematics easily reached.

The CDC Nepal has also been changing time-to-time the policies, curriculum, instruction and assessment system, now, more specifically in primary level where it is about to implement and extend the policy of liberal promotion system as well. These changes are the principal components of a concerted effort to create equitable and high-quality learning opportunities for all students, including those groups whose achievement has been impeded because of social injustices in school practices and policies. As Oakes (1990) stated both minorities and girls must be provided an equal opportunity to acquire the mathematical skills essential for employment, leadership positions and social and economic advancement in an increasingly technological society. Equity in mathematics education implies fairness, justice, and equality for all students so that they may achieve their full potential, regardless of race, ethnicity, gender, or socioeconomic status (Blair, M. & Bourne, J., 1998). Even having worthy goal, policy and curriculum according to the need of contemporary society if there is no better delivery system of teaching/learning then, neither one can achieve the objectives nor provide the alternatives. Thus, it has become essential to discuss and find the effective ways of teaching/learning system.

In ancient period, traditional conceptions of teaching emphasized direct instruction - the transmission of information from the head of *Guru* (teacher) to the head of *chela* (learner/student). It would be worthy to once remind the schooling system of our ancient period where the students used to go to Gurukul (*Aashram of guru*) for the study like, god Ram had gone to residence (*Aashram*) of Bashistha and god Krishna in residence of Sandipani. This is what Gurukul system was, in fact. According to Giri (2005) this is the great tradition and property of Arya society. In the past, learning methodology was oral, telepathy, audio, memorization, self-study (study and teach) etc. Until now, it has been following the methods of parrot learning, memorization, thinking/rethinking, lecturing, explanation, question/answer, discussion, debate, self-study, rote learning etc. (Swaminathan, 2000). He further added that many more minds lacked behind in mathematics learning and they have also phobia towards it. Even in family, many parents see themselves as poor in mathematics. The parents afraid of it so that they usually say oh! No, sorry to help for mathematics homework, even of younger children. Even they say that mathematics is a male subject. It seems that some of the baseless propagandas and math- phobias are the outcomes of defective traditional learning pedagogies. According to Erica N. Walker and Leah P. McCoy (1997) parents are most important influence on students' mathematics performance, only slightly ahead of the students' own motivation.

In this context few of the statements (Sanskrit, Nepali, English and Chinese) seem to be relevant e.g. *Bade bade jayate tatwo bodha; Hisab nagare - naudinma naulo, bishdinama birsane, tisadinma tarsine*; practice makes a man perfect (In addition, for mastery in mathematics it needs only three things to do i.e. practice, practice and again practice). Similarly, a Chinese proverb says that I hear and forget, I see and remember but I do and understand. All these proverbs mean to learn and bring it in regular practice with appropriate learning methods, and make the mathematics meaningful in real life situation; it seeks not only the group work inside the classroom rather it searches the help of peers. The remedial classes, coaching, tuition, parents' guidance etcetera whatever the name we might have given to it but its intention is how to make learning mathematics joyful, creative, student-centric and meaningful where we see the effective role of sharing and learning in groups.

In the classroom situation, what we observed was that the student doesn't speak because s/he perceives that everyone, except s/he, understands well that what's going on in subject matter. Consequently, they rarely spoke up in mathematics class unless their teacher directly asked them a question. Students' views of mathematics teachers are most often directly linked to how the teacher interacts with them on a personal level. Good students encouraged their friends to "try harder" and "do better". Matthews (1984), Stiff and Harvey (1988) argued that students who are self-motivated and had parents and peers to support them tended to do better in mathematics and realized its importance to their future goals. Also, the students have never seen the mathematics teachers as professional persons so that they don't think that they can have good career in mathematics sector. It is imperative that schools and teachers recognize that what occurs in classrooms can negatively affect students' achievement. The mathematics teachers must realize that his or her classroom environment may be damaging to the confidence of the students. Thus, the classroom should have conducive environment where students could expect to excel their potentiality. The schools, teachers and parents should work together to ensure that nurturing occurs both in the classroom and home.

According to Artzt & Thomas (1992), as teachers developed new understandings about mathematics, they became aware that previously they had been "feeding" a set of pre-established procedures to the students and training students to "parrot back" these procedures. It was supposed that more the rote learner more good in mathematics. So, there was no space for critical thinking, no value to pre-existed knowledge of students, teachers don't know that mathematics cannot be taught, so, just to mediate it. The high sounding methods were as chalk and talk method, repeating definitions, deductively use of symbols, rules and formulae etc. The accuracy and speedy in calculation by drill and practice were supposed to be the indicator of doing well in mathematics (Baker, 1991). The creative ways to think, peer share, reason, analyze, articulate logically, negotiate in peers' logics, present ideas, come to in consensus within group, as learning process all were ignored. However, the learning system has been changing and crawling towards what the learning theories say.

Learning is a process that brings together cognitive, emotional, and environmental influences and experiences for acquiring, enhancing, or making changes in one's knowledge, skills, values, and world views (Illeris, 2000; Ormorod, 1995). Learning theory is an attempt to describe how people learn thereby helping us to understand the complex process of learning. So, it is clear that the theories do not give the solutions, but they do direct our attention to those variables that are crucial in finding solutions.

The major learning theories are behaviorism, cognitivism, constructivism and social learning theory. Similarly, the theories most related to mathematics learning are Ausubel's meaningful learning, Diene's views on learning mathematics; Gagne's learning theory, Skemp's psychological learning of mathematics, Bruner's and Vygotsky's learning theory and Piaget's Cognitive learning theory (Upadhyay, 2007).

Out of these mathematics-learning theories, I have used the cognitive constructivism learning theory based on Piaget's cognitive learning theory through mental action to construct the mathematical knowledge and skills. Moreover, it has also adopted the social and peer-group friendly environment as stated by Vygotsky's learning theory, which has been designed for cooperative learning approach. According to Piaget, the role of teacher inside the classroom is to provide rich environment for the spontaneous researches. As the features of Piaget's learning approach, the cognitive development refers to understanding mathematical concepts and ability to think and reason. In terms of cognitive development, Piaget says that the students learn when there is a conflict between what they think and new information that they receive. Often this causes the student accommodation or to modify a cognitive schema, based on new information. He added that a cognitive schema is a cognitive structure that organizes information, making sense of experience. Students develop schemas in many different domains: motor, language, thinking, social etc. Students interpret the world and experiences in term of their cognitive schemas. The students grasp mathematical concepts in terms of contextualization in cut-pieces when they are able to talk about them among the peers. Piaget (1965) claimed that learning couldn't be fulfilled as passively as getting ready-made bread and gift. It is also said that mathematics cannot be taught, what can teacher do is just mediating for learning. So, it needs the schema, which is a framework that exists in a mind to organize and

interpret the information. It is also the potential to act reflexes (sucking, looking, reaching and grasping) in a certain ways in groups where they fit new information into existed schemas (assimilation). It brings modification in cognitive structures (accommodation) and produces uncomfortable then motivates to keep searching for solution to reach to the new (equilibrium) position.

The cultural background affects cognitive developments by helping to define what the students know, what is important, how they approach new tasks and interact with the peers. Learning is an active social process in which making errors and finding solutions go side by side in the peer groups. So, the instruction and classroom environment should always try to meet the interest and need of the different students. This means socialization is an important aspect for cognitive development. The teachers should give freedom to the students to learn and construct mathematical meaning. It is necessary to relate the students to their own world in own pace and strategies through individual developmental process. In this process, the students, in peer groups, are interacted, assimilated, accommodated and undergone to equilibrium position with new concepts of mathematics. Then, they individually realize the mathematical meaning and concepts, and finally they construct the mathematical knowledge. It was an envision of cognitive constructivism theory undertaken to this research study.

Introduction of the Study

The students receiving education services often lack the academic and interpersonal skills to achieve success within school settings. Students deficient in these skills are likely to become unmotivated learners and inactive participants in the classroom (Maheady, 2001). Cooperative learning provides a means for educators to positively influence social and academic outcomes for students with disabilities to facilitate student motivation and active participation within the classroom. Cooperative learning is an instructional strategy which places students in small groups and encourages individuals to work together for solving common problems, completing academic tasks, and learning specific content (Siegel, 2005; Slavin, 1995). Through cooperative learning, positive interdependence is developed through students sharing resources and working towards common goals (Abrami, Poulsen, & Chambers, 2004), which provides students opportunities to experience the dynamics

of team building (Dyson & Grineski, 2001; Dyson & Rubin, 2003; Grineski 1996). Students become responsible not only for their own learning, but for the learning of others (Mercer & Mercer, 1998). So, this is a teaching/learning method, which creates an environment of win-win situation among all.

Cooperative learning is as such the students working together to "attain group goals that cannot be obtained by working alone or competitively" (Johnson, Johnson, & Holubec, 1986). The main purpose of cooperative learning is to actively involve students in the learning process; a level of student empowerment which is not possible in a lecture format. Therefore, it is a process, which requires knowledge to be discovered by students and transformed into concepts to which the students can relate. The knowledge is then reconstructed and expanded through new learning experiences. It believes in learning takes place through dialog among the students in a social setting.

As Ritt (2006) argued that cooperative learning is a methodology that employs a variety of learning activities to improve students' understanding of a subject by using a structured approach, which involves a series of steps, requiring students to create, analyze and apply concepts. Kagan (1990) added that cooperative learning utilizes ideas of Vygotsky, Piaget, and Kohlberg in that both the individual and the social setting are active dynamics in the learning process as students attempt to imitate real-life learning. By combining teamwork and individual accountability, students work toward acquiring both knowledge and social skills. This method allows students to work together in small groups with individuals of various talents, abilities and backgrounds to accomplish a common goal. It can be concluded that each individual team member is responsible for learning the material and also for helping the other members of the team learn. Students work until each group member successfully understands and completes the assignment, thus creating an "atmosphere of achievement". As a result, they frame up new concepts being based on their prior knowledge and conclusions.

According to Johnson and Johnson (1989), cooperative learning experiences promote more positive attitudes towards the instructional experience than competitive or individualistic methodologies. The cooperative learning should result in positive effects on student achievement and retention of information (Dishon & O'Leary,

1984; Johnson & Johnson, 1990; Slavin, 1991). According to Mc Keachie (1986), students are more likely to acquire critical thinking skills and meta-cognitive learning strategies (as cited in Swortzel, K. 1997). It implies that cooperative learning, as an instructional methodology provides opportunities for students to develop skills in-group interactions and in working with others that are needed in today's world.

It is advocated that students should be provided with situations that allow them to construct and modify their mathematical knowledge through discourse (Yackel, Cobb, & Wood, 1991). Opportunities for students to communicate about mathematics arise when students work cooperatively on a problem (Artzt, 1996). Cooperative learning procedures are those that enable students to engage actively in the learning process through interaction and discussion with peers in small groups on inquiry tasks. It is a reciprocal process of mutuality where each other's reasoning and viewpoints are explored in order to construct a shared understanding of the task (Goos, 2000). These skills of positive interdependence allow the synthesis of independent and cooperative contributions thus making learning more successful than competitive or individualistic models (Brown & Thomson, 2000; Qin, Johnson, & Johnson, 1995). So, the structuring of cooperative learning increases the level of on-task discussion and provides a mechanism so that students can negotiate meanings from other students' task-related conclusions. Effective cooperative learning is not automatic. The situation requires structure with student-to-student interaction in small groups, individual accountability and responsibility, organized co-operation, and a common learning task or goal for the group.

Teachers have the option of structuring lessons competitively, individualistically, or cooperatively. The decisions teachers make in structuring lessons can influence students' interactions with others knowledge, and attitudes (Carson, 1990; Johnson & Johnson, 1987). In a competitively structured classroom, students engage in a win-lose struggle in an effort to determine who is best (Johnson & Johnson, 1991). In competitive classrooms students perceive that they can obtain their goals only if the other students in the class fail to obtain their own goals (Johnson, Johnson, & Holubec, 1986). Students in independently structured classrooms work by themselves to accomplish goals unrelated to those of the other students (Johnson & Johnson, 1991) whereas in a cooperative learning classroom,

students work together to attain group goals that cannot be obtained by working alone or competitively. In this classroom structure, students discuss subject matter, help each other to learn, and provide encouragement for member of the group, which are the basic ingredients for making learning meaningful. In regard to different methods of teaching learning, Upadhyay (in personal communication, August 8, 2009) argued that lecture method is adopted if no value is given to prior knowledge of the students and discussion method is applied when little value is given to pre-existed knowledge and skills of the students. To make the learning more effective; inductive and problem solving methods are used where the students use their potentiality. The cultural capital of the students should get proper place to make the teaching/learning meaningful. He also added, the cooperative method is one that gives significant role to cultural capital of the students to make their learning comfortable, joyful, meaningful and creative.

The cooperative learning is generally understood as learning that takes place in small groups where students share ideas and work cooperatively to complete a given task. There are several models of cooperative learning that vary considerably from each other (Slavin, 1995). In this method, the students work within their groups to make sure that all of them mastered the content. It means, essentially, cooperative learning represents a shift in educational paradigm from teacher-centered approach to a more student-centered learning in small group. It creates excellent opportunities for students to engage in problem solving with the help of their group members.

It can be concluded that the cooperative learning is the acquisition of knowledge and skill through active helping and supporting among companions. It is clear that cooperative learning is not a diluted and inferior substitute for professional teaching - it has quite different strengths and to deploy it to maximum learning so, the teachers need to be aware of its use (Topping, 2001). The core view of learning from peers' cooperation suggests that learners actively build (rather than acquire) their own knowledge, strongly influenced by what they already know. Learning is a social process of making sense of experience, constructing new representations of reality and further negotiating meaning through social activity, discourse and debate in groups (Tobin & Tippins, 1993). Duffy & Cunningham (1996) added that in the new education landscape, there are many pathways to arrive at the many peaks in the mountain range of talents over the past decade; the field of educational technology

has endorsed cooperative learning as a suitable referent for the development and meaningful use of appropriate software in education. Therefore, in this study, learning was viewed from the cooperative learning perspective.

Rationale of the Study

The teachers and practitioners use different working theories and their own practical classroom experiences give their views on how students learn and how their teaching can support this learning. Research can help us to refine these views and to recognize that certain methods work best for different kinds of learning. Drawing on this, teachers and practitioners can then use their professional experience and expertise to select appropriate methods to fit the learning needs of the students and the particular context in which these are occurring. Pedagogy is thus informed by an understanding of working theories, knowledge of the social context of the learning and the practical craft knowledge of teachers and practitioners as claimed by Rogoff (1991). So, at what degree these three components of pedagogy have been reflected and coordinated in the cooperative learning method, was a matter of investigation in Nepalese classrooms?

Thus, it was also aimed to assess the current teaching/learning classroom practices, problems and its learning worth that how this system of cooperative learning supports for formative assessment of their learning progress and needs. In fact, cooperative learning system provides the praiseworthy learning space for receiving feedback on students' behavior; being given opportunities to exercise personal choice; discussing their own and others' feelings, moods and emotions; discussing their own preferences and personal values; reflecting on their own learning and behavior and how it impacts on others; being provided with an 'emotionally safe' environment in which to talk about their thoughts and feelings; evaluating their own skills and abilities in working with others; identifying their own criteria for success; learning how to mentor and support the learning of others; personal goal setting; planning how to use their time and resources; predicting what they will do well and what they will have difficulty with; recognizing their own achievements, strengths and weaknesses; reflecting on learning styles and strategies – their own and those of others; reviewing and evaluating what they and others have done; specifying their own learning objectives etc. So, it was important to find out how have all of these

components of learning system been chanalized and functioning effectively within each friendship group.

According to Slavin (1995), the students are more likely to learn successfully in small groups where they feel unthreatened, secure, safe and valued; feel a sense of belonging to the group; are engaged and motivated; can see the relevance of what they are doing; know what outcome is intended; can link what they are doing to other experiences; understand the task; have the physical space and the tools needed; have access to the necessary materials; are not disrupted or distracted by others; can work with others or on their own, depending on the task; are guided, taught or helped in appropriate ways at appropriate times; can practice; can apply the learning in both familiar and new contexts; can continue when learning is hard; can manage their emotions if things are not going well; recognize that all learners make mistakes and mistakes can help them improve. These kinds of skills as such are essential ingredients for every learner, so they were to be tested in our classroom situation under the framework of cooperative teaching/learning method as Slavin (1995) has claimed so far, as these are the virtues of this method.

Moreover, according to Upadhyay (2001) the characteristics of Nepalese classrooms are as large number of students in a class, lack of T/L materials, overload of teaching-periods to the teachers, problem to finish the course in time, no matching evaluation system for formative learning etc. In addition, there are other problems as there is a gap in between the teachers and students that teachers could not understand the students' feeling, learning psychology, learning style, their pre-existed knowledge, learning pace, students' opinions, little bit domination and ignorance, no learning in cooperative way in small groups, less caring the individual difference etc. Hammond (2001) asked, "Do students learn more from their teachers or from their classmates?" He found that the students listen more to their classmates than to their teachers. In this context of Nepalese classrooms, the study has been taken place to over come with the contribution of cooperative learning method.

According to Joiner, (1991), the students think that following the teacher's instruction and do as teacher wants is their duty which is counted in discipline, honesty, moral character etc. But if it's a friend, they will keep asking until s/he tells more and more. Learning by cooperative method, the program not only helps weaker

students, it also benefits the stronger students in more ways than one. As they solve questions together, they reinforce what they know like "As I teach, I learn as well because I'm also revising the subject at the same time". Thus, it shows more importance of cooperative learning approach among the students of any standard, average than above and below both the levels.

To realize the benefits of cooperative learning, teachers must provide 'intellectual scaffolding' (Newman, Griffin & Cole, 1992). Thus, teachers leading students by selecting discussion topics that all students are likely to have some relevant knowledge of; they also raise questions/issues that prompt students to move towards more sophisticated levels of thinking. So, the cooperative learning process is formulated to get all group members to participate meaningfully. How far this concept has the strong roots, it was to get the concrete knowledge through this study from the real classroom practices.

As Stanne (2000) claimed that the cooperative learning is one of the most remarkable and fertile areas of theory, research, and practice in education. Cooperative learning exists when students work together to accomplish shared learning goals (Johnson & Johnson, 1991). For preventing and improving many of the social problems related to children, adolescents, and young adults, cooperative learning is the instructional method of choice. The combination of theory, research, and practice makes cooperative learning a powerful learning procedure. Thus, it was to be tested and established in natural setting of our classrooms using qualitative and quantitative both phenomena. It is, with this understanding, I undertook this research.

Research Questions

In this academic study, the underneath research questions were intended to be answered in Nepalese context:

1. Does cooperative teaching/learning approach get hold of better achievement than conventional teaching/learning system?
2. How does the cooperative learning system create self-regulation in students for learning mathematics?

3. How is the relevancy of cooperative learning approach in Nepalese classrooms?
4. How are the problems being faced by teachers while adopting the cooperative learning paradigm in T/L mathematics?

Statement of the Problem

It is observed that the students have shown the poorest result in mathematics among all the subjects whether it is the result of any grade or School Leaving Certificate or Higher level. The achievement of students is based on T/L pedagogy but what T/L methods we use are mostly the lecturing and we commonly say, mathematics needs drill and practice. In this regard, Johnson, Johnson, Holubec, & Roy (1984) claimed that while cooperative learning as an instructional methodology is an option for teachers, it is currently the least frequently used and more than 85% of the instruction in schools consists of lectures, seatwork, or competition in which students are isolated from one another and forbidden to interact. Goodlad (1984) reported that most classroom time is spent in "teacher talk", with only 1% of the students' classroom time used for reasoning about or expressing an opinion (as cited in Swortzel, K. 1997).

What classroom practices we have, in general, are teaching instead of facilitating and mediating for learning, rushing through the syllabus, making the students fall in fear of failure, teach to the test, making life for tests, dispensing the information only, making T/L less subject-value centric and less exciting the passion etc. Similarly, how we teach is like teacher-centric, differentiated, no inclusive, not accepting the diversity in learning capacity, rote learning, mechanical drill and practice, one size-fits all, instructing and talking more, listening less, summative and quantitative, deductive etc. We don’t care upon what they were required to analyze their process by considering, what they did, why used that method, why it worked, how they made sense of the problem and the solution. But, it should not be so, we are running in twenty-first century and many T/L methods have become more advance. Thus, why should we be in status quo for conventional methods? Actually, it needs to search the proper method of T/L system and establish it.

Moreover, in the conventional way of T/L practices, there is a big gap of effective communication between teacher and students. Sometimes, it is also blamed to the students that students talk parallel with the teacher, they don't maintain even the least courtesy and they talk mouth-to-mouth with teacher. The teachers wanted to make the students just nodding every time whether they understand or not, in the name of their duty and discipline. What a paradox, how can one learn in this situation? It's a big pedagogical problem and a challenge for creating a learning environment. In fact, the communication in the mathematics classroom allows teachers to reflect on students' understandings and to ask questions to stimulate thinking. When children communicate with one another or with teacher, the teacher gains insight into their understanding. This insight can be used to make grouping decisions as well as decisions about the need for further instruction for individuals or the whole class. Thus, the communications by students that build their power over the mathematics also increase the teacher's power to make appropriate instructional decisions. No care is given to this vital part, in spite of which teachers thought that learning is a sole duty of students but not of teachers. The teachers seem to think that they are all in all for knowledge.

The traditional T/L methods didn't emphasize on the learning activities "behind-the-screen, offering rich examples, learning in-the-moment, more learning to others, seeing for themselves, participating and reflecting the skills etc. These are the big problems of learning activities which have been searched less in our context.

According to Riggio, Fantuzzo, Connelly & Dimeff (1991), the teachers and school leaders continue to be a major force as we seek to transform teaching and learning. "Teach Less, Learn More" (TLLM) through cooperative learning system. Could it really work? Would it actually lead to students learning more? How does it relate to upgrade the hopeless results of mathematics (SLC Report, 2007) and achieving the desired outcomes of mathematics? Even though, the more than ninety percent public school teachers are trained (Flash Report, 2008) but they are ignoring their skill in the sense of implementing it inside the classrooms. It calls for all educators to teach better, to engage our students and prepare them for life, rather than teach mainly for tests and examinations. It is about transforming learning and shifting the focus from quantity to quality. As Goodlad (1984) claimed that the cooperative

learning is definitely active learning. Learning takes place readily and teachers are more motivated to teach when they find the students more receptive. Previously, when lessons were mainly textbook based and 'chalk and board' style, we had problems getting the pupils' attention. (ibid)

According to Rogoff (1990), mathematics is primarily a problem solving activity and problem solving is a social activity. So, mathematics to the students is a shared experience, they believe mathematics is a language and to be able to articulate it is a very important part of the learning process. Rogoff (1990) further added that learning comes through talk and discussion, mathematics learning occurs when the learner understands and can explain the concept that has been presented in their own words and knows it sufficiently to teach and talk to someone else. The teacher is the determining factor of how the mathematics curriculum is interpreted and taught. Thus, it is important to observe the teachers what they do and how they make the sense of mathematics in the classroom.

It is worthy to note down that there were reform recommendations in mathematics education that assign a significant role to learning together, how it gets implemented in the classroom would likely depend on the teacher's role and sense of group interactions. Of course, the teachers should regularly be updated and could examine their content knowledge, beliefs, conceptions, classroom practices, teaching/learning pedagogies and professionalism development. But, these things have been found to be lacking much.

Sternberg & Caruso (n.d.) explain, "Knowledge becomes practical only by virtue of its relation to the knower and the knower's environment (p. 136)." This implies that a teacher's practical knowledge is relevant to his or her personal context or classroom context. The goal of this study was to identify conditions and actions for cooperative learning that the teachers need to understand that how this process makes sense to them.

In the conventional methods of teaching, there are problems of stigmatization of dull students, inadequate time for peer education, unwillingness to take up additional responsibilities, noisy class, ignorance, dominance, curriculum and assessment system of not that kind of nature, not suitable environment, no support of

other teachers and school staffs/colleagues, difficult to identify socio-learning culture. Similarly, the problem of setting ground rules for peer groups, assess existed knowledge and attitude of the students, preparation and use of T/L aids with lesson plan, supervision, tools of supervision, to define indicators to monitor the progress, interpret the experiences and anecdotal records, making turn by turn group leaders, identifying inter and intra group relations/working modalities etc. But, the solutions of these problems are simply the basic characteristics of cooperative learning approach so they have been settled down and systematized in it.

Thus, despite of having praiseworthy learning ideas in cooperative approach, few of the common questions might arise which needed to be tested and addressed in classroom practices like; wouldn't cooperative learning lower standards? Why use it when lectures are a more efficient way of covering the course content? If students teach each other, won't the teacher loss control? Don't students want to learn from an expert rather than from peers who are as inexperienced as them? Don't student colleagues simply give the answers to them? Isn't it just a way of saving the lecturer's time? What do teachers say to students who say they're paying to be taught, not to do it themselves? Would teachers have the time to make any changes to the teaching program? Moreover, the learning demands own idea to construct mathematical knowledge and own strategies to solve the problems and learn mathematics. It creates the environment to think, share and germinate alternative approaches because a group of minds working together in it. Thus, the research about cooperative learning approach has been germinated and designed.

Objectives of the Study

The study had taken the following main objectives:

- To measure the impact of cooperative learning paradigm on the achievements of the students;
- To examine the effects of cooperative learning on the high, middle and low achievers with their self-regulating strength;
- To assess the cognitive (knowledge, comprehension and application) development of students in mathematics under the influence of cooperative learning paradigm;

- To develop and implement the models of cooperative-lesson plans of selected topics of mathematics;
- To dig out the problems faced by teachers while following the cooperative learning paradigm;
- To assess the relevancy of cooperative learning method for teaching/learning mathematics to primary level students.

Significance of the Study

In high-performance learning cultures, as Vygotsky (1962) claimed all members of the school and community share beliefs about ability and achievement, efficacy and effort, power and control, and these beliefs are visible in structures in the physical environment, group relationships, peering and, policies and procedures. The concept of cooperative learning system as such distributes accountability that has real meaning. This method helps to explore each of these concepts and apply them to schools, as how to work as a team member to build a high performance learning culture. Moreover, it will be as a fruit of pedagogy for students - how to grasp the mathematics, for teachers - how to transform own knowledge easily and for the organization-how to create the conducive learning environment. In addition, as a successful model of T/L system, it can be a milestone for subject experts, curriculum and policy makers.

Delimitations

Due to the constraint of time, cost, resources and purpose of the study, the research has been confined to the students two public schools only. Its interviewers were students and teachers of control and experimental groups, other teachers, subject experts, curriculum developer and trainers. It could not involve broadly the opinion of researchers, educationists and policy maker of the education. Therefore, the findings may not be applicable at the national level. However, the in-depth observation/study on the case would be sufficient to draw some conclusions on the potential findings.

Since this study was confined in only two sample schools of Kathmandu valley; so, it is delimited to large samples and any ecological zones of the country. It can also be conducted in any other community based, public and private schools, any

grade rather than grade III and any level of the schools and colleges. It is also delimited to frame up the similar researches by incorporating the supports provided by their parents to learn mathematics.

Definition of Terms

I have used the following terms with specific meanings to this study, they were:

Cooperative learning: It was firstly used in America and can be traced back to John Dewey's philosophy of the social nature of learning. It is a "specific kind of collaborative learning". In this setting, not only is the group assessed as a whole, but also students are individually accountable for their work (as cited in Ritt, 2006).

Cooperative- supervision: The supervision of the type of supporting, correcting, sharing, and feed backs- providing but not of authoritative type. It has indicated to the supervision taken place while conducting teaching/learning in the classrooms according to cooperative learning modality.

Cooperative-school: The name given to the school where the cooperative learning system was conducted by the researcher. In fact, this is a school of the students of experimental group.

Cooperative-class: The class in which the cooperative learning system was conducted.

Cooperative-supervisors: The supervisors who were trained for the supervision works of cooperative learning system in schools.

Cooperative-teachers: The teachers of the schools who were trained for cooperative teaching/learning system according to its concept and designs.

Cooperative-students: The students who were taking part in cooperative learning system.

Teaching incidents: The newly developed weekly lesson plans according to the phenomena of cooperative learning system.

Cooperative lesson plans: The newly developed daily lesson plans according to the phenomena of cooperative learning system.

Experimental group: A group of students of selected school who were under gone for learning mathematics through cooperative learning system.

Control group: A group of students of the selected school who were under the conventional methods of learning mathematics.

Pretest: The test taken before the implementation of cooperative learning system in schools that is test was taken while they were teaching under conventional methods.

Posttest: The test taken after a month of the implementation of cooperative learning system in schools.

Retention test: The test taken after a month of completion of cooperative learning system in schools.

Test items: The questions prepared and used for pretest, post test and retention test in the schools. Thus, I have used these terms to indicate three different and parallel tests, viz. pretest, posttest and retention test.

CHAPTER II

THEORETICAL FRAMEWORK OF THE STUDY

The researcher had undergone to study the different aspects of cooperative teaching/learning methods, which could be the ingredients for the research. There are increasingly recognizing different "forms of doing mathematics" or different "practices of a mathematical nature" or even better, "mathematical practices of a different form" or mathematics of a different style." But, the researcher must recognize different theoretical frameworks or philosophical systems that support these practices and into which they fit.

According to Johnson (2000), there were total of 164 studies on specific cooperative learning of different characteristics. All studies have been conducted since 1970, with 28 percent conducted after 1990. The 30 percent did not randomly assign participants to conditions, 45 percent randomly assigned participants to conditions, and 25 percent randomly assigned groups to conditions. Forty-six percent were conducted in elementary schools, 20 percent were conducted in middle schools, 10 percent were conducted in high schools, and 24 percent were conducted in post-secondary and adult settings. Sixty-six percent of the studies were published in journals. Four studies were conducted in Southeast Asia, 3 studies were conducted in the Middle East, 3 studies were conducted in Europe, four studies were conducted in Africa, and several of the North American studies contained minority group students.

According to Stanne (2000), the cooperative learning is clearly based on theory, validated by research, and operationalized into clear procedures that educators can use. First, cooperative learning is based solidly on a variety of theories in anthropology (Mead, 1936), sociology (Coleman, 1961), economics (Vonmises, 1949), political science (Smith, 1759), psychology, and other social sciences. In psychology, where cooperation has received the most intense study, cooperative learning has its roots in social interdependence (Deutsch, 1949, 1962; Johnson & Johnson, 1989), cognitive-developmental (Johnson & Johnson, 1979; Piaget, 1950; Vygotsky, 1978), and behavioral learning theories (Bandura, 1977; Skinner, 1968). It is rare that an instructional procedure is central to such a wide range of social science theories.

Epistemology of Cooperative Learning Paradigm

Poluhoff's (1997) main message is that "With proper resources all people can learn mathematics", and he strongly claimed, "With enough time and proper methodology, everyone in the class can learn the mathematics". It gives a hidden curriculum message that mathematics is useful in understanding the world; it is not just pushing around numbers, writing them in different ways depending on what the teacher wants.

It is emphasized that one child simply modeling the other cannot explain subsequent individual progress and become more advanced. But, it has been repeatedly demonstrated that "two wrongs can make a right" (Glachan & Light, 1981). It indicates that the knowledge is gained by action of learner. According to the pragmatic view of John Dewey (1916), it needs coaching rather than teaching, to see and act on own behalf; no body can see for others, no one can see in teaching which had stroked and pushed ahead to find the source of knowledge. It means students should participate in their own mind in group works.

An equitable learning environment engages students as active participants in mathematics instruction. The students cannot learn mathematics effectively by passively listening disengaged from the learning process. Teachers must provide opportunities for students to construct their own understanding of mathematical concepts (NCTM, 1989). Multiple learning situations must be providing that build on students' prior knowledge and cultural backgrounds. The investigator thought the way out of direct involving in and linking pre-existed knowledge to recent learning in cooperative learning.

So, the epistemology of cooperative learning attained that the students cannot receive knowledge as gift passively; in spite of they create it by action, as Piaget claimed. He further added that mathematics' meaning is in head so it needs mental action. Jean Piaget (1965) gave the new turning in mathematics learning by challenging to traditional epistemology, empiricism and rationalism by bringing in practice the "Action" as main source of knowledge. Similarly, Descartian (1661) challenged to the philosophy of knowledge is a universal truth, and replaced it by

working hypothesis. These were those strong platforms, which made the investigator more determined to study in cooperative learning.

Similarly, Lave and Wenger (1991) conceived of learning in terms of participation. Dewey (1916) emphasized learning through active personal experience and learning as a social process. In his view, purposeful activity in social settings is the key to genuine learning. Vygotsky (1978) claimed that individual development and learning are influenced by communication with others in social settings. In his view, interacting with peers in cooperative social settings gives the learner ample opportunity to observe, imitate, and subsequently develop higher mental functions. Specific to mathematics, Bauersfeld (1979) explained: teaching and learning mathematics is realized through human interaction. It is a kind of mutual influencing, an interdependence of the actions of both teacher and student on many levels. The student's reconstruction of meaning is a construction via social negotiation about what is meant and about which performance of meaning gets the teacher's (or peer's) sanction (p.25). It gives the knowledge of learning mathematics effectively in social phenomena.

According to D'Ambrisio (1976) ethnography is the source of knowledge even for learning ways. It looked into a mirror and saw nothing—often a change in the culture provides access for students who would otherwise not be full participants in our mathematics classrooms. When students experience the mathematics in a classroom as not relating to them or their culture, they may feel invisible and unconnected with the content. Thus, it is believed that the ethno-source of knowledge can be helpful for learning through social interaction and let them to reflect their experience; sharing ideas in task centric way for solving problems; linking experience, communication, knowledge which able to be rolled; self discipline, self motivation, self esteem, self management; experiment and the actions in groups which transforms the knowledge from action to mental thoughts and operation which brings students out from egocentrism called decentration (Piaget, 1965).

Theoretical concept of cooperative learning believes in gradual shifting teachers' instructions and clues to small groups. For cooperative learning, Piaget (1928) and Dienes (1942) have provided psychological base as learning through mental actions and reflection, Dewey (1916) laid the foundation of philosophical base

as developing working hypothesis and viability (relative, personal and subjective). The anthropological base as learning through scaffolding for cooperative learning has been provided by Lave, J (1991). According to him learning is meaningful through observation, sharing and teaching peers. Bruner (1960) stressed on social process of learning approach as learning is meaningful when they engage freely in social process, dialogue and discussion in-group. On the basis of these features, the cooperative learning has been framed up which needs working together, learning together, sharing the observations, finding and describing relationship/patterns, explaining procedures, getting feedbacks, going in conclusion, elaborating and transforming the facts in real life situation.

Ontology of Cooperative Learning Paradigm

This philosophy of learning, which promotes discourse, reflects both Piaget's (1965) cognitive development theory and Vygotsky's (1978) social learning theory. The expectation within this teaching and learning context is that individuals should develop better mathematical thinking by discussing mathematical ideas with peers, giving explanations, responding to questions and challenges, listening to peers, making sense of others' explanations, and asking for clarification of ideas. The use of such conceptually orientated explanations, involving alternative solution strategies, assists in building robust knowledge structures, thus strengthening students' mathematical achievements (Fuchs, Karns, Hamlett, Dutka, & Katzaroff, 1996; King, Staffieri, & Adelgais, 1998; Stein, Grover, & Henningsen, 1996). In the construction of knowledge, cognitive conflict and resolution are seen as the mechanism for transforming thought (Piaget, 1965) and (Vygotsky, 1978) those students who participate in the activities and social dialogues of collective discourse are seen to develop higher mental functions more effectively.

The group itself has become the unit of learning and evaluate, and the focus has shifted to more emergent, socially constructed, properties of the interaction. In between individual and group, we can find three different theoretical positions: socio-constructivist, socio-cultural and shared (or distributed) cognition approaches. The main thesis of this approach is that it is above all through interacting with others, coordinating his/her approaches to reality with those of others that the individual tends towards new approaches. In addition, it has tried to grasp the ingredients of

knowledge of mathematics like; sharing the ideas from Idealism, measuring the world from Realism, using viability from experimentalism and choosing and getting autonomy from existentialism for cooperative learning. Moreover, it has exploited the learning ideas of mathematics developed by Piaget, Bruner and Dienes. According to J. Piaget, there are three learning stages–formal operational, concrete operation and pre-operational. Similarly, J. Bruner's (1960) learning strategies-symbolic, iconic and enactive, and Z. Dienes' learning levels-formalization, symbolization, representation, generalization, and free play have been framed up as the theoretical concept of cooperative learning.

So, the cooperative learning through small-group work experiences help students explore mathematical concepts in an interactive problem-solving setting. Research carried out by Sparks (1989) reveals that group interaction or cooperative learning promotes female and minority student's self-esteem, motivation and achievement. Group interaction also promotes the development of mental operations or processes in students, since students tend to internalize the talk heard in the group (Vygotsky, 1978). Slavin (1986) claimed that when students participate in cooperative learning, their attitudes toward their classmates, particularly those from different ethnic backgrounds, improve student learning to respect other students' points of view and differences.

Thus, by talking turn by turn, listening more, reason, respect and response, use of teaching/learning materials, discuss to relate the problem with empirical ways, use of brain creatively, find the mathematics patterns, learn concrete to abstract, calling in action and do reflection, talking and describing to listening and asking by teachers, one can maintain the discipline of cooperative learning for its tangible result (Palincsar & Brown, 1984). Also, by actively contributing to group exploration, individuals are constructing knowledge. Initially, the newly constructed knowledge of the individuals is often diverse, nonstandard and incomplete. Further interaction with group, however, modifies each individual's knowledge structure. Diverse knowledge is homogenized through the group process, especially when group discovery occurs. In groups, students develop and support their own justification, struggle for solutions to problems, and share problem solving. More-challenging problems can be chosen because a group has the benefit of several minds working toward a solution. With

guidance from the teacher, students in one group can carry out investigations in further depth.

Johnson and Johnson (1987) have shown that as groups practice cooperative learning skills they develop through four stages: forming, functioning, formulating, and fermenting. The 'forming' skills are basic skills required for groups to function and include moving and talking quietly, using eye contact and group members' names, and encouraging all group members to participate. 'Functioning' skills are those skills, which allow greater self-management within the group. Individual members maintain their given roles, all group members are included and encouraged, and the interactions are both courteous and positive. Students use 'formulating' skills to apply and analyze ideas and to ask for and listen to elaborations, justifications, and summaries from other group members. 'Fermenting' skills enable students to integrate ideas to form a concept or general principle. Students with these skills are able to question, critique and evaluate peers' ideas, and develop and integrate the ideas of others into a new concept or application. At this level students are also able to handle controversy in a positive and constructive manner.

In this way, students go through four strategies of 4F (forming, functioning, formulating, and fermenting) that assist in developing group skills and systematize the learning in groups. Further, these strategies frame up the stepwise learning as: wait and give individuals time to think for themselves; be specific with feedback and encouragement; give help when asked in the form of a specific strategy, idea or question rather than an answer; and support agreement or disagreement with evidence. Regarding the group works, according to Upadhyay (2001), the 5E keeps specific meaning in learning as; engaged all in group, explore the idea, explain and elaborate the learning, and evaluate in group which assists to develop the skills of forming, functioning, formulating and fermenting respectively.

In conclusion, the cooperative learning is meaningful when there is positive interdependence (promotively interdependent goals), face-to-face interaction, individual accountability and personal responsibility for reaching group goals, frequent practice with small-group interpersonal skills and regular group processing and reflection in different steps as mentioned above.

Axiology of Cooperative Learning Paradigm

According to Moschkovich (1999), the cooperative learning method is based upon theories of social interdependence, cognitive development, and behavioral learning. He claimed that his research results indicate four worthy changes in student behavior: 1) students became more engaged in problem solving; 2) students moved from a competitive to a cooperative stance; 3) students discovered several correct ways of finding a solution; and 4) students code-switched to ensure everyone in the group understood. In addition, two changes in teacher behavior related to cooperative learning were: 1) the regular classroom teacher moved desks from rows to groups; and 2) the teacher became more aware of the students' mathematical abilities. Thus, mathematics educators are shifting away from traditional classrooms to reform-oriented mathematics classrooms that focus on students actively engaged in mathematical discourse in cooperative settings. As claimed by (Johnson, Johnson, & Holubec, 1994), some researches provide exceptionally strong evidence that cooperative learning result in greater effort to achieve, more positive relationships, and greater psychological health than competitive or individualistic learning efforts.

Social interdependence theory views cooperation as resulting from positive links of individuals to accomplish a common goal. The psychologist Kurt Koffka proposed in the early 1900's that although groups are dynamic wholes the interdependence among members is variable. Kurt Lewin (1948) stated that interdependence developed from common goals provides the essential essence of a group. This interdependence creates groups that are dynamic wholes. But, within cognitive development theory, cooperation must precede cognitive growth. Cognitive growth springs from the alignment of various perspectives as individuals work to attain common goals. Both Piaget and Vygotsky saw cooperative learning with more able peers and instructors as resulting in cognitive development and intellectual growth (Johnson, et al., 1998).

Similarly, the assumption of behavioral learning theory is that students will work hard on tasks that provide a reward and that students will fail to work on tasks that provide no reward or punishment. Cooperative learning is one strategy that rewards individuals for participation in the group's effort.

According to Slavin (1987), there are two major theoretical perspectives related to cooperative learning -motivational and cognitive. It means, the motivational theories of cooperative learning emphasize the students' incentives (rewards) to do academic work, while the cognitive theories emphasize the effects of working together. Motivational theories related to cooperative learning focus on reward and goal structures. One of the elements of cooperative learning is positive interdependence, where students perceive their success or failure lies within their working together as a group (Johnson, Johnson, & Holubec, 1986). From a motivational perspective, "cooperative goal structure creates a situation in which the only way group members can attain their personal goals is if the group is successful" (Slavin, 1990, p. 14). It means, in order to attain their personal goals, students are likely to encourage members within the group to succeed and to help one another with a group task.

Further, there are two cognitive theories that are directly applied to cooperative learning, the developmental and the elaboration theories (Slavin, 1987). The developmental theories assume that interaction among students around appropriate tasks increases their mastery of critical concepts (Damon, 1984). When students interact with other students, they have to explain and discuss each other's perspectives, which lead to greater understanding of the material to be learned. The struggle to resolve potential conflicts during cooperative activity results in the development of higher levels of understanding (Slavin, 1990). The elaboration theory suggests that one of the most effective means of learning is to explain the material to someone else. Cooperative learning activities enhance elaborative thinking and more frequent giving and receiving of explanations, which has the potential to increase depth of understanding, the quality of reasoning, and the accuracy of long term retention (Johnson, Johnson, & Holubec, 1986). It implies that the use of cooperative learning methods should lead to improved student learning and retention from both the developmental and cognitive theoretical bases.

Academic benefits include higher attainments in reading comprehension (Mathes, Fuchs, & Fuchs, 1997) and mathematics (Ross, 1995; Whicker, Nunnery, & Bol, 1997) and enhanced conceptual understanding and achievement in science (Lonning, 1993; Watson, 1991). Social benefits include more on-task behaviors and

helping interactions with group members (Burron, James, & Ambrosio, 1993; Gillies & Ashman, 1998; McManus & Gettinger, 1996), higher self-esteem, more friends, more involvement in classroom activities, and improved attitudes toward learning (Lazarowitz, Baird, 1996).

Regarding the autonomy of learning, as Saxena (2001) claimed, in cooperative learning the classroom democracy includes the abolishing all distinctions of colors, caste, creed and gender. It guarantees equality of opportunities to all. In short, justice, fair play, freedom, equality and fraternity are the watchwords of democracy. Similarly, Henriksen (1990) has given democratic principles in pairs as freedom of expression and publicity, resourcefulness and self-administration, individual and the collective's development. So, it was intuitional to appraise democratic norms and values in cooperative learning-approach because it is white space for connecting teachers with students (guidance platform), self-expression (spot), debating and dialoguing (discussion forum), searching archived knowledge (technology) and learning in a structured manner (tutorials).

Moreover, Saxena (2001) added that the system of learning looks empathetically as all people can feel the same range of emotions; different people will feel different emotions in the same situation; our actions affect other people – we can make them feel better or worse; use clues to guess other people's emotions and to imagine how we would feel if we were them; take on another person's point of view; distinguish between accidental and deliberate actions; recognize situations in which we may need to hide our feelings to avoid upsetting others (and those where we should not); support other people, e.g. by making them feel happy and by using 'good listening' when they share their feelings – demonstrating the skill of 'active listening'.

In my understanding, in cooperative learning, multi-minds work together in friendly environment in small groups on a structured activity. They should individually accountable for their work, and the work of the group as a whole should also be assessed. Cooperative groups work face-to-face and learn to work as a team. In small groups, students can share strengths and also develop their weaker skills. They develop their interpersonal skills. When cooperative groups are guided by clear objectives, students engage in numerous activities that improve their understanding of subjects explored. When students experience the mathematics in a classroom as not

relating to them or their culture, they may feel invisible and unconnected with the content. Always, it needs to visualize mathematics with own true participation.

As Toulmin (1958) claimed if the mathematics addressed in the classroom is trivial or frustrating, then the vision of mathematical understanding for all will not materialize mathematics and it must be challenging to students, without being discouraging, in order to stimulate engagement. If the mathematics is trivial or not meaningful to the students, then it may be boring. If it is boring, then the classroom environment will rapidly disintegrate (ibid).

Thus, in order to create an environment in which cooperative learning could take place were as students need to feel safe, but also challenged; the groups need to be small enough that everyone can contribute and the task that students work together must be clearly defined. The required techniques of cooperative learning to make this possible and effective, it should: learners actively participate; teachers also become learners at the same times, and learners sometimes teach; respect is given to every member; projects and questions interest and challenge students; diversity is celebrated, and all contributions are valued; students learn skills for resolving conflicts when they arise; members draw upon their past experience and knowledge; goals are clearly identified and used as a guide; research tools are made available; students are invested in their own learning etc. By envisioning these assumptions and pedagogical philosophies, I used quasi-experimental design and experimented it in the field.

CHAPTER III

REVIEW OF RELATED LITERATURES

Mathematics is a body of knowledge-the area of science, with its own symbolism, terminology, contents, theorems and technologies. Students must know lots of mathematical concepts, theories and relations at a time. They must know the mathematical language but more of them pass their time in listening and reading in terms of writing, thinking, analyzing and using the mathematical language. As a result, students miss the logical power and they cannot develop the creative power to think. In this situation theoretical knowledge with rote learning can be found. In this way, mathematics has become a challenging adventure to grasp its concept. By realizing this fact, many more researches have been carried out in this sector.

Effandi (2003) studied on how cooperative learning effects student achievement and problem solving skills. This study of intact groups compares students' mathematics achievement and problem solving skills. The experimental section was instructed using cooperative learning methods and the control section was instructed using the traditional lecture method. Cooperative group instruction showed significantly better results in mathematics achievement and problem solving skills. He also found that students in the cooperative learning group had a favorable response towards group work. He concluded that the utilization of cooperative learning methods is a preferable alternative to traditional instructional method. The ingredient extracted from this literature was about how to compare the achievements based upon different pedagogies.

Nor Azizah et al. (1996), in their study involving 966 pupils and using Students' Team Achievement Division, found that cooperative learning can inculcate values such as independent, love and cleanliness. Similar study done by Rahaya (1998) using Jigsaw as a model, which involved 1180 students from 18 schools, concluded that the values of self dependent, rational, love and hard working are prominently inculcated. From these studies, it was found that cooperative learning can enhance joyful learning, scientific and social skills promote enquiry learning and increase in the achievements. These things were considered to observe in the study.

Perrault (1983) found that cooperative learning resulted in significantly higher achievement in industrial arts students, especially, at the knowledge and comprehension levels of Bloom's taxonomy, when compared to students taught by competitive methods. In a study in which mathematics was taught to both elementary and secondary students using a cooperative learning strategy, Wodarski, Adelson, Todd, & Wodarski (1980) found significant gains between the pretest and posttest scores. The researchers concluded that cooperative learning was an effective method of teaching mathematics. In a review of 46 studies related to cooperative learning, Slavin (1983) found that cooperative learning resulted in significant positive effects in 63% of the studies, and only two studies reported higher achievement for the comparison group. Its ingredient for the study was how to use Bloom's taxonomy for cognitive development sector and the ideas were taken about the preparation of pretest and posttest.

Upadhyay (2001) has done a study on effect of constructivism on mathematics achievement of grade-V students' in Nepal. In his unpublished doctoral dissertation, he has given the philosophical, psychological and anthropological bases of constructivism. The way of comparative study over the traditional method was also the major ingredient taken from this study along with few of the research tools.

Humphreys, Johnson and Johnson (1982) compared cooperative, competitive, and individualistic strategies in mathematics classes and found that students who were taught by cooperative methods learned and retained significantly more information than students taught by the other two methods. So, the ways of comparison of progresses of different groups by applying different methods were more strengthened from it.

Sherman and Thomas (1986) found similar results in a study involving high school general mathematics classes taught by cooperative and individualistic methods. Allen and Van Sickle (1984) used STAD as the experimental treatment in a study involving low achieving students. They found that the cooperative learning group scored significantly higher than other one. The study was viewed from different cognitive perspectives.

Johnson, Maruyama, Johnson, Nelson & Skon (1991) conducted a meta-analysis of 122 studies related to cooperative learning and concluded that there was strong evidence for the superiority of cooperative learning in promoting achievement over competitive and individualistic strategies (cited in Kirk, 1997). It has explored many evidences about the superiority of the cooperative learning in against of individual and competitive learning. From this study, the bases of being superiority of the cooperative learning were extracted.

Johnson and Ahlgren (1976) examined the relationships between students' attitudes toward cooperation, competition, and their attitudes toward education. The results of the study indicated that student cooperativeness, and not competitiveness, was positively related to being motivated to learn. It has given the message of importance of social phenomena for learning achievement. It had helped to formulate the idea to examine the students' attitude towards the mathematics.

Gillies (2002) studied the effectiveness of cooperative learning one year after students were initially trained to effectively work together in cooperative groups. This study concluded that students who received training in cooperative learning were more cooperative, and were more likely to assist and seek assistance from peers in academic instructional tasks in comparison to those students not exposed to cooperative learning. It has emphasized on the development and use of those skills, which are essential for the cooperative learning. These kinds of skills and behaviors had to be developed and observed in the learning attitude of the students in this present study.

Jenkins, Antil & Vadasy (2003) investigated the perceptions of general education teachers towards the effectiveness of cooperative learning on students of low, middle and high levels. The majority of participants indicated that cooperative learning improved self-esteem, on-task behavior, academic success and productivity of the students. Additionally, these teachers stated that cooperative learning provided an effective alternative means to learning through increased opportunities for all level students to contribute and participate within their learning environment. It had helped to see how the cooperative learning assists for the students of all levels (low, middle and high) needed students and what sort of learning environment is needed for them.

Croom (1997), in his research of cooperative learning found that to support mathematical understanding in the classroom, it needs teachers to be the mediator for encompassing language, communication, mathematical content, mathematical connections, decision making, and equity. So, it gave multiple ideas for teachers and students to work together to create a mathematics culture in their classroom.

Regarding the nature of peer groups, Durfee et al (1989) found that the performance of a network of problem solving agents is better when there is some inconsistency among the knowledge of each agent. Gasser (1991) pointed out the role of multiple representations and the need for mechanisms for reasoning among multiple representations. These findings concern the heterogeneity of a multi-agent system. Bird (1993) discriminates various forms of heterogeneity: when agents have different knowledge, use various knowledge representation schemes or use different reasoning mechanisms (induction, deduction, analogy, etc.). For Bird, heterogeneity is one of the three dimensions that define the design space for multi-agent systems. Disagreement in itself seems to be less important than the fact that it generates communication between peer members (Blaye, 1988; Gilly, 1989). The role of verbalization may be to make explicit mutual regulation processes and thereby contribute to the internalization of these regulation mechanisms by each partner (Blaye, 1988). These findings could be the base for the formation of small task groups. It emphasized on the heterogeneity and multiple representation in group discussion on the basis of which different groups could be formed in the classroom.

Treniacosta & Kenney (1997) in Diversity in Learning coded that "Mathematical Power for All" cannot be fully realized if the classroom environment limits any child's access to challenging mathematics instruction. If students are to persist in their efforts to make sense of mathematics, if students are to do the work that is an inevitable aspect of under concepts and problem-solving strategies, then each student must feel that his or her response is valued. Its main ingredient was that, no one student is exempt from participation; no student is allowed to limit another's efforts to participate. So, each student is expected to contribute to the problem-solving process.

The research has found that the peer interaction can have a powerful influence on academic motivation and achievement (Light & Littleton, 1999; Steinburg,

Dornbusch, & Brown, 1992; Wentzel, 1999). The research has also suggested that socialization experiences that occur during peer tutoring can benefit both the tutor and tutee by motivating students to learn and increasing their social standing among peers (Fuchs, D., Fuchs, L.S., 2002; Rohrbeck et. al, 2003; Miller & Miller, 1995). When students understand the benefits of peer tutoring and have the tools to become effective tutors and tutees, they make greater progress than those who are not given any instruction on how to work together (Fuchs, L.S., Fuchs, D., Hamlett, C.L., Phillips, N.B., Karns, K., & Dutka, S., 1997). From these literatures' study, the research has made enriched in the ways and importance of peer works for meaningful learning.

According to the study of Mugny, Levy & Doise, 1978; Glachan & Light (1982) what is at stake here, then, is not imitation but a coordination of answers and subjects at the same level of cognitive development but who enter the situation with different perspectives can also benefit from conflictual interactions. Their research has showed that under certain conditions, peer interaction produced superior performances on individual posttest than individual training (Doise & Mugny, 1984; Blaye, 1988). It had provided the space for conflictual discussion and tactful dealing with them.

As Mandl & Renkl (1992) claimed in his study that teacher expositions are constructed using a variety of teaching strategies including: transforming global to local and domain/task-specific explanation; scaffolding; demonstration and teacher or practitioner modeling; questioning and the use of alternatives to questioning. It has been suggested that 10 to 20 minutes is the average attention span; after that the mind tends to wander. Good expositions are clearly structured. A piece of advice commonly given to peer speakers is: say what you're going to say, say it, say what you've said. In a structured exposition, a teacher or practitioner will indicate the purpose and content. The subject knowledge has an important influence on the quality of teacher expositions. Research indicates that if we know what we are talking about, we are more likely to be able to explain clearly and cope with others' misunderstanding by offering further elaboration. The main ingredient of this literature was to identify the role of teachers while implementing cooperative learning in classroom.

Blaye, & Light (1990) found in their study that it implies such as illustration, example, analogy and metaphor – helps understanding to develop by offering alternative ways to view and respond to the information being expounded. Here, the discussion method is an important component of peer teaching/learning because it can: encourage students to ask questions; give them opportunities to explain, clarify and justify their thinking; offer opportunities to assess understanding; strike a balance between teacher or practitioner contribution and students' contributions. It has given the ideas about the pedagogical matters of cooperative learning with appropriate illustrations and examples.

In the study, Robertson et al. (1999) have found that Cooperative learning is useful for any grade and any math topic. So, it had broaden the researcher's mind and made free from hesitation while selecting students of grade III and, units and topics of mathematics for the preparation of cooperative lesson plan. However, the researcher could go down with very younger children that they could not take part in two ways conversation with their real feelings.

According to the study of Riggio et al. (1991), the teachers' practical knowledge indicated that by engaging students in the following four learning activities/experiences, they would have opportunities to engage in group works and interaction.

a) Inquiry of the problem-solving process (what they did, why used that method, why it worked, how they made sense of the problem and the solution);
b) Inquiry of a new concept (looking for patterns and relationships);
c) Practicing problem solving (each one gives meaning of action);
d) Investigations/projects (planned and conducted using tools and technology).

So, on the basis of these ingredients, it was focused on how to engage, conduct the peer interaction and make a quality time for learning output.

Wertsch (1991) found that the teachers' practical knowledge indicated that the following five behaviors of the teacher would facilitate for cooperative interactions that promote learning.

a) Listens and observes (teacher listening conversation, observing process);
b) Questions and prompts (questions to facilitate and check for understanding or prompts when students are stuck);
c) Supports students' thinking (freedom to use mathematical tools);
d) Models questioning (teacher using a questioning approach during whole-class instruction that students then mirror i.e. students repeat the same questions in groups);
e) Promotes good peer relations (healthy dialogue through shared questions, seating plan, voluntary grouping, and peer observations).

It had helped to promote and make the group works effective and fruitful while conducting the cooperative learning approach among the groups.

While drawing out the teachers' practicum knowledge in the study carried out by Doise (1990) found that through cooperative interactions, students learn mathematics from and with each other as they engage in the following seven behaviors/outcomes.

a) Compare experiences (learn about learning and experiencing the same difficulties);
b) Share ideas (cooperate and expand their thinking);
c) Articulate mathematics (expressing and explaining mathematics in words);
d) Pose questions (asking each other questions and adapt the garden path);
e) Be motivated and gain confidence (lends support to each other, motivate each other to get their work done).
f) Gain autonomy (depending less on the teacher's thinking, look to each other and interact to each other);
g) Test understanding (test out thoughts and ideas, compare their work, compare the answers, compare the steps and they promote each other's learning and understanding).

It had opined up the ideas about how to filter, promote and consolidate the students' learning behaviors so that cooperative learning could be own business. It had helped to determine the working modality of students in small groups.

A study examining the effects of cooperative learning on mathematics achievement of a group of seventh grade students found that students involved in cooperative learning performed significantly better than students who were not exposed to cooperative learning (Reid, 1992). In a study comparing the effects of cooperative learning to individualistic learning in a classroom, Johnson and Johnson (1983) found that cooperative learning experiences resulted in higher academic achievement for so-called weak students. It gave the different ways of conducting the comparative study and so, extracted its working modality for cooperative learning.

According to Emmer and Gerwels (2002) some research on cooperative learning has addressed instructional components. In a number of studies, students have been taught interaction skills, such as how to question or to help each other so that they did not give answers but facilitated each other's thinking (Fuchs, Fuchs, Kazdan, & Allen, 1999; Gillies & Ashman, 1996, 1998; Nattiv, 1994; Webb, Troper, & Fall, 1995). And, when students are taught such skills, positive outcomes such as increased intrinsic motivation, liking for school and self-esteem can result. The ideas that I grasped from this literature were about how to develop the interaction skills in peer groups and create the conducive environment for cooperative learning system.

I have mentioned in different pages along with the pages of rationale of this study that why had I selected this cooperative learning paradigm for the research. After having thorough review of related literatures, I found that the paradigm is mainly based on social interdependence, cognitive development, behavioral learning and changing behaviors, motivational and developmental perspectives for meaningful learning. It has also emphasized on producing positive attitudes, covering peer groups, autonomy, psychology and anthropology.

Moreover, I convinced with what Palmer et al. (2006) said, "Cooperative learning" is an umbrella term for a variety of educational methodologies involving joint intellectual effort by students, or students and teachers together. The cooperative learning environment is enriched in team responsibility along with the individual's role in spite of solely individual competitive as claimed by Johnson and Johnson (1989). It was found to be enriched in democratic behaviors (cooperation, freedom, self-administrative, individual development, self-expression, debating and dialoguing, searching archived knowledge and learning in a structured manner, access to learning,

partnership, relationship between students and among colleagues etc) as Saxena (2001) claimed.

In addition, the cooperative learning approach has been found to be enriched with inquiry of the problem-solving process, inquiry of a new concept; practicing problem and investigations as claimed by Riggio (1991) and listens and observes questions, promptness; supports students' thinking, models questioning and good peer relations as argued by Wertsch (1991). Similalry, it was as Doise (1990) has given emphasized upon compare experiences, share ideas; articulate mathematics; pose questions; be motivated and gain confidence, gain autonomy and test understanding.

In this framework, I envisioned the cooperative learning paradigm with these inherent philosophies and theories. The reviewed related literatures helped me to build up its research modality as a whole because I had a curiously to test and research all of these virtues of this paradigm and transfer them into Nepalese classroom situation so far as it could be possible.

CHAPTER IV

METHODOLOGY

As per the nature of the study, the research design was qualitative and quantitative both. Like the action research improves the pedagogical matters, measurement type of research measures the variables, case study research observes the case from outside in some distance; the experimental research controls the extrateneous variables and sees the effect of independent variable (method) in the dependent variable (achievement). So, it was an experimental research by the nature of the study. It dealt with the control and experimental groups (i.e. quasi-experimental design which has involved pretest, posttest and retention test) of the students and included interviews of students, teachers, head teachers (as supervisor) and curriculum experts. Moreover, the opinion of other teachers, trainers and subject experts were also taken into consideration. The study was based on the perceptions of the sample population. More importantly, it was empirical, descriptive and qualitative in nature. The research strategy adopted was also interaction with students and close observation of the peer learning activities in their small friendship groups, each group consisting 3/4 friends.

The purpose of this study was to determine the effects of the cooperative learning approach through the formation of friendship small groups. It was measured the achievement made by the students through three different tests. It had also collected the opinions and attitudes of students and teachers toward this teaching method. To measure the effect of cooperative learning method, it was compared to non-cooperative (conventional) learning method in the classroom environment by using a quasi-experimental design.

At first the teachers of the selected classes of experimental school were trained for six days according to the philosophy of cooperative learning paradigm. Then simultaneously their classes were observed, facilitated and interacted by researcher, head teacher (trained for supervision) and curriculum developers. The data were collected from tests (pre, post and retention based on the three cognitive domains), observation, interview and the interaction (for non-cognitive skills). Regarding the research design, Thakur (1997) said,

> A research design is the arrangement of condition for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure. (p. 50)

During the study period, proper care was given for the arrangement of condition to collect the relevance data, direct observation, interview and interaction with the concerned people with the required tools and checklists of the research.

Sampling

According to Ross (1991), generally, the sampling frame of schools incorporates the list according to a number of stratification variables: size (number of students), program (comprehensive or selective), region (urban or rural), and sex composition (single or coeducational) (Ross, 1991, p. 3). Here, my research's sampling has incorporated the nearly same number of students, selective treatment, same location of schools and the coeducational composition.

The two-stage sampling is probably the most commonly used sample design in educational research. This design is generally employed by selecting schools at first stage of sampling, followed by the selection of classes within schools …This design permits analysis to be carried out at a) the between-student level b) the between-class level or c) both levels simultaneously (ibid, p. 17). Thus, I used it to select two schools and carried out the analysis in between two classes i.e. Grade III of two schools.

The study was conducted in two public schools of Kathmandu valley. The sample schools were chosen among the other ten schools by administering the pre-tests on the basis of the similar achievements made by the students in pretest, similar qualification and experiences of teachers and having similarity in regard to physical facilities, school environment, school management, SLC result. Both of these schools are public with 43 and 39 numbers of students respectively. To specify an experimental group of students, it was selected by lottery system in between two schools. The school of control group has given the name "X" whereas "Y" for the school of experimental group. The teachers were sampled as per their periods in the selected grade - III.

It was the process by which a relatively small number of individuals or measures of individual are subjected to or event is selected and analyzed in order to find out something about the entire population from which it was selected. It helps to collect vital information more quickly in small sample. Regarding the small sample Thakur (1997) has claimed for taking small sample as:

> Any research process includes selection of elements or objectives for study collecting information from them, organizing the data and drawing conclusion from them all these are based on a much smaller number of elements (p. 73).

In addition, regarding the small sampling, Ross (1991) has argued that the educational research is generally conducted in order to permit the detailed study of a part, rather than the whole, of a population. The information derived from the resulting sample is customarily employed to develop useful generalizations about the population (p. 1). In educational settings the researcher is usually dealing with a single sample of data and not with all possible samples from a population. In this way, the research was conducted in two sampled schools with the constraints of time, cost, resources, purpose and nature of the academic study etc.

Development of Research Tools

In the way of pre-preparation for the implementation of the research, it was considered as to have good planning and consequently the good construction of research tools. In regard to the reliability and validity of the research tools, the researcher had discussed the tools with the senior researchers, subject experts, trainers, teachers, and also consulted with the norms of non-equivalent control group of Quasi-experimental design. The reliability and validity of the tools have been discussed more in the respective topics. Few of the research tools, which were taken from other researches, had no problem regarding their reliability and validity since they were already tested and well established. The sources of these types of study tools have been cited properly. This research had included the following specified tools, tests, criteria, plans and processes:

1. Selection of content and formation of small groups;
2. Development and implementation of interview guidelines;

3. Development and administration of observation checklist;
4. A Guideline for classroom management;
5. Preparation of teaching incidents;
6. Construction of T/L aids;
7. Development of test items;
8. Test of reliability and validity;
9. Framework of the research in field;
10. Determination of T/L process;
11. Orientation to cooperative-teachers and supervisors;
12. Launching the experiment in field/schools;
13. A tool to check the validity of quasi-experimental design;
14. A tool to study the multiple variables of the research;
15. Selection of variables and control exercised
16. Data collection and analysis plan;
17. Statistical tools used;

Selection of Content and Formation of Small Groups

The selection of content for cooperative learning demonstration was done on the basis of what the teachers were teaching in the classrooms. Though, in order to have the same cooperative-lesson plan, a little effort was applied to bring the teachers in common consensus.

Regarding the age group of the children, Azmitia (1988) looked at pairs of 5 year old and found that when beginners (with respect to the domain) were paired with experts on a model-building task they improved significantly, so there is a teacher's role for this because they themselves could not sustain their discussion. In addition, Piaget (1965) argued that interaction with adults leads to asymmetrical power relations or social status, and that in such interactions adults or more capable children are likely to dominate. But, adult-child interaction may be more controlled by the adult rather than being a reciprocal relationship. Children are more likely to justify their assertions with peers than with adults.

Thus, to make the learning more effective, it needs to have reciprocal teaching process (Palincsar and Brown, 1984; Palincsar, 1987; Riggio et al., 1991) in which

one learner plays the teacher's role for few of the time and then shift roles with the other learner turn by turn in their groups. Further, Azmitia (1988) argues that pre-scholars may lack the skill to sustain discussions of alternative hypotheses. Rogoff (1990) argues that planning tasks may be difficult for very young children because they require reference to things, which are not in the "here and now". However, adults may be able to carry out such meta-cognitive roles that are beyond children. With these views, thus, the investigator decided to go for the students of primary level who were of in and above 8/9 years old of grade III.

Regarding the formation of small groups of the students, the researcher went through the study of advantages and disadvantages of sixteen different groups like; Pair-share (two students working together), Jigsaw (four-five students with specific role), Split-class discussion (splitting whole class into two halves), Random group of three, Diversity group, Multi-aged group, Peer-led group, 3-step interview (turn by turn then share to all), 3-review (3 minutes time), Numbered heads (instructor calls the number to ask), Team-pair-solo (work in team then in pair and lastly solo), Circle the sage (circle the selected leader of special knowledge by the students not from the same group they learn and go back to their group to discuss), Structure problem solving (giving problem for specific time), Send-a-problem (students of two groups write the solutions and keep inside the folder then it is examined by third group), Drill review pairs (a group of four split into two pairs where one pair explain then another checks then switch the role) and Friendship group (according to their ability and interest).

Out of these sixteen different ways of formation of small groups, the researcher had followed the last one i.e. friendship group. It was done on the basis of some quality of students where they can work at a pace that best suits them, they enjoy a lot in each other's insights while working with like minded friends, more motivated and less bored, they may visit one another's homes and work together as well. But it needs to manage the good help for weaker ones and motivate to the student of different nature.

Development and Implementation of Interview Guidelines

By nature the research study was of qualitative type as well, so the required interview guidelines were prepared by consulting with researchers, subject experts and review of literatures. The different interview guidelines, by focusing on cooperative learning system, were prepared for different category of the people e.g. 12 students, 6 from each school (randomly selected 2-excellent, 2-middle and 2-weak performer on the basis of pretest scores); two cooperative teachers, few other teachers, head-teachers, supervisors of located areas and curriculum experts. In addition, to probe the attitude of students towards mathematics, one more guideline format was prepared and used it. The entire different interview guidelines for different categories of people have been attached in its Appendices II, III, IV, V and VI. The questions were of open-ended type so that enough ideas could be drawn. The triangulation method was used among the stakeholders along with the experts' judgment for the consistency and validity of the opinions.

Development and Administration of Observation Checklist

It was intended to observe the teachers' instruction, facilitating role, guidance and communication; conduction of group works and its impact in learning outcomes; students' behavior and cooperative attitudes; students' preparation and their creativity, feeling, comfortability in works and students' attitude towards mathematics (for, see Appendix – VII).

To observe the lively teaching classroom under the phenomena of cooperative learning paradigm, two sets of observation checklists were prepared for the observation of students' behaviors, democratic practices and their overall learning progress in groups, see Appendices VIII and IX.

The researcher was being engaged in a series of observations (even after completing one month study period up to another one month of taking retention test) with observation checklists to complement the interviews. The researcher was himself an enumerator. The observation helped the researcher to identify the associated problems and characteristics belong to the research objectives, which varied from one classroom to another classroom. The main advantages of such observations were to

address the objectives of the research by conceptualizing the situation in which the classroom activities took place like; identification of the current teaching practices, students' learning nature, reflective behaviors, pupil's preparation, learning process, creativity and interest, teachers' lesson plans and their implementation process, obstacles while implementing cooperative method, relevancy of this method in the Nepalese classrooms, learning value and problems, evaluation of child-friendly school indoor and outdoor environment, democratic practices adopted and validation of the information. Knowing the advantage of classroom observation as a tool the researcher used it to describe few of the research questions with the help of qualitative information. It was also used it to find out what aspects of behavior or activities of the teacher and students are relevant to address cooperative learning approach. Marshall and Rooman (1995) have also claimed that,

> Observation seems most directly the research purpose of description, which was the primary goal of most ethnographic research. It can address research questions with regard to what are the most important events, beliefs, behavior and attitudes in social environment. (p. 4)

The researcher found out beliefs and teaching/learning behaviors of teachers and students both along with the few of the challenges of the classrooms and the ways that adopted to address them.

A Guideline for Classroom Management

To manage the small groups, furniture, teaching/learning aids, instructions and facilitation, systematization of group works, code of conduct and as a whole class management systematically according to the cooperative learning method, a guideline was prepared for the cooperative-teachers. It is given in Appendix I.

Preparation of Teaching Incidents and Cooperative Lesson Plans

The quality of education that teachers provide to student is highly dependent upon what teachers do in the classroom. Thus, in preparing the students of today to become successful individuals of tomorrow, mathematics teachers need to ensure that their teaching is effective. Teachers should have the knowledge of how students learn

mathematics and how best to teach. Changing the way we teach and what we teach in science and mathematics is a continuing professional concern. Efforts should be taken now to direct the presentation of mathematics lessons away from the traditional methods to a more student centered approach.

There were 26 cooperative-lesson plans (similar in number as prescribed by curriculum) under four weekly teaching incidents, which were designed and developed according to the learning philosophy of cooperative T/L paradigm. Actually, teaching incidents were prepared being based on the models given by Ask ERIC (1994 & 1998), for see in Appendices XII, XIII, XIV and XV. For, its preparation, it was reviewed the textbooks of different writers of the same grade written in both Nepali and English. It was taken the help of curriculum, teachers' guide, subject elaboration, exercise guideline books along with the curriculum and evaluation standard for school mathematics (NCTM, 1998). The different level of school mathematics of international level and the books written in specific chapters with the teaching pedagogy and effective use of T/L aids were also reviewed. It has gone through the teaching models of constructive and cooperative learning developed by different researchers like Millroy (1992, p. 26) and Wheatley (1991). The important space was also given to the experiences of teachers, senior colleagues, subject experts and researchers.

Construction of T/L Aids

It was given emphasize, so far as possible, to construct the materials of no cost, low cost and from the locally available materials. From the perspective of worth of time and economy, the care was given in creative use of already developed materials found in and outside the schools. The developed T/L materials on the basis of cooperative-lesson plan were as different cuttings of geometrical shape, blocks of papers, weight box, vessels of measurements, and tools of measurement of length e.g. tape, ruler, strings, graph papers, work sheets etc.

Development of Test Items

Focusing the cognitive domain of the learning, it was developed and standardized the examining tools. For, the test items were prepared by using textbook,

specification grid chart, curriculum and Teacher's guide developed and prescribed by CDC. Moreover, the test items were consulted with subject experts, senior teachers and trainers. According to Bloom's Taxonomy (as cited in Forehand, 2005); it was prepared three categories of questions (knowledge for concept, comprehension for process and application for behavioral use). The test items prepared, in this way, were piloted in one of the public school of Kathmandu district. Before finalizing the test items their difficulty level of the questions was taken under analysis. The difficulty level and discrimination power of the test items were examined with the help of statistical tools P-level and D-index. For the tests, the questions were set being based on their textbooks. The validity and reliability of the tests were taken under implication as Thakur (1997) and, Crmines and Zeller (1986) said that it needs always the consistency in concept, empiricism and comparability.

Moreover, the action verbs were used while preparing the test items in very short questions to assess knowledge level of the students. There was also a provision of long answer questions to evaluate their working procedure. Similarly, regarding the evaluation of application skill of the students, the questions were prepared being based on their skills acquired for reasoning, logics, problem solving etc. which is a final and higher understanding level of mathematics so, these types of questions were also long answer types. In this way, the weightages of question were provisioned 1, 3 and 6 marks (please see, Appendices: XVI, XVII and XVIII).

To identify whether the control and experimental groups of students of the selected schools would be equally fertile to implement the cooperative learning approach or not, it was administered the pretest to find their achievement level in both the groups. Similarly, to see the immediate learning achievement and last longer effect under the cooperative learning paradigm, the posttest and retention test were taken. The retention test was taken after a month of posttest. The test items were parallel but different for pretest, posttest and retention test (see Appendices: XVI, XVII and XVIII).

Test of Reliability and Validity

The validity should be ensured while controlling (extra variables) and, collecting, processing, analyzing and interpreting the information that the researcher collected from the field. In this regard, Crmines and Zeller (1986) agues,

> The validity of a measuring instrument can be defined as the extent to which it measures what it supposes to measure. Validity of a measure depends on the correspondent between a concept and empirical indicators that supposedly measures it. It's possible for a scale to be reliable. (p. 12)

The researcher fully obeyed the statement cited above to ensure the internal and external validity of Quasi-experimental research design. The researcher was conscious to check the items under of each and every norms and values of the validity and reliability. As it was to ensure the gathered information should be consistent in different circumstances, Thakur (1997) says that;

> Reliability means independent but comparable measures of the same object, or a mental process, attitude should give similar result unless the object itself or the situations or conditions under which the study model has changed (p.411).

In order to increase the reliability and validity of the research and to provide a deeper understanding of the cooperative interactions the data were triangulated through the use of multiple research instruments: audio recordings; questionnaires; anecdotal observations; and diagnostic interviews. In addition, the reliability and validity of the research tools have been discussed under their respective topics as well.

Framework of the Research in Field

Regarding the duration of conduction of research, it was found that fifty-two percent researches lasted for 2 to 29 sessions (a session was defined as 60 minutes or less), and 46 percent researches lasted for 30 sessions or more. In this scenario, the researcher designed 26 cooperative lesson plans for a month. The research was undergone to three different phases as mentioned below:

Pre-preparation

The main activities conducted in this stage were as preparation of test items by piloting them for pretest and administration of pretest, analysis of the test results, training to the teachers and supervisors, preparation of cooperative-lesson plan, general orientation to the students of experiment groups etc.

Administration of the Cooperative Lesson Plans in Schools

The implementation of the treatment was given to the students of experimental group by using the cooperative lesson plans in their schools. At this stage, the students of control groups were let to remain under as usual conventional process of teaching with similar T/L aids.

Evaluation Stage

As mentioned above, the two different T/L processes were going on which were evaluated by taking their examinations with the same test items. These scores were subjected to statistical analysis. Although, the record keeping system of the information obtained from the regular observation and interviews was kept systematic and updated.

Determination of Process of T/L System

The today's challenge in education arena is to teach effectively the students of diverse ability, background and differing pace of learning. Teachers are expected to teach in a way that enables pupils to learn mathematics concepts while acquiring procedural skills, positive attitudes and values, and problem solving skills. A variety of teaching strategies have been advocated for use in mathematics classroom, ranging from teacher-centered approach to more students-centered ones.

In the last decade, there have been numerous researches done on cooperative learning in mathematics. Cooperative learning is grounded in the belief that learning is most effective when students are actively involved in sharing ideas and work cooperatively to complete academic tasks. Moreover, the assumptions of learning were taken as learning is an active and constructive process; learning depends on rich

contexts; learners are diverse; learning is inherently social; civic responsibility (Educational Broadcasting Corporation, 2004).

Cooperative learning has been used as both an instructional method and as a learning tool at various levels of education and in various subject areas. Johnson, Johnson and Holubec (1994) proposed five essential elements of cooperative learning: (a) Positive interdependence: The success of one learner is dependent on the success of the other learners. (b) Promotive interaction: Individual can achieve promotive interaction by helping each other, exchanging resources, challenging each other's conclusions, providing feedback, encouraging and striving for mutual benefits. (c) Individual accountability: Teachers should assess the amount of effort that each member is contributing. These can be done by giving an individual test to each student and randomly calling students to present their group works. (d) Interpersonal and small-group skills: Teachers must provide opportunities for group members to know each other, accept and support each other, communicate accurately and resolve differences constructively. (e) Group processing: Teachers must also provide opportunities for the class to assess group progress. Group processing enables group to focus on good working relationship, facilitates the learning of cooperative skills and ensures that members receive feedback.

According to the philosophy of cooperative T/L paradigm, the whole classroom teaching/learning process was categorized into three phases:

Phase – I (*More Active Role of Teacher*)

The teacher introduced the concept of teaching topic of mathematics or any task of mathematics through relevant open ended questions, story-telling, relating with real life situation, any news etc. S/he might code few of the challenges with clues. The estimated time, for this session, used to be five to ten minutes.

Phase– II (*More Active Role of Students in Small Groups*)

The students went under five successive working steps (5E-Engaging, Exploring, Explaining, Elaborating and Evaluating) to develop four successive skills (4F-Forming, Functioning, Formulating and Fermenting) to follow up the phenomena

of cooperative learning paradigm (Johnson and Johnson, 1987). In the first step, the students engaged in 'forming' skills which are basic skills required for groups to function and include moving and talking quietly, using eye contact and group members' names, and encouraging all group members to participate. The second step was of exploring the 'Functioning' skills, which allow greater self-management within the group. Individual members maintain their given roles, all group members were included and encouraged, and the interactions are both courteous and positive. In third step, the students used to apply and analyze ideas and to ask for and listen to explains, justifications, elaborations and then summaries from other group members for 'formulating their skills'. Similarly, in last step, they were aware for using their 'Fermenting' skills, which enable students to integrate ideas to form a concept or general principle. Students with these skills are able to question, critique and evaluate cooperatives' ideas, and develop and integrate the ideas of others into a new concept or application. At this level students are also able to handle controversy in a positive and constructive manner.

In this way, students went through four strategies of skill formation that assist in developing group skills and systematize the learning in groups. Further, these strategies frame up the stepwise learning as: wait and give individuals time to think for themselves; be specific with feedback and encouragement; give help when asked in the form of a specific strategy, idea or question rather than an answer; and support agreement or disagreement with evidence, creativeness in use of T/L aids etc. Regarding the group works, according to Upadhyay (2001), the 5E keeps specific meaning in learning as; engaged all in group, explore the idea, explain them, elaborate the learning and evaluate it in group.

Phase – III (Equal Role of Both Teacher and Students)

The students presented their group works in plenary with their conclusion. The peers and teacher provided the essential feedbacks if any. Moreover, the teacher reviewed the works, carried out formative evaluation, and went for briefing, debriefing and conclusions.

Orientation to Teachers and Supervisors

To acknowledge the basic phenomena, the teachers were invited for a week long training program, (for detail program pls. see the training schedule in Appendix XXIII), so that they could be able to identify the basic principles of cooperative learning system, development and implement the teaching model of the system, use of T/L aids, facilitate the group works, understand and implement the basic phenomena of its approaches. In the workshop, it was also tried to refresh and enhance their previous knowledge and skills as well. The researcher had taken the similar types of short term (one week) and long term (more than two weeks) trainings about creating a learning environment in classroom from different national and international organizations e.g. CERID/TU, Ratobangala school in collaboration with Street Bank/USA, MTC/SOS, World Forum/Malaysia, MCITC/Israel, NCED/Nepal, World Forum/ U.K. etc. The researcher is himself a senior trainer since a decade long period and also a book writer of Basic Teaching Pedagogy (Vol. I, II, III - for three different levels of school). For the feed backing and validity of the content and program, the senior colleagues, experts and researchers were invited in the training program.

A second session of second last day was managed for model school-visit program in one of the reputed private school of Kathmandu valley where the child-centered learning methods has been adopted. At the mean time, an observation was made to watch the lively classroom teaching, which were child-centric, group-based activities, interactive etc. It was managed to take photographs, recording and note taking while observing and interacting in the school. At the end of observation day, a project work about the school visit program regarding classroom observation, classroom management, gaining new experience, skills and knowledge was given.

In the last day of the training, the trainees presented their project works of the previous day, and then they were subjected to discuss over their project works. Similarly, in the last session of the last day of the training, the head teachers as supervisor as well were also invited and gave away the orientation about the techniques of formative, corrective and creative supervision in spite of authoritative supervision, formative evaluation system, creating conducive environment, awareness

about possible problems etc. The teachers and head teachers were found to be very happy and gave the vow to follow the system as they learnt. Few of the handouts were also made available to them.

Launching the Experiment in Field/Schools

Rapport Building with School Family

Though the investigator was already familiar with the cooperative-teachers and head teachers while conducting trainings, it was necessary to build good rapport with other teachers, school environment and the cooperative- students. So, the first day was spent for few hours in the cooperative-schools with teachers and cooperative-students of the selected class for the same purpose.

Orientation to Students

We, the head teacher as a supervisor, cooperative-teacher and the investigator entered into the classrooms of both the schools and, gave and took the introduction of all, among us. But, in the cooperative school, the investigator put forth few words of purpose of being there and oriented the students regarding the implementation of new pedagogy of learning i.e. cooperative learning mechanism and its conduction in different modality. He was interacted with them regarding the classroom setting, code of following the learning steps and moulding them in a new way for learning.

They were found to be happy when they knew that the role of teachers would be changed from talking and describing to listening, asking open ended questions and guiding them in small groups. At last, we brought them in consensus to take one pretest in the next day before starting with the new system of learning.

Conduction of Pretests

As the students were familiar and oriented about the process of research, the short-term guideline was given to them regarding the way of appearing the pretest. Then, the prepared test items were distributed among them. The time of the test was of 45 minutes. For the administration of test, the school teachers and administration was found to be fully cooperative.

The result was not given to them because they needed not to be discriminated individually and made them to fall in inferiority complex. Besides, it was essential to see their creativity and potentiality in new learning system without pre-occupied mind.

Use of Cooperative Lesson Plans (Working with Teacher and Supervisor in Classroom)

The cooperative lesson plans were prepared by following the "Psychology of Learning Mathematics, Skemp, R. R. (1993)" and lesson plan models of cooperative learning prepared by Ask ERIC's (1994 &1998), which were brought into insight of cooperative-teacher and cooperative supervisor while providing training to them. To work with full of curiosity and creativity by using cooperative-lesson plans, all of four (teacher, supervisor, investigator and student) were working jointly. It was found to be of great interest among all of us.

Transformation of Traditional Classroom T/L System in Cooperative Learning Approach

(a) Introduction of content: For the intervention of new learning system, the teacher firstly introduced the topic of cooperative-lesson plan making it relevant with real life situation. It was based upon their pre-knowledge and experience but with little bit challenges and clues as well. Some other classes in other days, used to be introduced with story-telling, metaphors, daily news, little bit mathematical puzzles, legends etc. The time allocated for, was 5 to 10 minutes. If it had to present the specific problem, it would not take more than five minutes whereas it used to cross the boarder of ten-minute time in newly introduced concept of mathematics.

(b) Classroom setting: It consisted of group division, sitting arrangement and distribution of T/L aids. After dividing the students is groups, they used to undergo to small group works. Each group used to have 3 to 4 peers. In regard to size and nature of group formation, (Trowbridge, 1987) has claimed that groups of three are less effective because they tend to be competitive, even as pairs tend to be more cooperative. However, differences between group sizes seem to disappear when children are given the opportunity to interact with other in the class

(Colbourn & Light, 1987). Thus, the groups formed were of moderate size consisting of 3/4 students according to different classroom situation. It seems that collaboration does benefit even an individual if he or she is below a certain developmental level with the help of other peers in a group.

The sitting arrangement focused to make them to sit in different groups in face to face manner though there was not so easy way due to fixed furniture and small size of classrooms. In few of the sittings, the students of front bench used to sit by turning back. However, it was managed to some extent.

(c) *The distribution of T/L aids:* The T/L materials, not compulsorily but oftenally used to be distributed in groups as Piaget's learning philosophy argued that it is important to gain concrete knowledge before falling in symbolic knowledge. (It would be better if the teacher instructed in plenary about different problems, put the T/L materials in working tables and allow the students to go to join the tables according to their interest).

(d) *Following the learning steps 4F with 5E*: As mentioned earlier in "Determination of Process of T/L", the teacher used to facilitate them to follow up 4F by 5E model of cooperative learning paradigm. It was to be aware whether each student is spending quality time in learning?

(e) *Plenary session*: After spending the allocated time under the proper guidance of teacher, the groups used to be reached in conclusion and aftermath they presented their way of doing, used strategies and formulae, findings and conclusions in plenary session. But, it may not be needed after every item/activity of group works.

(f) Reinventing the wheel (Mosquito-coil): After making to reach in logical end to each problem, the process again went back to step 'a' and then proceeded ahead to follow up the steps 'b', 'c', 'd' and 'e'. It moved up in cycle but not exactly in closed circle, moreover, exactly in the shape of mosquito-coil because there was no repetition of same problem.

Duration of experiment in schools: The designed duration of the experiment was of 4 weeks. What it was found that the teachers and the students had made a consensus of giving continuity to this system of learning.

Collection of reactions: The opinions were collected while captured in the school visits and working over there. The collected opinions were of cooperative-teachers, other teachers, supervisors, school administration, and other subject teachers, which have been put in the chapter of "Analysis and Interpretation".

Conduction of posttest: After the completion of the specified time of experiment for a month long period, the posttest was taken by using those questions, which were prepared by considering cognitive domain (mainly knowledge, comprehension and application) and grade wise outputs specified by CDC, Nepal.

Conduction of retention test: To see the retention impact of cooperative T/L system, the research had made the provision of taking delayed posttest, which was taken after a month of the completion of the experiment in both the schools (control and experimental).

A tool to Check the Validity of Quasi-Experimental Design

To avoid the weaknesses and make the quasi-experimental design strong, it was necessary to find the sources of invalidity for it. For, it had used design number 10 of "Non-equivalent Control Group Design" of "Sources of Invalidity" for Quasi-experimental designs for this research prepared by Campbell and Stanley (1967) (as cited in Upadhyay, 2001) see in Appendix XI. Regarding design number 10 of non-equivalent control group of quasi-experimental design, no problems were defined under the external sources of invalidity. Similarly, there were no problems appeared regarding the internal invalidity sources e.g. history, maturation, testing, instrumentation, regression, selection and mortality due to their positive status in the given table (Appendix – XI) except in 'interaction of selection and material'. The weaknesses of interaction in selection and material, in two schools, were strengthened by various means (see below, table no. 1, p. 57) like; selecting two schools from ten schools having similar status regarding indoor and outdoor environment, school management, physical facilities, educational standard, SLC results, extracurricular activities, experience and qualification of cooperative-teachers, students' achievements of pre-tests etc. In addition, similar T/L materials were used in both the types of schools.

A Tool to Study the Multiple Variables of the Research

Which and what sort of variables related to structure of school, characteristics of students and teachers could influence to the students' learning was a keen interest for the researcher because without analyzing them the study could not be crystallized. Thus, it was analyzed with the help of "Reviewed of Educational Research, 1980, vol. 50, No. 2, pp 273-291" (as cited in Upadhyay, 2001). For, please see Appendix X.

Selection of Variables and Control Exercised

It was difficult to extract the relationship between dependent and independent variables from the influence of extraneous variables. However, the dependent variable was the achievement made by the students and the confidence built in. Similarly, the independent variable studied in this study was adoption of cooperative learning system as a T/L strategy. There was the possible effect of other non-controlled extratenous variables like; the individual differences, quality of time and job satisfaction whereas rest of other as experience gained by the teachers, salaries, class-size, quality of time difference, school environment, administration, ratio of teacher and students, status of schools were found to nearly similar etc.

However, the efforts have been made for the minimization of influence of other variables were as teaching same subject matter, using same T/L materials and same test tools, using the appropriate statistical tools etc. The other techniques used to reduce the extra effect were as use of standard classroom observation form, lay emphasis for the same level of qualification of teachers and their experiences, selection of almost the schools of same status, survey of students' attitude towards mathematics, measure the level of students before implementation of the new way of teaching etc.

The selected two sampled schools and two groups (control and experimental) of the students were likely to consider equivalent on the basis of the different variables as studied and found consequently the similar status. All above-mentioned criteria in foregoing three topics have been summarized in the table given below:

Table – 1: The two groups of two sampled schools were considered to be similar on the basis of the following variables:

#	Variables as considered	X - School (Control Gr.)	Y- School (Exp. Gr.)	Remarks
1	Selection of sample schools	By survey and tests	By survey and tests	From 20 & then 10 similar schools
2	*Physical facilities:* indoor and outdoor environment, library, classrooms' status, furniture,	Similar	Similar	Bit open area in X school
3	*School management:* SMC, SIP, PTA, administration, class-size, ratio of teacher and students, location	Similar	Similar	Almost similar
4	*Educational standard:* Class-wise and SLC results, extracurricular & co - curricular activities	Similar	Similar	In both
5	Experience and qualification of cooperative-teachers, age, gender, salaries	B. Ed in math with nearly 9 year's exp….	B. Ed in math with 9 year's exp.…	Little bit diff. in experience by months only but salary is same
6	*Educational materials:* T/L materials, textbooks and other reference mat.	Similar	Similar	In both
7	*Students' achievements:* pre-tests	27.91	26.56	Average marks
8	*Internal Validity:* History, maturation, testing, instrumentation, regression, selection and mortality	No strong role, found to be positive	No strong role, found to be positive	-Applied Qusi-expt. Design-10 - no problems because found

9	*External Validity:* Interaction of testing, selection and treatment, reactive arrangement, multiple interferences	Some are unknown & no strong role	Some are unknown & no strong role	them positive in Campbell & Stanley's Design (1967)
10	*Teachers' quality:* Individual differences and quality of time difference, job satisfaction, attitudes, values, expectations, social class,	Extrateneous variables	Extrateneous variables	Excluded in both
11	*Students' quality:* Aptitudes, individual differences and quality of time difference, attitudes, values, expectations, social class, parental effect	Extrateneous variables	Extrateneous variables	Excluded in both
12	Use of same classroom observation forms and survey of students' attitude	Similar	Similar	In both
13	Taught same subject matter, use of same T/L materials and test tools, use of the statistical tools.	Similar	Similar	In both

Data Collection and Analysis Plan

In regard to collection of qualitative data, the research tools e.g. observation of classroom activities, interactions and interviews were administered with the help of cooperative supervisor, curriculum developer and teachers. Then, consequently there was the mechanism of recording the voice, noting down the facts and filled up the forms. But, in the case of quantitative data collection, the record keeping means of marks of pretest, posttest and retention test were used. The marking scheme of different marks was prepared for the different level of questions owing to the different components of cognitive (knowledge, comprehension and application) and non-cognitive domains.

Administering the research tools/instruments upon the respective respondents were collected the related information. The critical judgment and statistical processes (data collection, tabulation, presentation, analysis and interpretation) were adopted for the compiled qualitative data collected through interactive interviews and observations, whereas the quantitative data collected, especially from the different examinations were treated by using different statistical tools.

Statistical Tools Used

According to the nature of the study, it had used the different statistical tools like; mean, standard deviation, coefficient of variation, dependent and independent different t-tests etc. The SPSS 13.0 version was used for the calculation of quantitative data. Moreover, by applying split half method and construct validity respectively tested the reliability and validity of the test items while piloting them. Similarly, to test the difficulty level and discrimination power of the test items, the P-value and D-index formulas were utilized. Similarly, to make the findings short and sweet as well as more presentable even to general people the different symbols, tables, diagrams, graphs and charts have been used in attractive way.

CHAPTER V

ANALYSIS AND INTERPRETATION

The study was based on both the types of data quantitative and qualitative. The quantitative data were based on the three tests taken under consideration of cognitive domain they were knowledge for understanding of concepts, comprehension for following the procedure and application for the transformation of knowledge in practice. Similarly, the non-cognitive data were collected on the basis of interviewing the concerned people and systematic observation of performances of the students regarding their attitude towards mathematics, development of mathematical skills, habits of self-regulation etc. The collected data were simplified, organized, tabulated, converted into presentable form, analyzed and interpreted in meaningful way with the help of different statistical tools. In addition, while analyzing and interpreting the data, a special focus was given to the objectives of the study as framed up.

Regarding the framework of analysis of the findings based on qualitative information, they were analyzed with respect to the related theories, findings of the review of research literatures and own reflections. Moreover, they were undertaken to the process of triangulation means. Similarly, the findings of the quantitative data were solely based upon the different statistical facts, tools and tests incorporated in this study. Later on their consistencies were also tested and theorized as well.

In order to make the visualization of the findings easy and clear, the quantitative data have also been presented in different tables whereas the qualitative data were verified and triangulated in different means. For the shake of simplicity, a care has been given to put the results separately to address the research questions and objectives under the two sections of quantitative and qualitative as follows:

Results of Cooperative Learning Achievement

The analysis and interpretation of the study on the basis of quantitative data was based on the marks obtained in pretest, posttest and retention test (please see Appendices-XIX and XX). These marks were also further separated according the different cognitive domains (knowledge, comprehension and application levels) for,

please see Appendices – XXI and XXII. The table wise data and their interpretations are given below.

The Descriptive Statistics of Total Scores for Control and Experimental Groups

Table 2: Achievements made by the students of both groups in three different tests

Tests (FM. 100)	X - School (Control Group)				Y - School (Experimental Group)			
	No.	Mean	S. D.	Cof. var.	No.	Mean	S. D.	Coff. var.
Pretest	34	27.91	12.03	0.43	40	26.55	10.52	0.39
Posttest	34	44.56	14.52	0.33	40	61.93	19.28	0.31
Retention	34	35.03	12.66	0.36	40	46.97	14.23	0.30

It was found that the mean scores and coefficient of variations of pretests of both the groups (control and experimental) were almost similar. The mean score of control group was 27.91 with standard deviation 12.03 and coefficient of variation 0.43. Similarly, the mean score obtained by experimental group was 26.55 with standard deviation 10.52 and coefficient of variation 0.39. It shows that both the grounds were found to be equally fertile to implement the treatment.

To measure their immediate learning output, there was a provision made for taking posttests after completing the lesson plan in four weeks. The researcher had got the increment of mean marks from pretest 27.91 to posttest 44.56 in control group whereas in experimental group it was increased to 61.93 from 26.55. The achievement made by experimental group was greater by 17.37 marks; it shows the learning achievement in conventional type of teaching method is quite low. In addition, the coefficient of variation shows that the experimental group has more consistency in achievement than that of control group. Though, the immediate learning could be taken place in both the methods, but significant learning achievement was seen with the cooperative learning method than conventional one.

In the same way, the retention tests were also taken place after a month of the posttests held in order to measure their effectiveness for long-term memory. Regarding their retention power, it shows that the decreased in marks in both the groups. The marks of control and experimental groups were found to be 35.03 and 46.97 respectively. It was revealed that experimental group has more memory power

than that of control group. On the basis of coefficient of variation, the experimental group has shown the more consistency as well.

Comparative Study of Pretests of Both the Groups by Using t-test

Table 3: Levene's t-test for equality of means for scores of pretests

Pretests	Levene's test for Equality of Variance		T-test for Equality of Means		
	F	Significance value	t	Degree of Freedom	Significance (2-tailed)
Equal variances assumed	0.967	0.329	0.519	72	0.605
Equal variances not assumed			0.514	66.16	0.609

To see the homogeneity of the two groups that is whether the initial differences of mean scores existed between them or not, t-test was administered. According to Levene's test of equality of variance, the researcher found F-value 0.967 and the significance value 0.329. The significance value 0.329 is greater than the level of significance i.e. α-value 0.05, so, it was found that the variances of two groups were homogeneous.

As the variances of two groups were homogeneous (equal), it was found t-value as 0.519 with significance value 0.605. The significance value was greater than the level of significance value i.e. $\alpha = 0.05$, so, it was accepted the null hypothesis. It means, there is no significant difference in between the achievements made by the students of both the groups. They can be treated as equal though their difference of mean marks was 1.35 (27.91 – 26.55), see table 2. This difference was not large enough to challenge the null hypothesis and so, it was not significant. So, the investigator got homogenous groups to apply the treatment for them.

Comparative Study of Posttests of both the Groups by using t-test

Table 4: Levene's t-test for equality of means for scores of pretests

Posttests	Levene's test for Equality of Variance		T-test for Equality of Means		
	F	Sig. value	t	Df.	Sig. (2-tailed)
Equal var. assumed	4.58	0.036	-4.31	72	0.000
Eq. var. not assumed			-4.41	71.038	0.000

According to Levene's test of equality of variance, the researcher found F-value as 4.58 and the significance value 0.036, the later one is smaller than the level of significance i.e. α-value 0.05, which implies that the variances of two groups were not assumed equal. So, it was taken t-value as -4.41 with significance value 0.000. The significance value was smaller than the level of significance value i.e. $\alpha = 0.05$, so, it rejected the null hypothesis. It means there is significant difference in between the achievements made by the students of both the groups. Thus, there is significance difference between the control and experimental groups. The mean mark of experimental group was 61.93, which is greater by 17.37 than that of control group with mean marks 44.56. It shows that the treatment given to experimental group has been found to be significant to produce learning outcomes.

Comparative Study of Retention Tests of Both the Groups by t-test

Table 5: Levene's t-test for equality of means for the scores of retention tests

Posttests	Levene's test for Equality of Variance		T-test for Equality of Means		
	F	Sig. value	t	Df.	Sig. (2-tailed)
Equal var. assumed	0.24	0.63	3.78	72	0.000
Eq. var. not assumed			3.82	71.84	0.000

According to Levene's test of equality of variance, the researcher found F-value as 0.24. The significance value 0.63 which is greater than the level of significance i.e. α-value 0.05, so, the investigator went for the row of equal variances assumed. Thus, it was found t-value as -3.78 with significance value 0.000. The significance value was smaller than α = 0.05. So, it rejected the null hypothesis. It means there is significant difference in between the achievements made by the students of both the groups. Thus, there is significance difference between the control and experimental groups. The mean mark of experimental group was 46.97, which is greater by 11.94 than that of control group with mean marks 35.03 (see table 2). This implies that the treatment applied to experimental group has been found to be useful for last longer memory as well.

This finding has got fine tuning with the claim of Johnson, Jonson, Holubec (1986) where they said "Cooperative learning activities enhance elaborative thinking and more frequent giving and receiving of explanations, which has the potential to increase in-depth understanding, the quality of reasoning and the accuracy of long term retention".

Net-gain of Control Group

Table 6 (i) Scores of pretest and retention tests of control group

Test scores of X – School (Control gr.)	Mean	N	Std. Deviation
Pretest scores	27.91	34	12.03
Retention test scores	35.03	34	12.66

Table 6 (ii) Paired Samples Test

Tests scores of X – School (Control group)	Paired Differences			t	Df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean			
Pretest / Ret. tests	7.12	5.58	.95	7.43	33	.000

The mean mark got rises from pretest to posttest and then falls down from posttest to retention test. In this rise and fall of mean marks, the investigator wanted to see the net gain of learning in the students. For, the difference between the marks of retention test and pretest were taken into account.

Using the paired sample t-test, the t-value is 7.43 whose significance value was found to be 0.000. The significance value 0.000 is less than $\alpha = 0.05$, so it rejected the null hypothesis. Hence, it was found that the increment in the mean scores. It implies that there is net gain in learning.

In other words, the table 6 (i) of paired samples statistics shows that the mean scores of pretest and retention test were 27.91 and 35.03 respectively. The difference of these two means is 7.12. Further, the table 6(ii) shows the significance value (p-value) is 0.000, which is less than α-value 0.05. Thus, there is significance difference in between pretest and retention test scores. So, net gain in learning took place even in the conventional method but the progresses of it found to be narrow.

Net-gain of Experimental Group

Table 7 (i) Scores of pretest and retention tests of experimental group

Test scores of Y – School (Exp. Group)	Mean	N	Std. Deviation
Pretest scores	26.55	40	10.52
Ret-test scores	46.97	40	14.23

Table 7 (ii) Paired Samples Test

Tests scores of Y – School (Experimental gr.)	Paired Differences			t	Df.	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean			
Pretest / Ret. tests	20.42	8.79	1.39	14.68	39	.000

The mean mark got rises from pretest to posttest and then falls down from posttest to retention test. In this rise and fall of mean marks, the investigator wanted to see the net gain of learning in the students. For, the difference between the marks of retention test and pretest were taken into account.

Using the paired sample t-test, the t-value is 20.42 whose significance value was found to be 0.000. The significance value 0.000 is less than $\alpha = 0.05$, so it rejected the null hypothesis. Hence, it was found the increment in the mean scores. Therefore, there is net gain in learning.

In other words, the table 7 (i) of paired samples statistics shows that the mean scores of pretest and retention test were 26.55 and 46.97 respectively. The difference of these two means is 20.42. Further, the table 7 (ii) shows the significance value (p-value) is 0.000, which is less than α-value 0.05. Thus, there is significance difference in between pretest and retention test scores. It means the net gain in learning has significantly been taken place by 20.42 points more for experimental group.

Comparison of Net-gain in Learning of Two Groups

Table 8 (i) Scores of difference of pretest and retention tests of both the groups

Difference of pretest & retention test scores	N	Mean	Std. Deviation
X - School (Control group)	34	7.0	5.7
Y-School (Experimental group)	40	20.4	8.8

The above table 8 (i) shows that the mean score of the difference of pretest and retention test of X- school (Control group) and Y- school (Experimental group) were 7.0 and 20.4 respectively.

Table 8 (ii) Independent Samples Test

Diff. of pretest and retention test scores	Levene's test for Equality of Variance		T-test for Equality of Means		
	F	Significance (p)	t	Degree of Freedom	Significance (2-tailed)
Eq.var. assumed	3.63	0.061	7.641	72	0.000
Eq. var. not ass.			7.909	67.19	0.000

According to Levene's test of equality of variance, the researcher found F-value as 3.63 with significance value 0.061 in table 8 (ii). The significance value is greater than α-value 0.05 so, the researcher went for the p-value 0.000 of the row of equal variances assumed. Again, the p-value 0.000 has been found to be smaller than α-value 0.05, which means the rejection of null hypothesis. Hence, there is significance difference in the net gain in experimental and control groups. The means score of experimental group (20.4) was found to be higher than that of control group (7.0). Thus, the investigator concluded that the effect of treatment was significantly seen in the favor of experimental group for net gain in learning.

Comparative Study of both Groups under Different Cognitive Levels

Naturally, the investigator became curious to find out whether the results of different tests found in the favor of experimental group were simultaneously distributed in cognitive domain (knowledge, comprehension and application levels). In deed, it was a plan to see the effect of the treatment of cooperative learning so; the questionnaires were prepared being based on three cognitive domains. Thus, the scores of each test were splited according to these categories, for; please see Appendices – XXI and XXII.

Descriptive Statistics of both Groups in Knowledge Level

Table 9 (i): Knowledge level scores made by both the groups in three different tests

Knowledge (F. M. 12)	X-School (Control Group)				Y-School (Experimental group)			
	No	Mean	S. D.	Cof. Var.	No.	Mean	S. D.	Cof. Var.
Pretest	34	3.85	1.97	0.51	40	3.80	1.30	0.34
Posttest	34	6.41	2.45	0.38	40	8.35	2.70	0.32
Retention	34	5.12	1.91	0.37	40	6.82	2.36	0.34

Table 9 (ii) Independent Samples Test

Knowledge Level		Levene's test for Equality of Variances		T-test for Equality of Means			
		F	Sig. (p)	t	Df.	Sig. (2-tail)	M. D.
Pretest	Eq. var ass.	6.18	.015	.138	72	0.891	0.05
	Eq. var. not ass.			.134	55.62	0.894	0.05
Posttest	Eq. var. ass.	1.53	.219	-3.207	72	0.002	-1.93
	Eq. var. not ass.			-3.233	71.68	0.002	-1.93
Ret-test	Eq. var. ass.	1.69	.197	-3.372	72	0.001	-1.70
	Eq. var. not ass.			-3.429	71.86	0.001	-1.70

The table 9 (i) shows that the mean scores of control and experimental groups were 3.85 and 3.80 respectively in pretest. The table 9 (ii) shows that p-value of Levene's test was .015, which is less than α-value 0.05. So, it went for the row of equal variances not assumed. In this row, the t - value was 0.134 and significance value was 0.894 which is greater than 0.05. It accepts the null hypothesis, which means there is no significance difference in between the knowledge level of pretest of control and experimental groups. So, the students of both groups were found to be in equal status.

In the posttest, the p-value was 0.219, which is greater than α-value = 0.05, so the investigator went for the values of row of equal variances assumed. The significance value 0.002 is smaller than 0.05, which rejects the null hypothesis. It means there is significance difference in between the achievements made by the two groups. Since, from the table 9 (i), the mean score (8.35) of experimental group was

greater than that of control group (6.41), the effect of treatment was found to be significantly useful in experimental group for conceptual understanding level.

By the similar process, the p-value 0.001 of retention test shows that there is significance difference in the mean scores of two groups. From the table 9 (i), the mean score (6.82) of experimental group is higher than that of control group (5.12). It means the last longer memory of knowledge level of students of experimental group was significantly seen effective and consistent as well.

Descriptive Statistics of both Groups in Comprehension Level

Table 10 (i): Comprehension level scores made by both groups in three different tests

Comprehension (F. M. 9)	X-School (Control group)				Y-School (Experimental group)			
	No	Mean	S. D.	Coff. Var.	No.	Mean	S. D.	Coff. Var.
Pretest	34	2.23	1.12	0.50	40	2.05	1.17	0.57
Posttest	34	3.44	1.28	0.37	40	5.12	1.68	0.32
Retention	34	2.73	1.35	0.49	40	3.70	1.15	0.31

Table 10 (ii) Independent Samples Test

Comprehension Level		Levene's test for Equality of Variances		T-test for Equality of Means			
		F	Sig. (p)	t	Df.	Sig.	M. D.
Pretest	Eq. var. ass.	.206	.651	.688	72	.494	.185
	Eq. var. not ass.			.690	70.889	.492	.185
Posttest	Eq. var. ass.	2.926	.091	-4.772	72	.000	-1.683
	Eq. var. not ass.			-4.877	71.230	.000	-1.683
Ret-test	Eq. var. ass.	.353	.554	-3.301	72	.002	-.964
	Eq. var. not ass.			-3.259	65.399	.002	-.964

According to the table 10 (i), the mean scores of control and experimental groups were 2.23 and 2.05 respectively in pretest. The table 10 (ii) shows that p-value of t- test was 0.651, which is greater than α-value 0.05. So, we assumed row of equal variances. In this row, the significance value of t-test was 0.494 which is greater than 0.05. It accepts the null hypothesis, which means there is no significance difference in between the comprehension level of pretest of control and experimental groups. So, both the group-students started with the same level of performance.

In the case of posttest, the p-value of t-test was 0.091, which is greater than α-value 0.05. So, the investigator went for equal variances assumed. The significance value (p-value) was found 0.000, which rejects the null hypothesis. Since, the mean score (5.12) of experimental group was greater than that of control group (3.44), the effect of treatment was found to be significantly fruitful in experimental group for procedural understanding level.

In the same way, the p-value (.002) of t-test for equality of means of retention test shows that there is significance difference in the mean scores of two groups. The mean score (3.70) of experimental group is greater than that of control group (2.73). It means the comprehension level of students of experimental group was significantly seen more effective. Moreover, with the evidences of the values of S.D. and Coefficient of Variation, the achievement made by the students of experimental group has been found to be less scattered and more consistent.

Descriptive Statistics of both Groups in Application Level

Table 11 (i): Application level scores made by both groups in three different tests

Application (F. M. 9)	X-School (Control group)				Y-School (Experimental group)			
	No	Mean	S. D.	Cof. of Variation	No.	Mean	S. D.	Cof. of Variation
Pretest	34	2.32	1.00	0.43	40	2.12	1.26	0.59
Posttest	34	3.38	1.20	0.35	40	5.12	1.81	0.35
Retention	34	2.64	1.01	0.38	40	3.72	1.37	0.36

Table 11 (ii) Independent Samples Test

Application Level		Levene's test for Equality of Varian.		T-test for Equality of Means			
		F	Sig. (p)	t	df	Sig. (2-ailed)	M. D.
Pretest	Eq. var ass.	1.155	.286	.738	72	.463	.198
	Eq. var not ass.			.752	71.71	.455	.198
Post-test	Eq. var. ass.	6.052	.016	-4.773	72	.000	-1.742
	Eq. var not ass.			-4.927	68.28	.000	-1.74265
Ret-test	Eq. var. ass.	2.310	.133	-3.778	72	.000	-1.07794
	Equal variances not assumed			-3.872	70.60	.000	-1.07794

From the table 11 (i), the calculated mean scores of control and experimental groups were 2.32 and 2.12 respectively in the pretest. In the second table 11 (ii), p-value (.286) of t-test indicates the p-value (.463), which accepts the null hypotheses. It means there is no significance difference regarding the application level of control and experimental groups. So, both the group-students were found to be with equal status, which explicitly provides equally fertile ground for the implementation of treatment.

Regarding the posttest, the p-value of t-test was 0.016, which is less than α-value 0.05. So, the investigator went for the row of equal variances not assumed. In the second row, the p-value of t-test for equality of means was found 0.000, which rejected the null hypothesis. Since, the mean score (5.12) of experimental group was greater than that of control group (3.38), the effect of treatment was found to be significant in experimental group in the application level as well.

Likewise, the p-value (0.000) of t-test for equality of means for retention test shows that there is significance difference in the mean scores of two groups. The mean score (3.72) of experimental group is greater than that of control group (2.64).

On the basis of these statistical facts, it was concluded that the treatment effect to application level of the students of experimental group was significant.

Factual Findings

The various statistical tools were applied to analysis the quantitative data collected while implementing the research study that has drawn the following conclusions. These conclusions have further been analyzed and made consistent with the conclusions of review of literatures, pre-existed theories and own reflections in the next chapter.

1. On the basis of pretest scores, the students of both the groups were found to be of same standard. After the use of cooperative learning approach, the experimental group students were found to be significant in regard to immediate learning achievement.
2. The statistical tool applied for retention tests implied that the treatment effect produced a longer memory in the experimental group rather than in control group,

3. The students of experimental group stood significant than the students of control group regarding the net gain in learning,

4. As an effect of treatment, the experimental group-students have performed well than by the students of control group in each cognitive domain of Knowledge level (concept building status), Comprehension level (procedural catching status) and Application level (transformational mode) as well.

Moreover, it needs to incorporate the experiences, opinions and observations of students, teachers, school-family, curriculum makers, and subject experts etc. All of these informative data and records were triangulated and verified to make the findings more consolidated. The interviews, interactions and observations were the major tools taken to fulfill its purpose.

Perceptual Findings

The analysis of qualitative information obtained from the interviews, narratives and observations have tried to be analyzed in the oven of social, psychological and anthropological theories and findings of the related researches. According to the research questions, it has been done under three major headings like; development of self-regulating habit of the students, relevancy of cooperative learning approach and problems faced by the teachers while adopting this new method.

Development of Self-Regulating Habit of Students

On the basis of following opinions of students and teachers along with the regular classroom observations, the students of cooperative learning were found to be more self-learning, self-motivated, self-esteemed, self-correcting and independents. The teachers reported that the students of experimental group used to start on their own immediately after receiving the instructions from teachers whereas the control group students used to make their copy and pen always ready to copy the solutions of the problems written in blackboard by teachers. The teachers added that the students of cooperative group wanted to work in groups and consulted with their friends when they got stuck to go ahead, they always used to be in search of clues in spite of whole solutions whereas the control group was found to be in reverse position.

The students of cooperative learning opined their views as they have developed the habit of searching the similar worked out examples, asking with seniors, sharing the answers though they may be wrong, try to find out the mistakes with friends etc. They said that they did not scare more with mathematics because they were getting opportunity to enhance their skills independently so, they were found to be happy with their improvement in learning. It is also supported by their opinions as given below.

Relevancy of Cooperative Learning Approach

To see the relevancy and implementation of the cooperative learning method in our classroom situation, it had taken the bases of academic achievement shown by

the experimental group of students, their opinions with the opinions of teachers and own observations.

The academic achievement made by cooperative group students has shown that they have performed significantly better than the control group students in posttest, retention test and net gain in each level of cognitive domain as taken in this study.

Regarding the relevancy of the cooperative learning method, the investigator had taken the views of top, middle and low performer students. The top students said that,

> After implementing this new method, we are supposed to be a good assistant of teacher because we grasp the clues of problems and facilitate our friends to learn them. Really, we have felt honored and become more caliber in mathematics though it was our most favorite subject.

In this regard, Palmer, G. et al (2006) says that the high achievement students, due to the repetition and the explanation they gave to the rest of the group helped them better comprehend the cognitive content of the study units. The opinion of middle level students was like;

> Before having this cooperative learning method, so-called top 4/5 friends used to lead the whole class and they disturbed others to learn mathematics but, now many of us have also supposed to be heroes. We facilitate our friends to learn it in our small groups where we feel comfortable to discuss more and share the ideas. It has made us easy to learn. We ask with teachers in the last stage otherwise we practice ourselves in groups. Really, it has improved our learning achievement.

Similarly, the low performer students put their views as:

> We used to think that mathematics is not for all; it has many more formulas and working rules. We used to be nervous in mathematics periods. But, now we think that we had a wrong concept, perhaps we may do well but we didn't have its base so that this method should have implemented from the

> beginning. However, we are catching few of the things from the friends while working in groups. We feel comfortable to ask with friends rather than teachers.

These above opinions have shown that the cooperative learning accepted as the students-centric method so that the students of each level have actively been participated in learning. The method seemed popular in students and made each level of students more hopeful. According to them, the smart students have become smarter and middle level students looked more active, enthusiastic and confident. Similarly, the below than average level students have been turned towards hopeful situation and they were changing the paradigm of learning and getting off from the mathematics phobia, and showing the positive attitude towards mathematics.

In this regard, the students were asked how they reacted when they got stuck on a problem. They said that,

> Individual methods such as re-reading, thinking harder and asking for personal help from the teacher were the core activities of the traditional way of teaching. We used to expect the answer written on the board and copy them. But, after starting to work in small groups, however, our perceptions have been changed. We all the students asked for help from our group-members, we discussed in our opinions, gave specific arguments to support them and drew the conclusions.

Regarding the cooperative learning method, the teachers who were involved in teaching reported that;

> In the beginning, we used to think that cooperative method would only be better to provide training for teachers. It could not be taken up to classroom practice. We could not imagine its implementation in the situation of lesson plan every day, T/L materials, crowded classes, no space for group activities, non-movable furniture etc. We were just agreed to adopt this method upon your request for not more than a month. But, when started with, after few days, we saw the visible progresses in students like; their active participation in-group works where they were participating on their own behalf, sharing and

> caring, developing positive attitude towards the subject, creation of comfortable learning situation etc. In short-lived, now, we cannot go away from it. We like to give it continuity because we have been feeling better in our job and observing the meaningful changes in students.

It means mathematics learning takes place only when the students make themselves involved in the action and practice with positive attitude, which can be found in cooperative learning method. Usually, students working in small groups mutually search for understanding, solutions, meanings, and creating a product.

In addition, the supervisor and curriculum developer have said that:

> By principle, literally, we knew that it is a good method. But, this time we got the chance of observing it closely and found it really fruitful. They suggested that it would be better if it could be used as method of T/L system in other subjects as well. While developing curriculum, it needs to give the space to it, especially; it should be illustrated in Teachers' Guide. They recommended to the teachers for training about its effective use, which is simple too and can be used any time and anywhere in Nepalese situation. It does not need of any more things except few of its techniques to the teachers with their zeal.

The investigator as an observer also observed the classes with checklist where he found that the students' direct participation and making the learning meaningful in small groups with the help of four skills (forming, functioning, formulating and fermenting). He saw the business of students enjoying in learning in their groups where they were properly engaging, exploring, explaining and elaborating the content and, evaluating their learning outputs. Though, it seemed to lack of few of the technical matters like; T/L materials, organization of works in systematic manner, changing the group members in time-to-time, different works in different groups and few of the physical managements. Rest of these things, it was found to be really milestone for learning mathematics.

Problems Faced by Teachers

To dig out the different types of problems being faced by the cooperative teachers according to the principle of cooperative learning method, they were interviewed. Moreover, the interview was also administered to supervisors, head teachers and peer teachers. They reported that, there were big problems of classroom design with limited space and fixed furniture, which obstructs to have zones of activities. The classrooms are small with no enough light, the dilapidated walls and ceilings so, no conducive environment, no proper management of T/L materials and equipments, no raw materials even card boards and sheet papers, colors, scissors etc. Though, the students were managed in-group works by making them to sit in face-to-face manner from each two benches and they were provided the materials for the period of research by the researcher.

Similarly, lack of training to the teachers and if training but of always stereotype, low remuneration and motivation, no cooperation of school administration, no support of other colleague-teachers, no training to the peer leaders, students with always same friends, remaining few of the students passive every time, sometimes quarreling, roaming here and there, old type of examination system of paper and pencil tests, overload of teachers etc.

In addition, the policy makers, subject experts and senior teachers said that in traditional method, the teachers could not be the good and trustworthy friend to the students, there is the communication and generation gap as well. There was no availability of curriculum, reference books, teachers' guide, exercise books and elaboration of the subject etcetera with modified form according to the norms and values of different pedagogy along with cooperative learning method. The commonly adopted T/L method was lecture method, teaching to the front benchers only, no group works, no project works, no giving feedbacks and comments in the students homework, degrading and blaming tradition to students, corporal punishment system, a gap with parents etc. In this situation, any effective method along with the cooperative learning one also could not work much.

CHAPTER VI

REFLECTION OVER FINDINGS

I have a strong experience, belief and feeling that learning takes place effectively in friendship groups where they can share their knowledge and skill without any hesitation in unconditional cooperative closure. In fact, the learning is a social process, in which each individual learns mathematics through social interaction, meaning negotiation, and shared understanding (Vygotsky, 1978). According to Perry and Greenberg (2006), there are four benefits of cooperative learning approach i.e. social, psychological, academic and assessment (evaluation of group and individual both and instant feedback). The cooperative learning environment is a virtue of team responsibility in learning in spite of individualistic and competitive as claimed by Johnson and Johnson (1989), and democratic behaviors as disclosed by Saxena (2001) and Henriksen (1990) who stated as in pairs the empathetic cooperation, freedom of expression and publicity, resourcefulness and self-administration, individual and the collective development. So, it was intuitional to appraise democratic norms and values in cooperative learning-approach because it is a white space for connecting teachers with students, self-expression, debating and dialoguing, searching archived knowledge and learning in a structured manner. Along with these best practices, the cooperative learning system was also found to be aware of students' cultural capital as Bordieu (1998) claimed, those children whose home culture is similar to the culture of educational system as they have similar cultural capital, can cope easily with the system resulting better achievement.

In this regard, Hargvreaves (1994) claimed that the teachers' works and culture in the "Post Modernism" reviewed that for enhancing the classroom environment for universal access to learning, strengthening cooperation, partnership, relationship between students and among colleagues the pedagogical practices of the teachers have profound effects. It makes the classroom life safer, more productive and more fulfilling for the children lives. Usually, students are working in groups of two or more, mutually searching for understanding, solutions, meanings, and creating a product.

Despite of all, I, in the beginning of the research days, had many more obstacles and challenges e.g. getting similar status of schools, training to the teachers; teachers were also afraid of making more teaching/learning aids, course may not be completed in time, class may not be under of control, good students may not follow the rules, different evaluation system; involvement of head teachers, right way of conduction of different tests, collection of opinion of students etc. And at last the theorization of the findings, but all of these problems came under the shadow of the zeal of the good research. Actually, I enjoyed upon these kinds of challenges. It's my happiness that still the teachers have been using the cooperative learning paradigm in their schools. At the time of taking the retention test after a month, students were found to be satisfied and they were giving me the credit upon it. In this way, though, I could not generate the new theories but in the fire of pre-established theories and review of literature, all of the findings were found to be as consistent as steel in furnace which have been depicted below.

A. Reflection of the Factual Findings

There were four findings obtained by using statistical tools to the quantitative data.

1. On the basis of pretest scores, the students of both the groups were found to be of same standard. The use of cooperative learning approach was found to be significant in the experimental group regarding their immediate learning achievement. The underlying theory is consistent: the consistent peer interaction can have a powerful influence on academic motivation and achievement (Light & Littleton, 1999; Steinburg, Dornbusch, & Brown, 1992; Wentzel, 1999). In the cooperative learning in friendship group, it has applied rational choice theory for peer activities as stated by Adam Smith and early functional theory for their self esteeming in peer groups as claimed by Auguste Comte (1851), could positively influence to have immediate learning. In this regard, Doise (1990) argued that the main thesis of this approach is that "...it is above all through interacting with others, coordinating his/her approaches to reality with those of others, that the individual masters new approaches" (p. 46). It sew that the high achievement of the students was as expected and consistent due to the mastery of individual in it while working in own groups. In this case, my study also found that the treatment

applied to the experimental group under the cooperative learning approach worked well to raise the score of the students.

2. The statistical tool applied for retention tests implied that the treatment effect produced a longer memory in the experimental group rather than in control group. The finding has been found to be supported by Palincsar & Brown (1984) with basic reasons as talking turn by turn, listening more, reason, respect and responsible, use of T/L materials, discuss to relate the problem with empirical ways, use of brain creatively, find the mathematics patterns, learn concrete to abstract, calling in action and do reflection, talking and describing to listening and asking by teachers, one can maintain the discipline of peer learning for its tangible result for a long time.

   Moreover, the early exchange theory in learning belongs to James Frazer (1939) says that in peers they feel comfortable to exchange their every idea, in the form of role theory as stated by Ralph H. Turner where each one is clear for his/her role of action, and self and identity theory as stated by Peter J. Burke where the students take their own responsibility and be activated for their identity as well. They learn the mathematical concepts in their own pace and methodology as stated by Hardd Garfinkel in his ethno-methodological theory. It means the students to verbalize their ideas to the group helps them to develop more clear concepts; thus, the thought process becomes fully embedded in the students' memory for a long time. Vygotsky supports this concept in his research on egocentric speech by claiming that verbalization plays significant role for long term memory (as cited in Bershon, 1992).

3. As an effect of treatment, the net gain in learning was found to be significant in the experimental group in the comparison of control group. This was done prior to the recording of baseline data to provide an optimal learning environment for the students' pre- and retention test measurements. The early interactionist and phenomenological theory belongs to G. H. Mead and analytical functionalism belongs to Herbert Spencer (1901) have worked as the foundation for the higher net gain of the students of experimental group because they had got the opportunities of early interaction in peers, reflecting own experiences and thinking

critically and analytically over there. According to Vygotsky (1978), it happens due to availability of opportunities like; more interacting, arguing, conceptualization of the problem, rich problem solving, discussing for alternative solutions so that the students extends the students' zone of proximal development (the difference between student's understanding and their potentiality to understand) so, the net gain was an obvious result.

4. Regarding the progresses made in three cognitive domains (knowledge, comprehension and application levels) as an effect of treatment, it was found that the students of experimental group stood significant than the students of control group in each level of it. As Golub (1988) pointed out, "Cooperative learning has as its main feature a structure that allows for student talk: students are supposed to talk with each other, the higher order cognitive talk included more understanding, conceptualizing, application and analysis at the fermenting level of cooperative skills, and synthesis and evaluation at the formulating level of cooperative skills.... and it is in this talking that much of the learning occurs." Cooperative learning produces intellectual synergy of many minds coming to bear on a problem by the application of behaviorist exchange theory as claimed by George Humans (1985), dialectic exchange theory of Peter M. Blau, and differential treatment theory of Bruce Fuller to the groups as per their necessity, and the social stimulation of mutual engagement in a common endeavor. This mutual exploration, meaning-making, and feedback often leads to better understanding on the part of students, and to the creation of new understandings for all. In this framework, it has been found to be a consistent result with the theoretical understandings that I went through.

B. Reflection of the Perceptual Findings

There were three major findings based on the qualitative information.

1. Development of Self-Regulating Habit of the Students

On the basis of opinions of students and teachers along with the regular classroom observations, the students of experimental group were found to be more self-learning, self-motivated, self-esteemed, self-correcting and independents.

Research also suggests that cooperative learning brings positive results such as deeper understanding of content, increased overall achievement in grades, improved self-esteem, and higher motivation to remain on task. Cooperative learning helps students become actively and constructively involved in content, to take ownership of self-learning, and to resolve group conflicts and improve teamwork skills (Educational Broadcasting Corporation, 2004).

The teachers reported that the students of experimental group used to start on their own immediately after receiving the instructions from teachers whereas the control group students used to make their copy and pen always ready to copy the solutions of the problems written in blackboard by teachers. The teachers also added that the students of cooperative group wanted to work in group in the framework of cluster theory and consulted with their friends when they got stuck to go ahead, they always used to be search of clues in spite of whole solutions whereas the control group was found to be in reverse position. It has been found to be fine tuned with Johnson and Johnson (1989) claim, "cooperative learning experiences promote more positive attitudes" toward learning and instruction than other teaching methodologies. Because students play an active role in the learning process in cooperative learning, student satisfaction with the learning experience is enhanced. Cooperative learning also helps to develop interpersonal relationships among students. The opportunity to discuss their ideas in smaller groups and receive constructive feedback on those ideas helps to build student self-esteem.

The students of cooperative learning opined their views as they have developed the habit of searching the similar worked out examples, asking with seniors, sharing the answers though they may be wrong, try to find out the mistakes with friends. They said that they did not scare more as fear theory of John Holt said with mathematics because they were getting opportunity to enhance their skills independently. In this regard, Goleman (1995) has said that for peer learning, it identifies short- and long-term goals; break goals down into smaller steps; own strengths and what leads to good outcomes; recognize what is helpful/unhelpful in achieving the goals; practice sustained effort and learning; anticipate obstacles and plan for them; take responsibility where appropriate; recognize excuses and the ways sometimes try to absolve themselves of responsibility; confident enough to take

appropriate risks; flexible in switching goals when necessary; tolerate frustration (e.g. by keeping the big picture in mind, believing that they can get there, using positive self-talk and visualization); range of strategies for 'bouncing back' from mistakes and setbacks; enjoy and celebrate the achievements as in role, identity and personal theories. So, the peers found to be more interacted, discussed, shared and achieved confidence in content as well.

In this context, NCTM (2001) said that the students bring multiple perspectives to the classroom-diverse backgrounds, learning styles, experiences, and aspirations. As teachers, they can no longer assume a one-size-fit all approach. When students work together on their learning in class, they get a direct and immediate sense of how they are learning, and what experiences and ideas they bring to their work. The diverse perspectives that emerge in cooperative activities help them to be self-regulated.

2. Relevancy of Cooperative Learning Approach

The relevancy of the cooperative learning method in our classroom situation was judged on the basis of academic achievement made by the students of experimental group, their opinions, the opinions of teachers and own observations. Regarding the opinions of the students, I had taken the views of top, middle and low performer students. The meaning of the opinions of top level students was that they were having more learning by teaching to the peers as Palmer, G. et al (2006) said that the high achievement students, due to the repetition and the explanation they gave to the rest of the group helped them better comprehend the cognitive content of the study units.

The gist of opinion of middle level students was of being empowered and supposed to be competent with ever winners. As per the mathematics education community (NCTM, 1991) has advocated that observation; experimentation, collaboration and discovery should be as much a part of mathematics as they are of natural science, the opportunities available in cooperative learning approach have made them more confident and achiever.

The low performer students meant for mathematics is not for all, they have the math-phobia but, now, in this method, they have started to learn comfortably in peers' group and felt free from such a phobia. Research shows that students cannot learn mathematics effectively by passively listening and disengaged from the learning process. Teachers must provide opportunities for students to construct their own understanding of mathematical concepts (NCTM, 1989). It means equitable learning environments engages students as active participants in mathematics instruction and improve confidence accordingly. Multiple learning situations must be providing that build on students' prior knowledge and cultural backgrounds. Small-group, cooperative-learning experiences help students explore mathematical concepts in an interactive problem-solving setting. Research also reveals that group interaction or cooperative learning promotes weak students' self-esteem, motivation and achievement. Group interaction also promotes the development of mental operations or processes in students, since students tend to internalize the talk heard in the group (Vygotsky, 1978). In this way, the method seemed popular in students and made each level of students more hopeful. So, the relevancy of this method has got the similar wavelength with the pre-existed thought.

Regarding the cooperative learning method, the teachers who were involved in teaching with this method had few of the challenges e.g. daily lesson plan and teaching/learning aids, fearness of no completion of course in time, handling the students etc. But, later on they found positive changes in students and they started to feel easy job with it. In fact, it opposes the claim of Poluhoff's (1997) stated as in the lack of proper resources people can not learn mathematics and science, and he strongly claimed "With enough time and hard work, everyone in the class can learn the mathematics". It gives a hidden curriculum message that …, mathematics is just pushing around numbers, writing them in different ways depending on what the teacher wants. But, teachers found the creative students and keep learning by sharing without enough materials and hard work. Behind of it, there was a strong motivation and open discussion among the peers as teachers reported.

In addition, the supervisors and curriculum experts had unanimously said that the method is relevant and implementable, and it should be extended to other subjects as well though it needs to modify the curriculum and provide the training to the

teachers. In this context, NCTM (1998) argued that to learn new information, ideas or skills, our students have to work actively with them in purposeful ways. They need to integrate new materials with what they already know. In cooperative learning situations, the students are not simply taking in new information or ideas. They are creating something new with the information and ideas. These acts of intellectual processing of constructing meaning or creating something new-are crucial to learning. Moreover, it has been argued that the subcultures, the distinctive norms and values of social classes and ethnic groups, influence performance in education system (Haralambos, p, 193). As stated by Edmond in school effectiveness theory, the cooperative learning approach also gives importance to cultural code theory that makes the students empower to learn effectively and hence it seems the relevant method.

3. Problems Faced by Teachers

Regarding the problems faced by the teachers while acclimatizing with cooperative learning approach; the cooperative teachers, peer teachers, supervisors and head teachers reported that, poor status of classrooms, lack of T/L materials, raw materials and equipments, limited space and fixed furniture, which have obstructed to organize zones of activities. Similarly, lack of reference materials, lack of training and if training but always of stereotype to the teachers, low motivation, communication gap, no cooperation of school administration and other colleague-teachers, overload of teachers etc. In this regard, Educational Broadcasting Corporation (2004) asserted that it may be the stigma of dull students, inadequate time for peer education, unwillingness to take up additional responsibilities, noisy class, ignorance, dominance, curriculum and assessment system of not that kind of nature, anti-environment, no support of other teachers and school staffs/colleagues, difficult to identify socio-learning culture, setting ground rules for peer groups, assess of existed knowledge and attitude of the students, preparation and use of T/L aids with lesson plan, supervision, tools of supervision, to define indicators to monitor the progress, interpret the experiences and narratives/anecdotal records, making turn by turn group leaders, identifying inter and intra group relations/working modalities etc. It means, it needs to remedy these kinds of problems to see the full-fledged positive impacts of cooperative learning approach. Because, the research suggests learning is

fundamentally influenced by the context and activity theories in which it is embedded (Brown, Collins & Duguid, 1989). Collaborative learning activities immerse students in challenging tasks or questions. Rather than beginning with facts and ideas and then moving to applications, cooperative learning activities frequently begin with problems, for which students must marshal pertinent facts and ideas. Instead of being distant observers of questions and answers, or problems and solutions, students become immediate practitioners as empirical theory emphasized upon it. Rich contexts challenge students to practice and develop higher order reasoning and problem solving skills. In this way, it was found to be the technical, managerial, pedagogical, cultural, contextual, textual, motivational etcetera problems regarding the implementation of cooperative learning paradigm even though they are considerable, affordable and good dealt with.

C. Reflection over Observed Understandings

1. The students of control group have been found to be in search of working rules whereas the students of experimental group were going beyond the fixed rules so, they were making themselves more involved in the works with more enthusiasm. The students of control group have been confined by fixed rules of teachers as bracketing theory claimed. It has been influenced by the power theory applied by the teachers that the teachers are supposed to be all in all. As Haralambus (2006) argued that there are two forms of power, authority and coercion. The authority is that form of power, which is accepted as legitimate, that is as right and just and therefore obeyed on that basis. In this context, the students could not expose their ideas and hence they could not go beyond the instructions of the teachers as a result they compelled to follow the fixed rules.

2. Though the students of conventional method had their own pace and strategies for learning the new concepts but it was more revealed in the students of cooperative learning group. The learning pace, action and strategies are based upon the contemporary situation as the system of values, beliefs, norms, artifacts and symbols that have been developed by the circumstances created around it, which is an action theory as claimed by Bhandari (2000). He further added that every

activity of a person is based on cause and circumstances; so, the performance of experimental group could be better depending upon the environment as created.

3. The learning could meaningfully be taken place through their own behalf in their own direct involvement in the cooperation of colleagues rather than the teachers' instructions. They felt comfortable to be corrected in the group rather than in plenary with the supervision of teachers. As Ivan Illich claimed that education should be a liberating experience in which the individual explores, creates, uses his initiatives and judgment and freely develops his faculties and talents to the full (as cited in Haralambos, p. 187.), where the students represent in their own behalf for learning. Further, it has attracted the self-participation, cooperation, coexistence and homonization theories, which have been used in peer works. Further, Foucault claimed that it needs to get the reshaping in learning to make it meaningful with peers in own groups.

4. The students of cooperative learning were looking more forward, sharing, valuing to colleagues, interacted, trying for hard problems, discussing, and happy to provide own contribution in the group. Because of the individual is not a bundle of attitudes but a dynamic and changing actor, always in the process of becoming and never fully formed (Abraham, 2001, p, 209). So they need to have set of connections of peers for bartering their ideas and prior-knowledge as network exchange theory claimed. Moreover, they seemed that they came out from any kinds of shyness, nervousness and mathematics phobia. As Abraham (ibid, p. 210) says that the interaction theory interprets each other's actions or reacts to each other's actions which involve interpretation, sharing, valuing, discussing, motivating and mediating as well. The mediating is equivalent to inserting a process of interpretation between stimulus and response in the human behavior. Thus, it could bring the interacted students forward and make them free from backwardness.

5. The students of cooperative group were found to be in the search of some kinds of drawing or tools to handle their mathematical problems. The passive students started to compete with so-called talented ones when they were learning with demonstrations with scissors, papers, cubes, blocks, open ended questions, etc.

The simple trial and error method as Thorndike's learning theory was also found to be popular in the working groups. Moreover, the functional theory has been activated. As Johnson (1961) says functional theory motivates to go to the action for the fulfillment of individual or group's needs. Merton (1962) added that functions are those observed consequences, which are made for the adaptations and adjustment. In this way, the students of experimental group were handling the situation and even weak students were under of demonstrating the problem solving skills. According to Sharma (2006), the good functioning brings the good performances in the groups because they convert their unfavorable situation into own favor as well, so, the functional theory seems workable in this situation.

6. The students of experimental group, in a little while, started to work in their groups for solving the problems rather than seeking the correct answers. They discovered and felt that there are often several correct ways of finding a solution. This finding was concerned with the heterogeneity theory of a multi-agent system as Durfee et al (1989) found that the performance of peers of problem solving agents is better when there is some inconsistency among the knowledge of each agent. Man does not just react to fire; he acts upon it in terms of the meanings he gives to it. S/he cannot simply observe action from the outside and impose an external logic upon it he must interpret the internal logic which directs the multi-actions of the actor. (Haralambos, p., 20). Similarly, Gasser (1991) pointed out the role of multiple representations and the need for mechanisms for reasoning among multiple representations brings several ways of finding the solution. It means they were found to be moved from a competitive to a cooperative stance as Johnson and Johnson (1991) claimed. Rather than competing for the correct answer, they began to share their problem solving ideas and answers.
7. The students were more engaged in mathematical problem solving through cooperative learning. Reluctant learners, who previously did not do their work, began to participate in the problem solving process. According to Blau's Exchange Theory, a person who enters into a particular activity expects a reward, the more he receives a valuable reward in return for an activity, the more s/he emits that particular activity, the more a particular activity brings expected rewards. It was a finding as Croom (1997), in his research, found that to support mathematical understanding in the classroom have encompassed friendly

behavior, communication, mathematical content, mathematical connections, decision-making, and equity. So, teachers and students work together to create a harmonious culture in their cooperative classroom.

8. Students' language developed as they worked together in mother tongue and mainstream languages to solve the problems. The students needed to use general terms, problem specific terms, and technical mathematical language during the discussions. They often code-switched between these two languages to make sure everyone in the group understood as Neves (1983) said that the cooperative learning helps students learn language better than the drill and practice of traditional language training. It would appear that peer interaction in natural settings is the ideal use of language that is necessary for successfully acquiring second language skills.

9. The teachers were found to be more aware towards students' abilities when they worked in small groups. In the similar manner NCTM (1998) declared that while closely working with the students, it gives the teacher insight into problem-solving abilities. They solicit students' ideas about how the problems might be solved and then give the students time to solve the problems. As the teachers reflect on the strengths and ideas offered by their students, their expectations generally change. To realize these goals, the classroom must be a place where thoughts are accepted, ideas are investigated, and meaningful problems are solved.

10. The teachers used to think that students lack the necessary skills to work in-group activities, which was an early structure theory of Karl Marx that the teachers always think in that pre-existed structure. The cooperative learning approach disproved it. According to Ong and Yeam (2000) teachers should teach the missing skills and/or review and reinforce the skills that students need and hence it did not create a problem.
11. The teachers were afraid of suspecting of taking longer time by cooperative learning methods to finish the course in time. It was found to be influenced by Cultural Structuralist theory in the mind set thoughts of teachers in the traditional structure of Pierre Bourdieu but, it settled down later on due to wise use of time with lesson plan, no more repetition, positive attitude of students, use of this method where and when needed only etc. Though, Ong and Yeam (2000) claimed

that since students have to generate an answer or information within their group, work time might take longer than the traditional lecture. Further, he added that because of this additional time, instructors might be unable to cover the same amount of curriculum as before, when they used teacher directed class discussions (ibid) but, it was found to be opposed by this research due to the reasons as mentioned above.

12. Teachers need to instruct and guide the students properly that what and how to learn. The teachers must have the knowledge and expertise about it as Nel (1992, pp. 38-40) argued that teachers thinking, knowledge, perceptions, and beliefs could be major contributing factor in the empowerment or the disabling the students.

13. As a lesson learnt, it was found that the efficient teacher and the proper planning give better result. As Cobb (1994) claimed that:

> The teacher's role is characterized as that of mediating between students' personal meanings and the culturally established mathematical meanings of wider society. From this point of view one of the teacher's primary responsibilities when negotiating mathematical meaning with students is to appropriate their actions with proper planning into this wider system of mathematical practice. (p. 15)

It means with proper planning and easy ways of transformation of meaning of mathematical concepts to the students, it adds power to learning more. The teacher is often a facilitator rather than a source of rules and information. He needs to be conscious in setting high expectations and give every learner confidence that they can succeed by; establishing what learners already know and build on it; focusing on structure and pace the learning experience to make it enjoyable and challenging; inspiring in learning through passion for the subject; making individuals as active partners in their learning; developing learning skills and personal qualities for the better result.

In order to make the fine-tuning of research categories, research questions and respective findings with the use of related theories, a table has been given below.

Table – 12: Reckoning research questions and findings with checklist of applied theories

Category	Research questions related to:	Related finding	Theories used
Based on Achievements due to CL-Approach	i) Immediate learning, ii) Retention iii) Net gain and iv) Gain in cognitive levels (K, C & A)	Students of experimental group were found to be with significantly better performance in each category.	- Consistent, choice, functional, exchange, role, identity, ethnomethodological, early interactionist and phenomenological, analytical functionalist, critical, social, experimental, behaviorist exchange and dialectic theories. -Quantitative data were dealt with statistical tools
Based on Qualitative Information (Interviews)	Development of self-regulating habits of the students	Found to be self-regulated with lots of opportunities for their true participation in friendship environment by using LP, T/L aids, facilitation, +ve attitude, 4F and 5E, Ck/Tk, prior ideas/exp.	Personal theory, role theory, identity theory, action theory, functional theory, fear theory, clusters theory etc. -Consistency test with pre-existed research findings.

	Relevancy of CL-approach in Nepalese classrooms	No comm. gap, change behaviors of teachers/friends, every one can learn, multi-cult/lang, support, action encouragement, creative etc with some improvements	Discovery theory, collaboration theory, school effectiveness theory, cultural code theory, explanation theory, discussion theory and interaction theory
	Problems faced by the teachers while acclimatizing CL-approach	Mgt of raw mat. and equipments, change in examination system, need of curriculum, teachers' guidebook, exercise books of CL, training, incentives, work load, infrastructures	-Context and activity theory, motivational theory, triangulation theory, action theory - Consistency tests with review of literatures
Based on Direct Observations and Interactions	Miscellaneous findings (Interesting ones)	Self-driving, gr. works, no answers, multi vs. single mind, own pace and strategy, competition to cooperative, Beyond the fix rules, seeks tools (tech. mind), language dev., mistakes in peers, no math phobia, happy forward	Bracketing, power, authoritarian, action, cooperation, coexistence, homonization, network exchange, interaction, motivation, demonstration, functional
	Challenges of CL-approach	Underestimating the students, aware with students' ability, take longer time, burden of daily LP & mat., in-service training	Heterogeneity, exchange, communication, drill, inspiration, cultural structure and other findings of the reviewed literatures

CHAPTER VII

SUMMARY, FINDINGS AND RECOMMENDATIONS

Summary of the Report

In this section of the study, it was tried to put forth the summary of the research and findings extracted through various means, which have been more systematized in accordance to address the research questions and objectives. And in last, the space has been given to the challenges so far as found while implementing the research in field and the valuable academic recommendations based on the cognitive and non-cognitive findings of the study.

The main objectives of the study was to find the effect of cooperative learning in terms of achievements made by the students in the comparison of traditional way of learning. It took the help of different tests (pre-, post- and retention) based on the cognitive and non-cognitive domains. Similarly, the study has also been focused on the development of self-regulating habits of the students, relevancy of this cooperative learning approach and problems faced by the teachers in it.

The design of the study was qualitative and quantitative both where the results obtained being based on quantitative data were verified with the help of qualitative information, and further these information were triangulated with different means along with the related theories. In this way, a good links have been established among the academic achievements, interviews, observations and, pre-existed findings and theories with the help of meaningful research tools.

For the study, the students of grade III of the Kathmandu valley were taken as population. The random sampling method was adopted to select the schools for the students of experimental and control groups. Though, these two schools were selected from ten public schools on the basis of students' achievement made in pretests and, similar status of the students and schools.

In this study, the treatment was given to the students according to the principle of cooperative learning method. The treatment given to them was taken as independent variable whereas the achievements made by them were considered as the

dependent variable. The preparation and delivery of the treatment were based on a week long training to the teachers, cooperative lesson plans and teaching aids, management of classroom settings, determination of teaching/learning process, provision of observation and supervision etc. The data of quantitative and qualitative both were collected, organized, presented, analyzed and interpreted to draw the conclusions with the help of different statistical tools using SPSS program of 13.0 version. Then, the findings of the study have been presented in two sections being based on two kinds of the data as given below.

Factual Findings

There were four findings obtained by processing the quantitative data with the help of various statistical tools.

1. The pretest had shown that at the out set, the students of both the groups (control and experimental) were found to be same standard. In this situation, the immediate learning achievement was seen higher in the experimental group than in control group.

2. While comparing the retention tests, it was found that the treatment effect produced a longer memory in the experimental group rather than in control group.

3. The overall achievement of learning (net gain in learning) was seen in the difference of outcomes in between pretest to retention test scores where it produced the experimental group with higher net gain than the control group.

4. Regarding the progresses made in three cognitive domains (knowledge, comprehension and application levels) as an effect of treatment, it was found that the experimental group students stood better than the students of control group in each level of it.

Perceptual Findings

It was necessary to compare the results obtained from the quantitative data and qualitative information so that it could substantiate the findings only when there exited fine- tuning between them. It means, it was to see whether one kind was

supported from another or not. The interviews were taken with the students on the basis of their achievement of tests; it was found that the experimental group students could have done better as they have got more learning alternatives and opportunities in the cooperative learning system.

Development of Self-regulating Habit of the Students

Students' Perspectives

On the basis of their opinions and observation, it was found that they were self-regulated in their own true participation and getting the comfortable learning environment in the small group of friends having similar interest and ability. They added that there was no tense, negative attitude and depressive environment despite of which they got the opportunity of learning in joyful, creative and meaningful way. So, they could do better in cooperative learning approach than in conventional way of learning.

Teachers' Perspectives

Regarding the new method, the teachers' experiences have opinioned that the regular use of lesson plan with specific objectives, activities and use of manipulative learning materials, raising curiosity of the students, making conducive environment for learning, opportunities of teaching/learning among the students in peer groups, making the argument and convincing the peers, facilitating role of teachers, positive attitude of students etc. were found to be the foundations for the development of self-regulating habits of the students. So, these evidences have shown that there was a positive correlation of better performance with the students of experimental group.

Supervisors, Curriculum Developers and Subject Experts' Perspectives

They were arguing that the better performance of experimental group was obvious on the basis of what they observed in the classrooms like; the high level of excitement, lively participation and hence the self-regulation of the students in the peer groups with the new method. Actually, the teachers have been tired up by so traditional chalk and talk method. They added that they want to extend this method into other subjects too.

Relevancy of Cooperative Learning

On the basis of the interviews taken and observations made with the checklists, it was found that the learning friendly environment, less gap of communication in between teachers and students, mediating role of teachers, activeness of students, discussion and practice in groups, brainstorming, use of experiences of all, freedom in strategic learning, practicality in dealing the problems, turn taking in, display of students' creations, enough encouragement, support and cooperation of friends etc. These matters showed the essentiality and relevancy of the method that could be implemented in our classroom situation.

Problems Faced by the Teachers

While adopting cooperative learning method; the views of the teachers, supervisors, head teachers, subject experts and observers collectively stated as there was the need of improvement of physical facilities of the classrooms as a whole and they needed to be converted into conducive environment for learning. Mainly, there were the problems of lack of training to the teachers, over work load, no management of raw materials and equipments, no change in examination system based on paper and pencil, lack of safely storing management of the materials, no teaching allowance to the trained teachers etc. In addition, the teachers were in need of curriculum, teachers' guidebook, exercise books, subject elaboration etc. that should be prepared with the norms of this method.

Miscellaneous Findings over Observed Understandings

Moreover, the cooperative learning as a process, its general results illustrated as:

a) The students of experimental group, in a little while, started to work in their groups for solving the problems rather than competing and seeking the correct answers. They discovered and felt that there are often several correct ways of finding a solution. They were found to be moved from a competitive to a cooperative stance.

b) The students of control group have been found to be in search of working rules whereas the students of experimental group were going beyond the fixed rules so, they were making themselves more involved in the works with more enthusiasm.

c) The students were more engaged in mathematical problem solving through cooperative learning. Reluctant learners, who previously did not do their work, began to participate in the problem solving process. The passive students started to compete with so-called talented ones when they were learning with demonstrations with scissors, papers, cubes, blocks, open ended questions, etc. The students of cooperative group were found to be in the search of some kinds of drawing or tools to handle their mathematical problems.

d) Students' language developed as they worked together in mother tongue and mainstream languages to solve the problems. The students needed to use general terms, problem specific terms, and technical mathematical language during the discussions. They often code-switched between these two languages to make sure everyone in the group understood.

e) Though the students of conventional method had their own pace and strategies for learning and building the new concepts but it was more revealed in the students of cooperative learning group. In the meantime, they may go with misconception as well. The simple trial and error method was found popular in the working groups

f) The learning could meaningfully be taken place through their own behalf in their own direct involvement in the cooperation of colleagues rather than the teachers' instructions. Similarly, they felt comfortable to be corrected in the group rather than in plenary.

g) The students of cooperative learning were looking more forward, sharing, valuing to colleagues, interacted, trying for hard problems, discussing, and happy to provide own contribution in the group. Moreover, they seemed that they came out from any kinds of shyness, nervousness and mathematics phobia.

Challenges of Cooperative Learning Approach

While adopting cooperative learning method in mathematics-classroom, it was not free from challenges. Initially, teachers and students had to face various challenges. The major challenges raised in the beginning days were as follows:

a) The teachers used to think that students lack the necessary skills to work in group activities because they were often concerned with their active participation. Teachers thought that they must tell their students what and how to learn. Only the teachers have the knowledge and expertise. They were not trusting to the students that they could learn by own.

b) The teachers were afraid of suspecting of taking longer time by cooperative learning methods though it did not happen, actually.

c) It needed to require a lot of work of the teachers to prepare materials; therefore, it seemed a burden for them to prepare new materials but later on it was converted into enjoyable tasks.

d) The teachers were found more aware of students' abilities while working in groups.

e) The method was new to the teachers so they needed times to get familiar with the new method. Intensive in-service course seemed essential to overcome the problem.

Conclusion

The present situation of teaching/learning process was found to be deviated in the schools. While surveying and observing the schools, they were found to be conducting the traditional approaches to teach the students where the teachers were controlling the majority of the talk, sometimes they used to select the students and say who will speak, who knows its answer etc. The teachers used to fix that when the students will speak and for how long. In this way, the traditional T/L system showed that teacher asks a question, students raise their hands up; teacher takes an answer, accepts, rejects or develops the answer. Again, teacher asks a further question and so

on. Such exchanges often close down learning opportunities because students were steered towards a correct answer that the teacher was seeking. The effectiveness of teacher–learner exchanges depends on the quality of the questioning (or alternatives to questioning). When the students were with their teachers, they tended to hold themselves back even when they had lots of questions to ask. In conventional T/L system; the teachers seemed dictator so they controlled the class, maintained discipline and structure. There was no students' freedom and discussion so; the students felt always the communication and generation gap with teachers. They just mechanically used to follow the directional instructions strictly and pay more attention. Moreover, the teachers used to blame the students' creativity like; are you trying to be superior to me, you know more than me etc.

In this scenario, the investigator convinced few of the teachers where they kept a positive attitude about the benefits of cooperative learning and encouraged the students to give it a try. They also started with a fun activity to help boost student morale. The teachers carefully formed friendship groups with the priority of each group consisted of a diversity of student abilities and backgrounds. The cooperative-teachers continued to follow the strategies mentioned in this chapter for successful implementation. The cooperative teachers were impressed with the results. They found that, once the students had some experience with this method, the higher-achieving students were being paired with lower-ability students. In fact, it helped to build their self-esteem to know that they were able to help their peers. They also found that the students with learning disabilities were actually very creative and could offer new perspectives on how to solve the given problem. The students also began to realize that students from different cultures may struggle to communicate in the mainstream language, but they were very dedicated students who had a desire to do well on given assignments. Interestingly enough, the teachers also found that absences began to decrease. In the reflection papers that they had students complete at the end of the project, they discovered that students felt valued as part of the group and that they attended their classes so that they would not disappoint their peers. But most importantly, student grades actually improved over time. Students of all ability levels took pride in their accomplishments and felt a sense of involvement by being allowed to have input into the activities and classroom expectations. They also seemed to have a more complete understanding of the materials and were able to score higher on all

types of tests, including knowledge, comprehension and application levels. Overall, they saw a dramatic difference in his classroom atmosphere. Both the teachers and their students were more motivated and enthusiastic about each lesson. They realized that there were still situations, which would arise periodically within his classroom, and that cooperative learning would be a teaching strategy that they would have to improve on over time. But after learning more about cooperative learning, they believed that they would have a whole new perspective on classroom strategies.

On the basis of these kinds of positive changes even within a very short period of time (a month), it could be concluded that the cooperative learning method among the peers would be higher productive, self-regulating, and quite relevant even in the Nepalese classroom-situation with some modifications in terms of physical setting and technical matters along with action research-based trainings to the teachers and school authority.

Suggestions of the Study

The cooperative learning approach has been recommended with some suggestions like; training to the teachers, specific lesson plan, manipulative T/L materials, improved classrooms situation with appropriate furniture and sitting arrangement, use of alternative evaluation system, support and cooperation of head teachers, peer teachers, parents etc. In addition, they need to have newly revised and modified curriculum, teachers' guide, text and reference books etc. The effective methods of teaching may also be put in curriculum of teaching license. It may need to have movable furniture to work in-group and black/white boards in different place to be used by the groups of students.

In regard to training to the teachers, most of the public schools teachers are trained but why they have not been implementing their knowledge and skilled hands. It's a big question of policy level. However, the teachers always talk and talk then get fade up as a result, there is no quality education. At least, they need to enjoy in their job so, why don't we look towards the easy way. The observer has seen a little but effective way of enjoying in teaching job with new method like cooperative learning method where they need not to be talking more and getting faded up.

For teachers, it is informal but effective teaching method, inductive method, role of teachers changing from talking to listening, describing to feed backing, chance of using their creativity; they can be in individual touch of students, no need of parroting to students etc.

It can be recommended to students because it is based on their pre-existed knowledge, easy access to learn in peers, informal learning, learning in own pace and strategy, own direct involvement, self regulation and self correcting opportunities which are essential ingredients to make the learning meaningful.

As an ice break of the process, it was suggested that begin trying cooperative learning with a homework assignment. Students could check their homework in groups, going over each problem and clarifying if there were any questions. The groups could then work each problem on the board. Also, the students who are inexperienced with cooperative learning method often have a difficult time getting started or reaching their goals. Having a worksheet to guide them will help the groups set their priorities, work towards their goal, and produce the assessment task.

It creates the working together environment in classrooms and schools, no depression and frustration in organization, better result, sharing the ideas, no feeling of doing the job, discussion among the teachers about the varieties of learning psychology of students etc. so that the cooperative learning approach could be recommended in the favor of organizations as well.

Recommendations for Further Researches

The further researches of in this paradigm can be carried out in different eco-zones, other grades and levels of schools, by focusing the other extrataneous variables, which are not involved in it. It can be recommended that the similar types of researches will be goodness of fit for use of cooperative learning in multi-languages and multi-cultural classrooms in the age of federalism system and providing the education in their own mother tongues.

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Appendix I

Creating a Learning Environment for Cooperative Learning Approach

A. Guideline for Teachers to Create Conducive Environment

1. Transformation of teachers' role from talking and describing to listening and guiding to the students respectively;
2. The teacher is subjected to follow the three steps of cooperative learning paradigm (i.e. posing problem targeting to pre-existed knowledge of the students; mediating group works; and drawing the conclusion)
3. Distribution of necessary T/L aids for all the groups;
4. Thoroughly facilitating the students in their peer groups by giving clues and asking supportive questions if necessary at the time of facing the challenges (one peer-lesson plan may go for couple of days)
5. Minute observation for think-peer-share activities in the peer groups;
6. Following the learning steps and organizing the knowledge with 4F & 5E
7. Observation of 3R (responsibility, respect and reason), socialization, alternative approaches of learning, interest and progress along with ensuring the equal participation and spending quality time in peer groups by every one;
8. Create the environment of "Keep up trying" so, "quitter never win and winner never quit" and "Two mistakes make one correct";
9. Students' role – changing from listening and talking to exploring and describing;

B. Guideline for Teachers While the Students are in Work

Teachers' possible questions to develop mathematical power of students while they are working in peer groups:

1. How did you get your answer?
2. Is there any pattern?
3. How can you check to see for yourself?
4. Tell me what to do next. Explain it to me.
5. Did any one get that answer in a different way?
6. Did anyone get a different answer? What was your way?
7. What is alike (or different) about these two ways of solving this problem?
8. Will this way work if we use different numbers or a different shape? Try it.
9. Make a drawing (or use materials or use symbols) to show me your thinking.
10. Find a friend and see if you can work it together.
11. What else could we do or use to help you, figure out it?

Appendix II

An Interview Guideline for Students

(Translated version of Nepali language)

Name/s: School:

Class: Date:

1. What kind of problems appears in classroom while learning mathematics?
2. Can you help each other while learning mathematics?
3. How do you interact with your friends in class?
4. Who is rapid learner? How did he become so?
5. Who is desk/group monitor? How do you follow him?
6. Who get more punishment from teacher? Why does s/he get?
7. Do you solve only the problems given by teacher or more than that?
8. Does the teacher ask more to someone? If yes why?
9. How do you be clear about confusing matters/questions?
10. Are you listening teacher only or you say something? Do you obey the teacher?
11. Do you apply the knowledge and skills that you learn in the class in your every day lives/at home?
12. Do you sometimes feel like not going to school? Why?
13. How the teachers make you to learn new topics? Does he discuss with you?
14. Who is the teacher that you like most? Why?
15. How did you find this cooperative approach of learning?
16. In what aspects, it is differ from the conventional ways of T/L system?
17. How far this method is helpful to be the student self-starter and to develop the self-esteem, self-regulation and independent habits in students?
18. Any suggestions regarding this method?

Appendix III

An Interview Guideline for Cooperative-Teachers

Name: school: T/L experience:

Qualification: Trainings (duration): Date:

1. What were the past practices of T/L process before introducing this method?
2. What short of T/L pedagogy, the students want to have?
3. How did you find this method regarding pedagogical perspectives regarding content delivery, students perception, joyness, learning achievement, time frame, evaluation system etc.?
4. What are its positive aspects?
5. What are its weaknesses and challenges?
6. What were your strategies to solve the problems?
7. What does your experience say while implementing it?
8. In what aspects, it is differ from the conventional ways of T/L?
9. How far this method is helpful to be the student self-starter and to develop the self-esteem, self-regulation and independent habits in students?
10. How would you evaluate it? How do you take the homework and class work system in mathematics?
11. What are the problems being faced by you regarding the T/L pedagogy?
12. Do you have any peculiar/worthy narratives and examples while T/L process of mathematics?

Appendix IV

An Interview Guideline for General Teachers

Name: school: T/L experience:

Qualification: Trainings (duration): Date:

1. How do you analyze the over all performance of students in Mathematics?
2. What may be the hidden causes behind it?
3. What are the current practices of T/L system?
4. Which methods, you often apply in mathematics-class? Why?
5. What short of T/L pedagogy, the students want to have?
6. Are the methods of mathematics differing than that of other subjects? If so how?
7. Have you ever thought about the different ways of T/L mathematics?
8. How is your experience about cooperative learning system?
9. How do you take the homework and class work system in mathematics?
10. What is the difference in nature of extra classes, tuition classes and regular classes?
11. Do you have any sharable narratives and examples while in T/L process?
12. What short of problems and challenges that you are facing in T/L system?
13. How do you cope with them?
14. Any suggestions regarding the pedagogical matter.

Appendix V

An Interview Guideline for Cooperative-supervisors/Head Teachers

Name: Office: experience:

Qualification: Trainings received/duration Date:

1. How do you assess the situation of school regarding physical infrastructure, qualification of teachers, students' performance, parental involvement, students' background (multi-culture, multi-language, and status), reward system etc.
2. How is the scenario of this school in the achievements made by the students in mathematics?
3. How is going on the development of knowledge, comprehension and application in mathematics of the students?
4. Do the present curriculum and textbooks address the cognitive domain of the students?
5. How did you find this method regarding pedagogical perspectives?
6. In what aspects, it is differ from the conventional ways of T/L?
7. What are its strong and positive aspects?
8. What are its weaknesses and challenges?
9. How far this method is helpful to be the student self-starter and to develop the self-esteem, self-regulation and independent habits in students?
10. How is this method impacting to develop the mathematical knowledge, comprehension and application?
11. How far you know about the problems faced by the teachers regarding the T/L pedagogy?
12. What short of suggestions you provided to solve the problems?
13. How would you evaluate it? Further suggestions, if any.

Appendix VI

An Interview Guideline for Curriculum Experts

Name: Experience:

Qualification: Date:

1. How is the national scenario of achievement made in school mathematics?
2. How is going on the development of knowledge, comprehension and application in mathematics of the students in national level?
3. Does the curriculum address the cognitive domains of the students?
4. Does the present curriculum give the space to promote cooperative learning, if so, how? If not, what measures to be taken?
5. Do you have any idea about the current practices of the T/L pedagogies in the schools?
6. How far you know about the problems faced by the teachers regarding the T/L pedagogy?
7. What is your opinion regarding the use of Cooperative approach in learning mathematics?

Appendix VII

Attitude Inventory Guideline towards Mathematics

Tick (√) on the best as you feel:

S.N.	Theme	Always	Sometimes	Never
1	I like mathematics			
2	I like to work problems and puzzles in math			
3	I think mathematics is useful			
4	I make good grades in mathematics			
5	I want to continue my study in mathematics			
6	I am afraid of mathematics			
7	I worry about my grades in mathematics			
8	I use mathematics outside of school			
9	I work hard in mathematics			
10	I find mathematics easy			
11	To be reviewed and added few others			

Source: Grossnickle, F. F., Reckzeh, J. Perry, L. M., & Ganoe, N. S. (1973). *Discovering Meanings in Elementary School Mathematics* (7th edition), New York. Holt, Rinehart and Qinston (cited in Upadhyay, H. P. (2064 B. S. pp. 355).

Appendix VIII

An Observation Checklist for Students' Reflective Behavior

Tick (√) on the best score as you feel: Name of observer:

S. N.	Statements	Not at all	Moderately so		Very much so	
		1	2	3	4	5
1.	Students making up questions					
2.	Students reflecting on learning difficulties and					
3.	Students reviewing and classifying (interviewing each other, drawing concept maps)					
4.	Students constructing or building on each other's					
5.	Students devising and using marking schemes					
6.	Students diagnosing errors critically					
7.	Students assessing themselves against statements of					
8.	Students predicting their own performance					
9.	Students teaching students					
10.	Students writing meanings for different mathematical statements					
11.	Students use terminology and definitions					
12.	Students surveying the structure of text					
13.	Students sequencing pieces of text					
14.	Students composing text					
15.	Students conducting mini-debates					
16.	Students conducting small group discussions					
17.	Students observing students					
18.	Students describing what learning feels like					

Source: Upadhyay, H. P. (2001).

Appendix IX

An Observation Guideline for School and Classroom

A. General Observation

The school and teaching-classrooms were minutely observed with respect to the following variables:

1. School environment and available resources, size of classroom, no. of teachers, no. of students, co-curricular/extra activities;
2. The availability of trained, experience, qualification, teaching license of male/female teachers;
3. The performance of principal/SMC/PTA, visits of authorized supervisors;
4. The preparation of teachers for lesson plan, mental plan, used methods, T/L aids;
5. Classroom setting, furniture, capacity of seats, student sitting pattern, (by gender, caste, religion, intelligence, friendship);
6. The interaction (inter and intra) of groups, collaboration, comfortability, participation, reward/punishment system, learning psychology, discrimination of any type confidence/self-esteem of the students;
7. The provision of revision of lesson, tests, types of tests, homework, class works, individual works, direct questions, use of blackboard, cultural activities or impacts, seasonal effects, languages, individual differences, special students, special treatments, motivations, participation in extracurricular activities, participation on the basis of caste, social behaviors etc.

B. Observation of democratic practices in classrooms

The good governance and harmony of the classes with peer works were observed on the basis of eight fundamental perspectives with their further categories:

Right of the Child

Freedom (interaction, self initiation, flow of ideas, social relations); Justice (dealing child as a person, as object); Equality (opportunity, power sharing, reward punishment, giving information); Autonomous class;

Participation of the Child

Ask question relevantly, answer teacher's question, participate in the classroom, follow of directions, learning by doing activity, solving related problem, other activities

Interaction

Sharing view, sharing interest, sharing problems, others,

Facilitation and Self-Government

Making easy in concept by teacher, cooperation, decision making, shared responsibility, accountability

Equal Opportunity and Individual Difference

In questioning, material using, giving opportunities (according to individual difference), in other learning process

Democratic Method of Teaching

Play-way method, heuristic method, discovery method, group discussion method, experimental, demonstration, problem solving and others

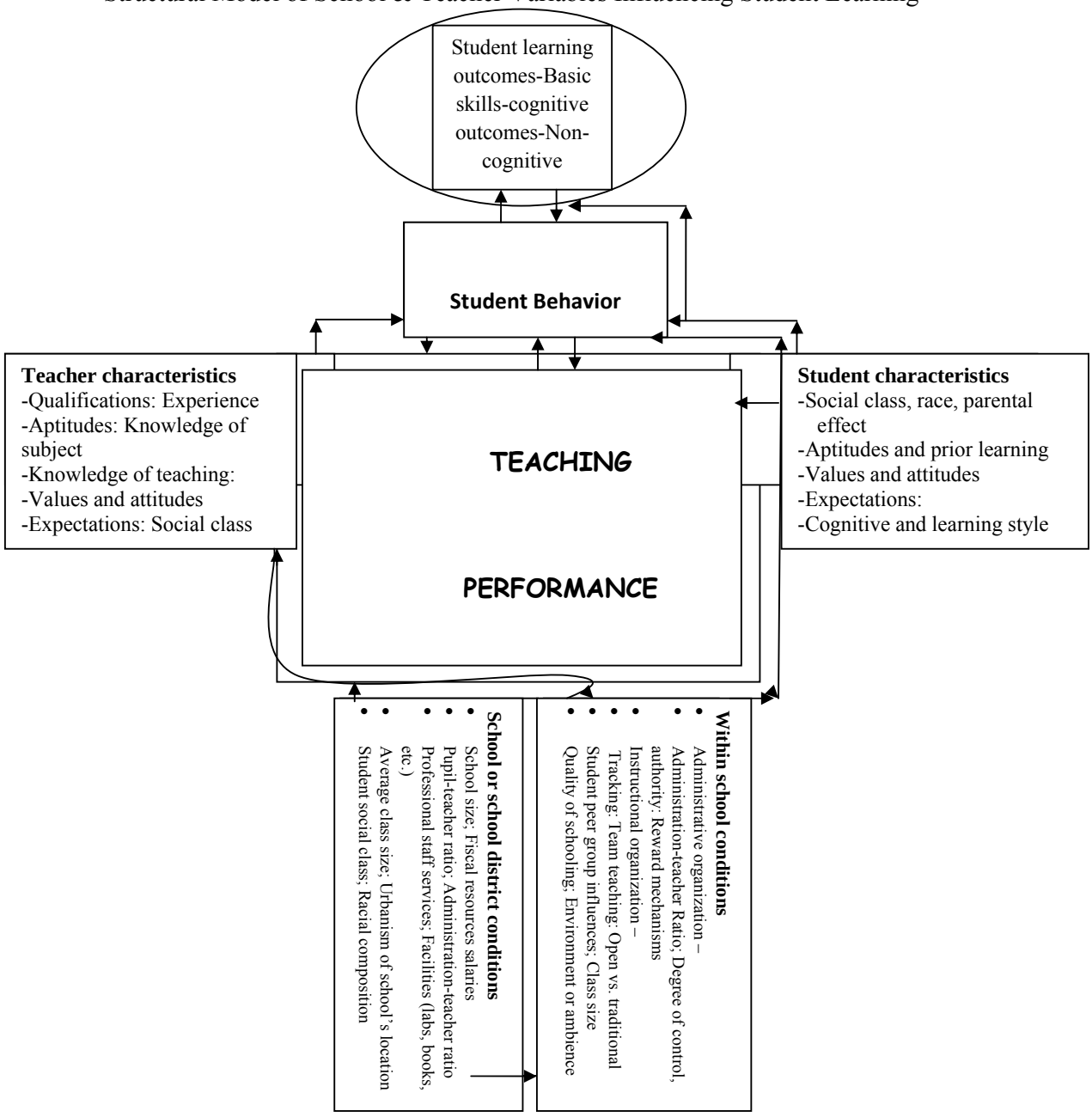
Social Activities: Social, cultural, co-curricular, others.

Preparation of Learning Materials

The democratic practices with respect to the preparation of the content of curriculum, textbooks, examples etc.

Appendix X

Structural Model of School & Teacher Variables Influencing Student Learning



Note: The straight-line arrows indicates predicted causal relations whereas curved arrows represent correlation but not causal relations

Source: Review of Educational Research, 1980, vol. 50, no. 2 pp. *273-291. (Developed by John A. Centra and David A.).*

Appendix XI

Sources of Invalidity for Quasi-experimental Designs 7-14

Design No.	Quasi-experimental Designs	Sources of Invalidity											
		Internal								External			
		History	Maturation	Testing	Instrumentation	Regression	Selection	Mortality	Interaction of selec. & mat.	Interaction of testing and X	Interaction of selection & X	Reactive arrangements	Multiple X Interference
7	Times series O O O O X O O O O	-	+	+	?	+	+	+	+	-	?	?	
8	Equivalent time samples design X_1OX_2OX_3OX_4O etc.	+	+	+	+	+	+	+	+	-	?	-	-
9	Equivalent materials samples design MaX_1O MbX_2O McX_3O MdX_4O etc.	+	+	+	+	+	+	+	+	-	?	?	-
10	Non-equivalent control group design O X O O O	+	+	+	+	?	+	+	-	-	?	?	
11	Counter balanced designs X_1O X_2O X_3O X_4O X_2O X_4O X_1O X_3O X_3O X_1O X_4O X_2O X_4O X_3O X_2O X_1O	+	+	+	+	+	+	+	?	?	?	?	-
12	Separate sample pre-post test design R O (X) R X O	-	-	+	?	+	+	-	-	+	+	+	
12a	R O (X) R X O R O (X) R X O	+	-	+	?	+	+	-	+	+	+	+	
12b	R O_1 (X) R O_2 X R X O_3	-	+	+	?	+	+	-	?	+	+	+	
12c	R O_1 X O_2 R X O_3	-	-	+	?	+	+	+	-	+	+	+	
13	Separate-sample Pretest-posttest Control group design R O (X) R X O R O R O	+	+	+	+	+	+	+	-	+	+	+	
13a	R O (X) R X O R O (X) R X O R’ R O (X) R X O R O R O R O R O R’ R O R O	+	+	+	+	+	+	+	+	+	+	+	
14	Multiple time-series O O O X O O O O O O O O O	+	+	+	+	+	+	+	+	-	-	?	

Source: Campbell & Stanley (1967). Experimental and Quasi-experimental Designs for Research

Appendix XII

Teaching Incident (1st Week)

Unit: Measurement of Area Class: III

Topic: Calculation of area by counting squares Time: 45 min.

Specific Objectives:

- To explain the concept of area;
- To define and identify the area;
- To give argument 'against and for' for why the given models are of 1 square unit;
- To use geo-board, geo-dot, 10-by-10 grids, square copies for making square rooms of different measurements;
- To calculate the area by counting square rooms;
- Addition and subtraction of areas in provided figures;

1. Task Intervention Activities: (10 min)

- Show them six faces of match's box to give ideas about surface;
- Do the same by showing a book;
- Compare the surfaces covered by different faces of match-box and book
- Link the concept of surfaces with their areas;
- Give the concept of area of 1 square unit by using square papers;

2. Group work (i) (Engage and Exploration): (20 min)

- To create surfaces, distribute pages of square copy and different colored pencils in groups and ask them color few of the square rooms where they can construct different shapes by using square rooms e.g. ladder, +, - signs etc. or whatever they like to construct;
- Ask for the groups, is each square is of all equal sides? Ask them to find the area of all colored square rooms;
- Distribute some readymade figures in square copy and ask them to find their area;

- Distribute geo-boards among the groups and ask them to form different shapes with the help of rubber bands;
- Ask them to find the areas developed so far;
- Do the same with geo-dots and 10-by-10 grids;
- Make them to go for the exercises, figures and problems of exercises given in pages 77 and 78 of their text book *Mero-Ganit* book;

(ii) Group-work Rubric: Filling up the forms by colleagues to evaluate the cooperation for its design please, see Miscellaneous Appendix - XXIV.

3. Presentation (i) (Explain and Elaboration): (10 min)

- Make them to describe their group's solution with justification in plenary session;
- The presentation should be focused on the questions like how did they find their solution and how did they know that they have done correct? Also, display their figures/drawings;

(ii) Presentation Rubric: Filling up the forms by colleagues to evaluate the presentation for its design please, Miscellaneous Appendix - XXIV.

4. Closure and Reflection (Evaluation): (5 min.)

- The surface covered by any face of an object is called its area;
- The area can be obtained by counting the square rooms;
- The unit of area of a square room is sq. unit;
- The area of a square room with side of 1 cm. is 1 square cm;
- The unit of measurement of areas can be square mm, sq. cm, sq. m etc;

Source*: Based on cooperative lesson models of Area developed by Timothy Welch (1994) for Ask ERIC Lesson Plan.*

Appendix XIII

Teaching Incident (2nd Week)

Unit: Capacity Class: III

Topic: Measurement of Capacity Time: 45 min.

Specific Objectives:

- To explain the concept of capacity of varieties of living and non-living things e.g. carrying, running, holding etc;
- To define the concept and capacity of vessels of different shapes and sizes;
- To give the examples of bigger and smaller capacity holders;
- To make the opinions 'in against and for' guessing and reaching nearby of the capacity of different vessels;
- To identify the different units of measurement of capacities;
- To use different means of vessels to measure the capacity of vessels;
- To compare the capacity of different vessels so that how many small vessels equivalent to big one;
- To use standardized vessels to measure the capacity of vessels;
- To convert the bigger and smaller units of measurements of capacity to each other like ml. to liter and vice versa;
- To do addition and subtraction about the measurement of capacity;
- To solve the word problems related to measurement of capacity;

1. Task Intervention Activities: (10 min)

- Show the figures of men and elephant (for eating capacity), cycle and taxi (for running), van and truck (for loading), man and monkey (for jumping), bottle and tank (for holding water) etc;
- Ask them to compare the different capacities in plenary;
- Focus the interaction to make the concept and compare the capacity;
- Interact by showing them the capacity of small and big standardized vessels of measurement of capacity and let them to know 1 lit = 1000ml;

2. Group work (i) (Engage and Exploration): (20 min)

   - Distribute the vessels of different measurement e.g. 5 ml to 1 lit. and let them to fall on group discussion;
   - Distribute few of the vessels and standardized vessels to measure the capacity of given vessels (e.g. cup, bucket, gallon etc.);
   - Distribute the figures of different capacity and ask them to find how many times one can fill up the bigger one;
   - Give few problems for conversion e.g. 9 liter 400 ml into ml. 10 lit into ml, 1200 ml into lit and ml etc;
   - Organize the group works for add. and subtraction based on different capacity of vessels e.g.

Add.	lt.	ml.	Subt.	lt.	ml
	12	200		6	300
	15	800		3	900

   - Organize group works for simple division e.g. 4200 by 200, so that they could be able to count and find how many times it needs to fill up a bucket of 4200 ml by a cup of 200 ml?
   - Give them few of the word problems for the discussion, sharing, solving and drawing the conclusion in their group e.g. if each child is sharing 100 ml. juice, for how many children a bottle-juice of 1 liter can be distributed equally?
   - Let them to do the problems given in *Mero-Ganit* book, pages 79, 80 and 81;
   - Give them the project works e.g. finding the capacity of their 5 vessels at home and add them;

   (ii) Group-work Rubric: Filling up the forms by colleagues to evaluate the cooperation for its design please, see Miscellaneous Appendix - XXIV.

3. Presentation (i) (Explain and Elaboration): (10 min)

   - Make them to describe their group's solution with justification in plenary session;

- The presentation should be focused on the questions like how did they find their solution and how did they know that they have done correct? Also, display their figures/drawings;

(ii) Presentation Rubric

- Filling up the forms by colleagues to evaluate the presentation for its design please, Miscellaneous Appendix - XXIV.

4. Closure and Reflection (Evaluation): (5 min.)

- Capacity of vessels is the holding-strength of amount of liquid substance;
- The different vessels have different capacity as long as the big and small vessels have more and less capacity respectively;
- The standardized vessels of measurement of capacity means, the vessels with fixed capacity everywhere like 100 ml, 200 ml, 500 ml, 1 lit etc.;
- The units of measurement of capacity are convertible e.g. ml to lit and vice versa;
- The addition and subtraction of units of measurement related with daily life situation;

Source: *Based on cooperative lesson models of Capacity developed by Timothy Welch (1994) for Ask ERIC Lesson Plan.*

Appendix XIV

Teaching Incident (3rd Week)

Unit: Volume Class: III

Topic: Measurement of volume by counting cubes Time: 45 min.

Specific Objectives

- To make them to visualize the three dimensional objects with l, b, h;
- To explain the concept of volume;
- To explain why l = b = h of cube;
- To explain volume of a cube with each side of 1 unit is 1 cubic unit, so, 1 cm^3;
- To use different blocks to develop different shapes and find their volumes
- To calculate the volume of given different three dimensional figures;

1. Task Intervention Activities: (10 min)

- Show them the three dimensional objects e.g. match-boxes, duster, chalk-boxes, books, cubes etc. to give the ideas about l, b and h, and their opposite faces;
- Relate space occupied by cubical object with its volume;
- Deliver the concept of units of measurement of volume i.e. 1 cubic unit and 1 cm^3 with the help of a cube;
- Develop and demonstrate different shapes with the help of cubes and find volume;

2. Group work (i) (Engage and Exploration): (20 min)

- Distribute few of the cubes in each group and ask them to discuss over its six faces, opposite faces, relation of opposite faces, l, b, and h, the space taken by it;
- Make them to discuss over how is the volume of 1 cube is 1 cubic unit or 1 cm^3;

- In second step add other cubes to each group and ask them to form different shapes with the help of them and find their volume by counting system;
- Distribute square copy and make them to draw the figure of cubes in few of the square rooms. Help them to make the square room three dimensional;
- Make the groups to make different shaped of cubes;
- Ask them to find the volume of these figures;
- Distribute some readymade three dimensional figures developed by cubes and ask the groups to find their volume;
- Give few examples so that why do we also need other units of measurement of volume e.g. cubic mm/m/km etc;
- Give them some project works so that they could learn from the real field works e.g. calculate the volume of cubical objects found in their community;
- Make them to do the Exercises of page 82, 83 and 84 of textbook *Mero-Ganit*.

(ii) Group-work Rubric: Filling up the forms by colleagues to evaluate the cooperation for its design please, see in Miscellaneous Appendix - XXIV.

3. Presentation (i) (Explain and Elaboration): (10 min)

- Make them to describe their group's solution in plenary session;
- The presentation should be focused on the questions like how did they find their solution and how did they know that they have done correct?

(ii) Presentation Rubric: Filling up the forms by colleagues to evaluate the presentation for its design please, Miscellaneous Appendix - XXIV.

4. Closure and Reflection (Evaluation): (5 min.)

- The volume is the space occupied by an object;
- Cubical objects are three dimensional with equal l, b and h;
- The unit of measurement of volume of cube is cm^3 or cubic unit;
- The necessity of mm^3, cm^3, km^3 etc.;
- Calculation of volume of cubical figures by counting the cubes contained in it;

Source: *Based on cooperative lesson models of Volume developed by Wendy Michelson (1998) for Ask ERIC Lesson Plan.*

Appendix XV

Teaching Incident (4th Week)

Unit: Weight Class: III

Topic: Use of standardized weights Time: 40 min.

Specific Objectives

- To use the balance-weight;
- To select the small unit as gram and big unit as kilogram according to the small and big objects to be measured;
- To nearly guessing the weight of few of their objects/belongings;
- To identify standardized weights and use them
- To compare the weights of different objects;
- To convert the different units of weights to each other;
- To do addition and subtraction belong to weights;
- To solve the word problems related to weights;

1. Task Intervention Activities: (10 min)

- Show them balance-weight and discuss about its importance;
- Show them standardized weights e.g. 5og, 100g, 200g, 500g, 1kg etc. and let them to discuss about them;
- Explain about the use and importance of standardized weights by showing them;
- Ask them to guess about their own weight;
- Let them to compare the weights of friends;
- Let them to make opinions about bigger and smaller objects have big and less weights respectively;
- Interact with them about small and big units of weight;

2. Group work (i) (Engage and Exploration): (20 min)

- Distribute balance-weight and different standardized weights and let them to conclude that 1 kg contains 1000 gram;
- Organize few of the activities so that they could select the weights to take the weight of their belongings;
- Let them to find the total weight of few of their belongings in the group;

- In groups, distribute papers with one page figures of different weights (small and big) by labeling them and ask them to color those weights which equivalent to the weight of their friends;
- Ask them also to find the total weight of the different groups;
- Ask/assist group to convert big weights in small and vice versa e.g. convert the weight of belongings of the group into grams only and gram 7450 into kg and gram;
- Organize the group works for addition and subtraction of weights e.g.

Add.	Kg	g	Subt.	Kg	g
	10	900		9	800
	13	600		7	300

- Ask/assist to do the word problems in groups for, distribute the sheets of paper with word problems;
- Give them project works e.g. ask them to note down the weight of their family members and find their total weight;
- Ask/assist them to do the problems given in page 85, 86, 87 and 88 of *Mero-Ganit* book

(ii) Group-work Rubric: Filling up the forms by colleagues to evaluate the cooperation for its design please, Miscellaneous Appendix - XXIV.

3. Presentation (i) (Explain and Elaboration): (10 min)

- Make them to describe their group's solution with justification in plenary session;

- The presentation should be focused on the questions like how did they find their solution and how did they know that they have done correct? Also, display their figures/drawings;

(ii) Presentation Rubric

- Filling up the forms by colleagues to evaluate the presentation for its design please, Miscellaneous Appendix - XXIV.

4. Conclusion/Reflection (Evaluation): (5 min.)

- Development of skills that how to use standardized units of weight;
- Able to take active part while weighting the objects of daily use;
- Development of ideas about weighting the grocery items;
- Conversion of weights;
- Handling addition and subtraction and verbal problems related to daily life circle;

Source: *Based on cooperative lesson models of learning Measurement developed by Wendy Michelson, edited by Ask ERIC and endorsed by Dr. Don Descy in Mankato State University in 1998.*

Appendix XVI

Test Items (Pretest)

Name: Class: III R. N.:

School: Time: 1 hrs. F. M.: 30

Attempt all the questions. The weightage of the questions are allocated in the right side.

Q. N. 1. Tick on the best answer 4x1 = 4.

(i) The unit of measurement weight of our body is;

(a) ft. (b) ft. and inches (c) m and cm. (d) Kg.

(ii) For the measurement of volume of a cubical object like boxes of chalk, *chau-chau* etc.

(a) length, breadth & height (b) length & height (c) height & breadth (d) length & breadth

(iii) If the length and breadth of our classroom room 10 m and 8 m resp. then its area is.

(a) 18 sq. m. (b) 2 sq. m. (c) 180 sq.m. (d) no height is given so can not find area.

(iv) If the length, breadth and height of a cubical vessel each is 1 cm. its capacity is:

(a) 1 cm. (b) 1 cu. cm. (c) 3 cm. (d) 3 cu. cm.

Q. N. 2. Fill in the blank spaces 4x1 = 4.

(i) We find the exact weight of goat by ……..it.

(ii) The surface covered by the base of a box is called it's……

(iii) We know the how flat is the play ground by measuring it's …….

(iv) The capacity of smaller vessel is …….than the capacity of bit vessel.

Q. N. 3. Find true/false on the following statements 4x1 = 4.

(i) The area is of only those objects, which are like rectangular sheet of paper.

(ii) The capacity of cup is smaller than the capacity of bucket.

(iii) The volume of a cubical vessel can be calculated by its length x breadth x height.

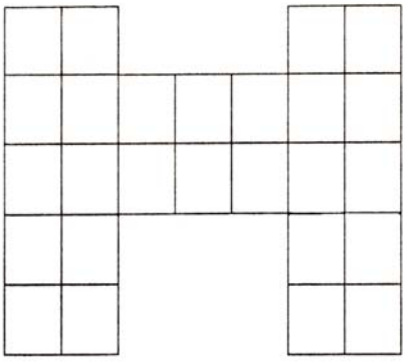
(iv) The height and weight of any object cannot be compared together.

Q. N. 4. To fill up the big drum of kerosene of capacity 100 liter, how many minimum times it is required for a drum of capacity 10 liter? Show its working process. (3)

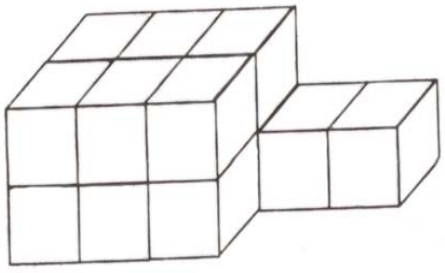
Q. N. 5. A mother purchased and put the four small bags of 1 kg of apples, 2 kg of oranges, 3 kg of mangoes and 4 kg of banana into a big bag. If so, what will be the weight of the big bag? Calculate it. (6)

Q. N. 6. Find the area of whole figure no. 1 given below where all rooms are of equal size, each with the area of 1 sq. cm. Write down your process of finding it. (3)

Q. N. 7. Find the volume of whole block given in figure no. 2 where each cube is of measurement 1 cu. cm. Write down the process of finding it. (3)



(Figure No. 1)



(Figure No. 2)

Appendix XVII

Test Items (Posttest)

Name: Class: III R. N.:

School: Time: 1 hrs. F. M.: 30

Attempt all the questions. The weightage of the questions are allocated in the right side.

Q. N. 1. Tick on the best answer 4x1 = 4.

(i) The weight of an object is measured in:

(a) cm. (b) meter (c) Kilometer (d) Kilogram

(ii) For the measurement of volume of a cubical object, it needs to:

(a) length & breadth (b) length & height (c) height & breadth (d) length, breadth & height

(iii) If the length of a square room is 15 ft., then its area is.

(a) 15 sq. ft. (b) 30 sq. ft. (c) 225 sq. ft. (d) can not be measured.

(iv) If the length, breadth and height of a cubical object each is x cm., its volume is:

(a) x cm. (b) x cu. cm. (c) 3x cm. (d) 3x cu. cm.

Q. N. 2. Fill in the blank spaces 4x1 = 4.

(i) The space covered by the surface of an object is called its……

(ii) The capacity of any vessel does mean, the ……substance contained in it.

(iii) We measure the area in …….unit.

(iv) The capacity of big vessel is …….than the capacity of smaller vessel.

Q. N. 3. Find true/false on the following statements 4x1 = 4.

(i) The area is of only those objects, which have four corners.

(ii) If we double the length of a rectangular surface then its area will also be double.

(iii) The volume of an object can be obtained by multiplying its length and bredth.

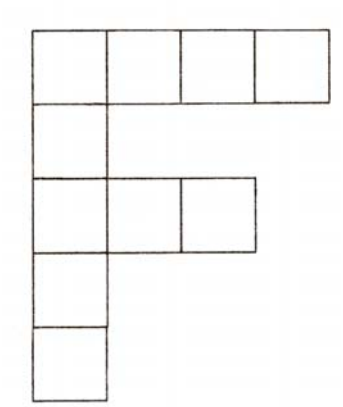
(iv) The capacity of a cubical vessel can be calculated by its length x breadth x height.

Q. N. 4. To fill up the jug of capacity of 2 liter and bucket of capacity 10 liter, how many minimum times, is it required for a bottle of capacity 200 ml? Show, its process of finding. (6)

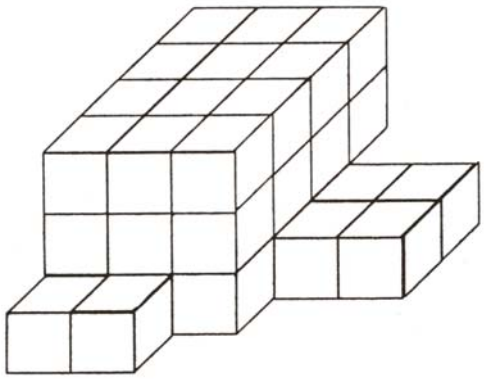
Q. N. 5. Prasidda purchased and put the four small bags of 1 kg 200g of apples, 2 kg 400g of oranges, 3 kg 600g of mangoes and 4 kg 800g of banana into a big bag. If so, what will be the weight of the big bag? Calculate it. (6)

Q. N. 6. Find the area of whole figure no. 3 given below where all rooms are of equal size, each with the area of 1 sq. cm. Also, write down your process of finding it. (3)

Q. N. 7. Find the volume of whole block given in figure no. 4 where each cube is of measurement 1 cu. cm. Also, write down the process of finding it. (3)



(Figure No. 3)



(Figure No. 4)

Appendix XVIII

Test Items (Retention test)

Name: Class: III R. N.

School: Time: 1 hrs. F. M.: 30

Attempt all the questions. The weightage of the questions are allocated in the right side.

Q. N. 1. Tick on the best answer 4x1 = 4.

(i) In what unit, is area measured?

(a) cm. unit (b) m. unit (c) square unit (d) cubic unit.

(ii) The area of any object does mean?

(a) width of it (b) length of it (c) Sum of it length and breadth (d) surface covered by it.

(iii) A measurement of weight of an object implies that:

(a) How big is it (b) how high is it (c) how thick is it (d) how heavy is it.

(iv) What do we need to measure the volume of an object?

(a) l and b (b) A and l (c) A and b (d) A and h

Q. N. 2. Fill in the blank spaces 4x1 = 4.

(i) The volume of the object is measured in …….unit.

(ii) The capacity of a vessel means the amount of ……....contained in it.

(iii) 1 kilogram consists of ……..gram.

(iv) It needs ……and…….to measure the weight of an object.

Q. N. 3. Find true/false on the following statements 4x1 = 4.

(i) The weight of an object is measured in millimeter.

(ii) The area of small surface of the object is measured in square centimeter.

(iii) The capacity of any vessel can be measured in millimeter and liter.

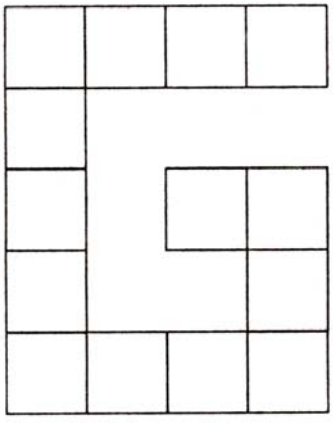
(iv) Area of square room can be obtained by squaring length or breadth.

Q. N. 4. By a small cup of capacity 200 ml, in how many minimum times, one can fill up a bucket of 2 liter and 200 ml? Show its calculation in detail. (6)

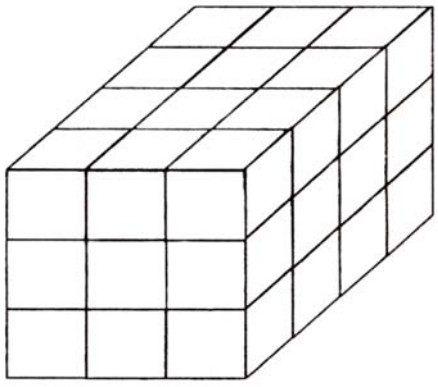
Q. N. 5. Pramoon went to a shop and purchased 2 Kg. 200 g. sugar, 3 Kg. 300 g. tea, 4 Kg. 400 g. pulse and 5 Kg. 500 g. rice. In total, how much weight has he purchased? Do the proper calculation. (6)

Q. N. 6. Find the area of whole figure no. 5 given below where all rooms are of equal size, each with the area of 1 sq. cm. Also, write down your process of finding it. (3)

Q. N. 7. Find the volume of whole block given in figure no. 6 where each cube is of measurement 1 cu. cm. Also, write down the process of finding it. (3)



(Figure No. 5)



(Figure No. 6)

Appendix XIX

Scores obtained by the students of X – School (Control group) in different tests

Class: III

S.N.	Name of Students (Alias Names)	Marks (Pretest)	Marks (Posttest)	Marks (Ret-test)	Remarks
1	Urmila Thapa	12	15	11	FM. 30
2	Miki Kumari Jha	5	8	6	
3	Surekha Kumari	4	8	6	
4	Sudip Bhandari	11	16	15	
5	Shushila Rai	9	15	12	
6	Sita Ram Chaudhary	3	11	9	
7	Anil Lama	9	15	9	
8	Sukalal Tamang	10	15	11	
9	Sumitra Rai	7	11	8	
10	Ranjita Kumari chaudhary	9	15	13	
11	Santosh Pantha	16	26	20	
12	Santosh Magar	5	9	8	
13	Indira Thapa	10	15	11	
14	Pabitra Kunwar	6	10	9	
15	Nitu Kumari Sharma	5	8	6	
16	Rachita Chhatha	4	8	5	
17	Suraj Kumar	9	14	13	
18	Kalpana Sunar	12	18	16	
19	Sancha Bahadur Tamang	7	13	12	
20	Radhika Mijaar	14	20	16	
21	Sabin Maharjan	8	13	8	
22	Goma Prajuli	12	16	14	
23	Uma Budha	9	14	13	
24	Bimala Ghimire	13	19	14	
25	Samira Raj Bachhak	5	9	6	
26	Nabina Pandey	6	10	7	
27	Arati Tamang	6	10	7	
28	Menuka Kumari Jaisawal	5	12	9	
29	Bishnu Tamang	4	8	7	
30	Aaisha Manandhar	15	20	16	
31	Aaditya Poudel	12	15	11	
32	Dharmendra Kumar	4	8	5	
33	Arun Kumal	6	11	9	
34	Bishal Pariyar	13	19	15	
Note: Out of 39 students, it had taken in use the marks of 34 students only because rests of others were absent in either test.					

Appendix XX

Scores obtained by the students of Y- School (Experimental group) in different tests

Class: III

S.N.	Name of Students (Alias Names)	Marks (Pretest)	Marks (Posttest)	Marks (Ret-test)	Remarks
1.	Sunita Maya Gurung	12	24	19	F. M. 30
2.	Roshan Lama	8	23	16	
3.	Kaushila Thapa	6	15	13	
4.	Kumari Lama	5	9	7	
5.	Madhu Pasaban	6	11	6	
6.	Anita Thapa Magar	4	27	11	
7.	Bal Bahadur Ghising	8	22	14	
8.	Nipu Yadav	10	21	18	
9.	Puja Shah	7	13	11	
10.	Bimala Praja	5	19	13	
11.	Samjhana Majhi	3	12	9	
12.	Kiran Jashwal	9	13	20	
13.	Kalpana Dahal	13	24	19	
14.	Prabha Gachhadar	6	22	13	
15.	Geeta Gurung	10	24	19	
16.	Dina Dangol	3	11	8	
17.	Sita Thing	11	14	18	
18.	Nabin Danuwar	12	20	15	
19.	Tej Kumar Bhujel	8	19	15	
20.	Sanjay Majhi	13	22	19	
21.	Tanka Bahadur Magar	12	26	20	
22.	Pratibha Dongol	11	24	17	
23.	Ruchi Sharma	10	25	18	
24.	Deepak Karki	11	17	14	
25.	Dipendra Pasawan	5	13	9	
26.	Shyam Tamang	4	12	10	
27.	Raju Shrestha	7	11	9	
28.	Shushila Khadka	9	28	21	
29.	Nitu Lama	8	21	14	
30.	Namrata Shrestha	9	20	15	
31.	Deepak Shrestha	11	23	18	
32.	Suresh Khatri	10	17	14	
33.	Kushum Kumal	13	25	18	
34.	Ashmita Tamang	4	20	13	
35.	Pappu Rai	3	17	13	
36.	Raju Gurung	7	28	18	
37.	Shekhar Thapa	3	7	6	
38.	Rabina Chaudhary	4	9	7	
39.	Pinky Shah	10	18	14	
40.	Ganga Bhattarai	9	17	13	

Note: Out of 43 students, it had taken in use the marks of 40 students only because rests of others were absent in either test.

Appendix XXI

Distribution of marks for Knowledge (K), Comprehension (C) & Application (A)

X- School (Control group) Class: III

S.N.	Name of Students (Alias Names)	Marks (Pretest)			Marks (Posttest)			Marks (Ret-test)			Remarks
		K-12	*C-9*	*A-9*	*K-12*	*C-9*	*A-9*	*K-12*	*C-9*	*A-9*	
1	Urmila Thapa	6	2	4	6	5	4	5	3	3	Full marks: 30 Splited into K, C and P. K – 12 C – 9 A - 9
2	Miki Kumari Jha	2	1	2	3	3	2	3	1	2	
3	Surekha Kumari	2	1	1	4	2	2	4	1	1	
4	Sudip Bhandari	5	3	3	7	4	5	7	5	3	
5	Shushila Rai	4	2	3	7	4	4	6	3	3	
6	Sita Ram Chaudhary	1	1	1	6	3	2	5	2	2	
7	Anil Lama	4	2	3	9	3	3	4	2	3	
8	Sukalal Tamang	5	3	2	7	5	3	5	4	2	
9	Sumitra Rai	3	2	2	6	2	3	3	2	3	
10	Ranjita Kumari	4	2	3	6	3	2	7	2	4	
11	Santosh Pantha	7	4	5	12	7	7	9	6	5	
12	Santosh Magar	2	2	1	4	2	3	4	2	2	
13	Indira Thapa	4	3	3	7	4	4	5	3	3	
14	Pabitra Kunwar	2	3	1	6	3	1	4	3	2	
15	Nitu Kumari Sharma	2	1	2	3	2	3	3	1	2	
16	Rachita Chhatha	2	1	1	4	2	2	2	2	1	
17	Suraj Kumar	4	2	3	6	4	4	6	3	4	
18	Kalpana Sunar	6	4	2	10	5	3	7	5	4	
19	Sancha Bahadur	3	1	3	7	3	3	5	3	4	
20	Radhika Mijaar	8	3	3	11	5	4	9	4	3	
21	Sabin Maharjan	3	3	2	7	3	3	3	3	2	
22	Goma Prajuli	6	3	3	9	4	3	7	3	4	
23	Uma Budha	4	2	4	6	4	4	7	4	2	
24	Bimala Ghimire	6	4	3	10	4	5	6	4	4	
25	Samira Raj Bachhak	2	1	2	4	2	3	4	0	2	
26	Nabina Pandey	3	1	2	4	2	4	4	2	1	
27	Arati Tamang	3	2	1	5	2	3	4	2	1	
28	Menuka Kumari	2	2	1	5	3	4	4	2	3	
29	Bishnu Tamang	2	0	2	4	1	3	3	2	2	
30	Aaisha Manandhar	8	4	3	11	5	4	9	4	3	
31	Aaditya Poudel	5	4	3	7	4	4	5	3	3	
32	Dharmendra Kumar	1	2	1	3	3	2	3	0	2	
33	Arun Kumal	3	1	2	4	4	3	4	3	2	
34	Bishal Pariyar	7	4	2	8	5	6	8	4	3	

Appendix XXII

Distribution of marks for Knowledge (K), Comprehension (C) & Application (A)

Y – School (Experimental group) Class: III

S.N.	Name of Students	Marks (Pretest)			Marks			Marks (Ret-test)			Remarks
		K-	*C-9*	*A-9*	*K-*	*C-*	*A-9*	K-12	*C-*	*A-9*	
1.	Sunita Maya	5	3	4	11	7	6	9	4	6	Full marks: 30 Splited into K, C and P. K – 12 C – 9 A - 9
2.	Roshan Lama	3	2	3	12	6	5	7	5	4	
3.	Kaushila Thapa	3	1	3	7	3	5	6	3	4	
4.	Kumari Lama	3	2	0	4	3	2	3	2	2	
5.	Madhu Pasaban	3	2	1	5	4	2	3	1	2	
6.	Anita Thapa	2	0	1	12	8	7	5	4	2	
7.	Bal Bdr Ghising	4	2	2	10	6	6	6	4	4	
8.	Nipu Yadav	4	3	3	10	6	5	8	5	5	
9.	Puja Shah	2	3	2	6	3	4	5	2	4	
10.	Bimala Praja	3	1	1	9	5	5	6	3	4	
11.	Samjhana Majhi	2	0	1	5	3	4	5	2	2	
12.	Kiran Jashwal	4	3	2	6	4	3	9	5	6	
13.	Kalpana Dahal	6	4	3	10	7	7	10	4	5	
14.	Prabha Dongol	3	2	1	11	4	7	6	3	4	
15.	Geeta Gurung	4	2	4	11	6	7	8	5	6	
16.	Dina Dangol	3	0	0	5	2	4	3	2	3	
17.	Sita Thing	5	3	3	6	4	4	9	6	3	
18.	Nabin Danuwar	5	2	5	8	7	5	7	4	4	
19.	Tej Kumar	3	3	2	10	4	5	7	4	4	
20.	Sanjay Majhi	6	3	4	11	6	5	10	4	5	
21.	Tanka Bdr Magar	5	3	4	12	6	8	11	4	5	
22.	Pratibha Shrestha	6	2	3	12	5	7	8	5	4	
23.	Ruchi Sharma	4	3	3	11	7	7	9	4	5	
24.	Deepak Karki	5	4	2	8	5	4	6	4	4	
25.	Dipendra	3	2	0	6	4	3	4	3	2	
26.	Shyam Tamang	3	0	1	5	4	4	6	2	2	
27.	Raju Shrestha	3	2	2	4	3	4	4	3	2	
28.	Shushila Khadka	4	2	3	11	8	9	10	5	6	
29.	Nitu Lama	3	2	3	9	6	6	7	3	4	
30.	Namrata Shrestha	4	3	2	9	6	5	7	5	3	
31.	Deepak Shrestha	5	3	3	10	5	8	10	4	4	
32.	Suresh Khatri	5	3	2	8	5	4	6	5	3	
33.	Kushum Kumal	7	4	2	10	8	7	11	4	3	
34.	Ashmita Tamang	2	0	2	9	6	5	6	3	4	
35.	Pappu Rai	2	0	1	7	6	4	5	3	5	
36.	Raju Gurung	3	2	2	12	8	8	8	5	5	
37.	Shekhar Thapa	3	0	0	3	2	2	3	3	0	
38.	Rabina	2	2	0	4	3	2	3	2	2	
39.	Pinky Shah	5	2	3	7	5	6	7	4	3	
40.	Ganga Bhattarai	5	2	2	8	5	4	10	5	4	

Appendix XXIII

COOPERATIVE TEACHING/LEARNING METHOD
Tentative Teachers' Training/Orientation Schedule

Day I (21st, January 2009)

Time				Session	Methodology	Spur by
10:30	-	12:30	2 hrs.	Introductory Session • Introduction of the Session, • Broader objective sharing of the study • Current teaching/learning practices in the schools, national and global perspectives, • Introduction of different learning practices	Presentation Game/open discussion Mini-lecture Individual work Presentation Interactive Lecture	M P K
12:30	-	1:30	1 hr.	Lunch Break	-	-
1:30	-	3:30	2 hrs	Concept of cooperative learning approach • Origination/introduction and history, • Basic principles of cooperative teaching/learning system, • Young Children's Learning Techniques, • Different ways of Stimulation/Motivation for children's Learning	Group discussion Presentation Brain storming Group Work Demonstration Workshop activities	M P K
3:30	-	4:00	30 min.	Days Evaluation	Participatory	All

Day II (22nd, January 2009)

Time				Session	Methodology	Spur by
10:30	-	12:30	2 hrs.	Class Room Reorganization • Physical Environment • Educational Environment • Formation of small working groups • Examples of responses that help modify behavior and unproductive teacher-responses (Appendix-XXIV-A (i) & (ii)) • Resolving small group conflicts and troubleshooting (App.XXIV-B(i) (ii))	Drawings Brainstorming Matching game Role plays Visual aids Individual exercise	M P K
12:30	-	1:30	1 hr.	Lunch Break		-
1:30	-	3:30	2 hrs	Different Activities for T/L • Determination of T/L process • Suitability of cooperative approach • Organization and systematization of group works • Use of "Rubric of Cooperation and Presentation" (App.-XXIV-C(i), (ii))	Group Work Individual Work Case Study A/V presentation	M P K
3:30	-	4:00	30 min	Days Evaluation	Participatory	All

Day III (23rd, January 2009)

Time				Session	Methodology	Spur by
10:30	-	12:30	2 hrs.	Implementing strategies of cooperative learning system • Different phases of CL implementation • 4F and 5E in group works • New role of teachers and students • Challenges • Cognitive and non-cognitive domains • Learning philosophy, students psychology, learning theories, different methods, • Classroom observation, progress, habits, cooperation, attitudes, checklist etc.	Mini lecture Brainstorming Matching game Role plays Visual aids Individual exercise	M P K
12:30	-	1:30	1 hr.	Lunch Break		-
1:30	-	3:30	2 hrs	Teaching/learning material development • Unit wise teaching aids development • Technically and pedagogically know-how to use them • Modeling them in classroom situation by focusing the small groups	Sheet paper works Drawings Brainstorming Group works Role plays Individual exercise	M P K
3:30	-	4:00	30 min	Days Evaluation	Participatory	All

Day IV (24th, January 2009)

Time				Session	Methodology	Spur by
10:30	-	12:30	2 hrs.	Instructional Planning and Evaluation • Types of cooperative approaches • Long term – Annual Planning • Short term- daily, weekly and monthly planning • Development of cooperative lesson plans	Demonstrations Individual exercise Sheet paper works Drawings Brainstorming Group works Mini lecture	M P K
12:30	-	1:30	1 hr.	Lunch Break		-
1:30	-	3:30	2 hrs	Model classes demonstration • "Changing role of Teacher" (See Appendix XXIV-D) • Teaching of measurement of Area, Weight. , Capacity and Volume with the help of cooperative lesson plans and T/L aids	Presentations, Demonstrations Group Work Individual Work A/V presentation	M P K
3:30	-	4:00	30 min.	Days Evaluation	Participatory	All

Day V (25th, January 2009)

Time				Session	Methodology	Spur by
10:30	-	12:30	2 hrs.	Evaluation System • Formative evaluation system • Other formal and informal means of evaluation, Filing/record keeping • Development of test items • Exam administration • Use of "Exit slip" and "Group Work Assessment Sheet" (Appendix – XXIV-E (i) & (ii))	Interactive Participatory Group works Mini lecture	M P K
12:30	-	1:30	1 hr.	Lunch Break		-
1:30	-	3:30	2 hrs	Organization of school visit • Preparation • Code of conduct • Ways of observation and interaction • Focusing on child-centric, interaction, and group works etc. • Note making system • Taking photos	Interactive, Group Works, discussion, orientations	M P K
3:30	-	4:00	30 min	Days Evaluation	Participatory	All

Day VI (26th, January 2009)

Time				Session	Methodology	Spur by
10:30	-	12:30	2 hrs.	Sharing the experiences of the trip • Presentation of yesterday's school visits • Extraction of useful ingredients of the visits • Plans for school works in new modality i.e. implementation of cooperative learning system in school	Presentation Question/answer Group works	M P K
12:30	-	1:30	1 hr.	Lunch Break		-
1:30	-	3:30	2 hrs	Orientation to supervisors/head teachers of the schools ➢ CL-concept ➢ Small group-works ➢ Raw materials ➢ Cooperative environment ➢ Supportive supervision and observation ➢ Formative evaluation system ➢ Problems faced by the teachers	Interactive Lecture, Group Work, discussion, demonstration	M P K
3:30	-	4:00	30 min	Days Evaluation	Participatory	All

Appendix XXIV

Few of the Training Contents (Tools) of Cooperative Learning Approach

A (i) Examples of responses that help modify behavior

* Respect the student.
* Identify specific and clear expectations.
* Structure the environment.
* Create contracts, perhaps with parents' help.
* Affirm students' positive behavior.

(ii) Examples of unproductive teacher responses

* Ignore disruptive behavior.
* Expect blind compliance to adult expectations.
* Embarrass the student in front of peers.
* Judge a student's motives.
* Injure the student in any way.

B. (i) *Checklist to Help Students Resolve Small-Group Conflicts*

(This checklist may be turned in with the projects, used as a point of discussion between students and teacher, or placed in a student's portfolio. The students should rate each criterion as "not at all," "some," or "very much.")

Listen

- We listened to each person's ideas each time we met. _____
- We used at least one idea from each person. _____
- We encouraged every participant to share. _____

Define responsibilities

- We invited volunteers for each task. _____
- Every person chose a meaningful part. _____
- We took turns facilitating the others' input. _____

Value each person's gifts

- We can describe the strengths of each person in the group. _____
- We can identify what each enjoys doing most. _____
- We give encouragement where people show weakness. _____

Model excellence

- Each person had opportunities to show his or her best work to the group.--
- We encouraged everybody to bring his or her very best work. _____
- Together we set goals for excellence. _____

Promote humor

- We laughed together. _____
- We did not laugh at each other's efforts. _____
- We worked together to enjoy our entire group. _____

(ii) Specific *Troubleshooting*

Problem	Solution
Students are not all involved or on task	Assign specific tasks to all students.
Groups are too noisy	Have students move closer together
Work is slow or incomplete	Work with students to set specific goals each day; have students create a timeline for their project and stick to it.
Members act out	Use motivation tactics to hold each person responsible for his actions -- for example, remind students that their participation in the group and their individual work are both being graded.
And so on…	

C (i) The Rubric of Cooperation

Category	Expert	Effective	Average	Ineffective
Researching together				
Dividing and sharing works				
Solving problems and differences				
Achieving consensus				
And so on…				

(ii)The Rubric of Presentation

Category	Expert	Effective	Average	Ineffective
Accuracy of materials				
Organization of materials				
Technical elements of presentation				
Content				
Graphics an other elements used				
Persuasive presentation				
And so on…				

D. Changing Teacher's role from Conventional to Cooperative Learning

S. N.	Concerning to	Conventional method	Cooperative method
1.	Space	Rows facing teacher	Clusters, learning centers
2.	Climate	Teacher's classroom	Students own classroom
3.	Lesson presentation	Lecturer	Resource guide
4.	Curriculum materials	Independent access	Shared/independent access
5.	Grouping	Whole class/ability grouping	Heterogeneous learning team
6.	Study methods	Individual seatwork	Group discussion, per coaching
7.	Classroom management	Teacher sets rules, discipline, time organization, teacher solves students problems	Shred management be\between teacher and students, group problem solving, monitoring, facilitating, processing
8.	Motivation	Individual regards increasingly extrinsic	Group rewards increasingly intrinsic
9.	Evaluation	Individual grades global, unidimensional	Individual and group grades specific multidimensional

Source: *Latitude Publications, Melbourne, Australia.*

E. (i) Exit Slip

The exit slip questions simply give a bird's-eye view of students' understanding of main topics explored, which was developed by Anna Chan Rekate and Martha Ehrenfeld.

Name: ---------- Date: ----------

After today's work I know how to identify three types of units of measurement.

1……. 2……. … 3……

These three types of units are helpful because……..

(ii). Group Work Assessment Sheet

Student's name: ----------Date: ----------Class: ---

Type of work or project: ----------

1. Who did you work with in your group? Describe one thing that each person contributed to the group to make the project successful?

i) List of individual names: ----------

ii) List of individual contribution: ----------

2. Were there any conflicts that came up? Describe how did you solve this problem?
3. How was doing this activity with the group different than if you were to do it alone?
4. List three suggestions about how the group could have done something differently?

i)

ii)

iii)

5. What did you do to contribute to the success of the activity for the group?
6. What would you change about your own contribution to the group?
7. What did you enjoy most about working with this group?

*********The End**********