EFFECTS OF COOPERATIVE LEARNING APPROACH ON LEARNING ACHIEVEMENT AND OPINION OF THE EIGHTH GRADE STUDENTS TOWARD MATHEMATICS, BHUTAN

BY

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KEY WORDS : **COOPERATIVE LEARNING, LEARNING ACHIEVEMENT, OPINION, EFFECTIVENESS, EIGHTH GRADE, MATHEMATICS**

LOBZANG NAMGYAL :EFFECTS OF COOPERATIVE LEARNING APPROACH ON LEARNING ACHIEVEMENT AND OPINION OF EIGHTH GRADE STUDENTS TOWARDS MATHEMATICS, BHUTAN. THESIS ADVISOR : ASST. PROF. SOMCHANOK PHUAMPAI, Ed.D., 106 p.

The basis of this research was to find out the effects of cooperative learning approach on learning achievement and opinion towards mathematics of eighth grade students in Bhutan. The research was conducted at Tashiding Lower Secondary School, Bhutan. The population of the study comprised 72 eighth grade students. The study was quasi experimental using pretest and posttest to both experimental and control group. The research instruments used were, learning achievement test and opinion questionnaire. The statistics used for data analysis were mean, standard deviation, paired samples t-test, and content analysis. The results of learning achievement test score analysis showed that the experimental group had significantly higher scores than the control group with the paired sample t-test, t=11.94, df =35 and p=0.00(<0.05). The paired sample t-test for pretest was with the value t= −0.43, df= 35 and p=0.67 (>0.05) which indicated that there was no difference in pretest. The means of control and experimental group during pretest was 11.17 and 10.92 respectively and 14.89 and 22.28 respectively after treatment. The result indicated that cooperative learning approaches were effective in improving students learning achievement level. The students' opinion analysis results showed that the means of enjoyment was (4.54), value was (4.48), motivation was (4.42), and, belief was (4.48). The results indicated that there was positive change in their opinion as a result of inclusion of cooperative learning approaches.

Students Signature.....Thesis Advisor's Signature.....

CONTENT

CONTENT (Cont.)

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Page

CONTENT (Cont.)

Page

LIST OF TABLES

Page

Table

LIST OF FIGURES

Page

Figure

LIST OF ABBREVIATIONS

NCTM……....National Council of Teachers of Mathematics

DCRD……Department of Curriculum and Research Development Bhutan

STAD…… ...Student Team Achievement Division

IOC……Index of Item-Objective Congruency

SPSS……..Statistical Package for the Social Sciences

CHAPTER 1

INTRODUCTION

1.1 RATIONALE

Before the Bhutanese mathematics curriculum reform took place in the recent years the Indian mathematics curriculum throughout the country was in full swing. India is Bhutan's primary neighbor and trading partner, so it was sensible to have the curriculum to set students up for tertiary education in India (W.David, 2009). Bhutan sought to develop a uniquely Bhutanese curriculum that addressed Bhutanese contexts and associated with international Standard. The new mathematics curriculum closely resembles New Brunswick's curriculum, which explicitly follows principles and standards established by the National Council of Teachers of Mathematics (NCTM). After implementing the new mathematics curriculum from the academic year 2008 very limited research had been conducted on ways to teach the new curriculum using various teaching and learning method.

In Bhutan, mathematics is one of our main weaknesses and most students do not like mathematics and the majority scores less than 50% (National Education Frame Work 2009). According to the 2009 National Education Policy Framework, it stated that Bhutan have to respond to the growing demands of scientific methods of learning while retaining the essentials of its traditional approach. Due to large uneven teacher student ratio and shortage of teaching learning material, teachers often resort to instructional teaching where one way information flow takes place. Though teacher training focuses on activity-based learning, often the field realities dictate teachers to resort to lecture methods thereby undermining the very philosophy of child-centered teaching. (National Education Policy 2011). Therefore K. Prem (2013) discussed that

there is an urgent need of instructional varieties to enhance learning in Bhutanese curriculum.

Udeinya & Okabiah (1991) mentioned that poor performance of students in mathematics on inappropriate methods and approaches to teaching which has reduced the level of achievement. They also asserted that the issue of poor performance in mathematics examinations was due to problem of teaching methods. There has also been an increasing awareness by those concerned with mathematics education that the conventional methods of teaching mathematics, has not been very successful. According to Zakaria, Solfitri, Daud, and Abidin (2013), they say that mathematics is still a subject that is considered difficult to many students.

Thus Cooperative learning is one of the most widely researched approaches to pedagogy in mathematics. Research on cooperative learning in mathematics has found strong impacts on mathematics learning if the methods incorporate two key elements: group goals and individual accountability. Cooperative learning has been found to be a successful teaching strategy at all levels, from pre-school to post-secondary. Young adolescents need to socialize, be a part of a group, share feelings, receives emotional support, and learn to see things from other perspectives. Cooperative learning groups do not separate students on the basis of class, race, or gender and the goals of middle schools are consistent with the goals of cooperative learning theories. It is a peer-centered pedagogy that promotes academic achievement and builds positive social relationships.

There is a need for bringing various teaching methods in our new curriculum that will improve student's attitude, thinking, motivation, understanding, appreciation and value towards learning mathematics. Many research indicated that cooperative learning method will help to achieve the above mentioned abilities. My research, on the effect of cooperative learning method which is an experimental research will try to find out the effectiveness of cooperative learning method in new mathematics curriculum classes. Therefore I hope that my study will be useful for the mathematics

teachers to consider cooperative learning method and bring it in to the mathematics classroom teaching and learning.

1.2 RESEARCH OBJECTIVES

1.2.1 To find out the effectiveness of cooperative learning approach on learning achievement towards mathematics of grade eighth students.

1.2.2 To study the students opinion towards mathematics after using cooperative learning approach.

1.2.3 To compare the students learning achievement before and after implementing with cooperative learning approach.

1.3 RESEARCH QUESTIONS

1.3.1 What is the effect of cooperative learning approach on learning achievement of the students of the eighth grade in mathematics?

1.3.2. What is the opinion of the eighth grade students towards mathematics using the cooperative learning approach?

1.3.3 What is the difference between learning achievements of control group and experimental group after the treatment?

1.4 RESEARCH HYPOTHESES

1.4.1 There will be a significant difference in mathematics achievement between students who are exposed to cooperative learning approach and those who are exposed to traditional method.

1.4.2 There will be a positive change in the opinion of students after teaching with the cooperative learning approach.

1.4.3 There will be a significant difference between the learning achievement of control group and experimental group.

1.5 SCOPE OF THE STUDY

1.5.1 Location of the study

The study was conducted at Tashiding Lower Secondary School in Dagana, Bhutan. Dagana Province is located in the central part of the country. The school is Simi-urban. The location of the school is shown in the appendix E.

1.5.2 Population and Sample

The population of the study comprised of 394 8th grade students of Dagana province. Sample of the study included two sections of the 8th grade students of Tashiding Lower Secondary School which comprised 72 students.

1.5.3 Content of the Study

The contents of the study included were "Fractions and Rational Numbers". The learning outcomes as prescribed by Department of Curriculum and Research Development (DCRD), Bhutan were;

1.5.3.1 Add and subtract fractions mentally.

1.5.3.2 Add and subtract symbolically.

1.5.3.3 Multiply and divide fractions.

1.5.3.4 Diving fractions with a common denominator.

1.5.3.5 Concept of rational numbers and operations with rational numbers.

1.5.3.6 Order of operations

1.5.4 Time Frame

The study was conducted during first semester within six weeks from the month of May to June 2014 and was completed by the end of June 2014. The total time used for research was 7 hours.

1.5.5 Variables

There were two variables in this study, cooperative learning approach as independent variable and Students learning achievement and opinion as dependent variables.

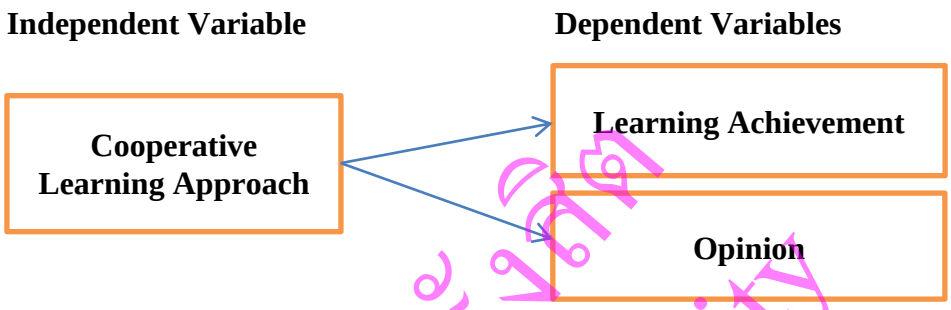

Figure 2 Independent and dependent variable

1.6 OPERATIONAL DEFINITIONS

Effect

Refers to the changes brought by the cooperative learning approach in students of the experimental group after teaching them with cooperative learning approach.

Cooperative Learning

Refers to a teaching arrangement in which small, heterogeneous groups of students work together to achieve a common goal. Cooperative learning also refers to small heterogeneously mixed working groups of learners learning collaborative/social skills while working toward mathematics.

Learning Achievement

Refers to gain in the scores in the achievement tests of the experimental group. It was conducted twice as pretest and posttest.

Opinion

Refers to the enjoyment, value, motivation and belief of students of the experimental group towards learning mathematics after using cooperative learning approach.

Mathematics

Refers to the mathematic subject prescribed by the Department of Curriculum and Research Division for the eighth grade students in Bhutan.

1.7 LIMITATION OF THE STUDY

1.7.1 The content in this research was limited with one chapter and five lesson plans of 50 minutes each.

1.7.2 Since the school was located in one of the remote parts in central Bhutan the study may not be applicable in other parts of the country.

1.8 BENEFITS OF THE STUDY

1. 8.1 The study would acquaint students with the cooperative learning skills and enhance their learning in mathematics.

1.8.2 The study would be helpful for mathematics teachers in Bhutan to improve their teaching strategy.

18.3. The study would serve as a reference for future researcher to carry out studies on similar field.

CHAPTER 2

LITERATURE REVIEW

This chapter presents the review of the related literature and theoretical framework of the study. The following topics will be covered in this chapter

2.1 Cooperative learning
  2.1.1 Principles of cooperative learning and advantages
  2.1.2 Underlying theories of cooperative learning
  2.1.3 Structures and types of cooperative learning
  2.1.4 Assessment in cooperative learning
2.2 Mathematic Education in Bhutan
2.3 Related research
2.4 Conclusion

2.1 COOPERATIVE LEARNING

Cooperative learning is generally defined as a teaching arrangement in which small, heterogeneous groups of students work together to achieve a common goal. Students encourage and support each other, assume responsibility for their own and each other's learning, employ group related social skills, and evaluate the group's progress. The basic elements are positive interdependence, equal opportunities, and individual accountability. Human beings are social creatures by nature and cooperation has been used throughout history in all aspects of our lives. Therefore cooperative learning in schools would be used as a logical teaching method.

Johnson and Smith (2007,p:15-29) defined cooperative learning as the instructional use of small groups so that student's work together to maximize their own and each other's learning. They also define three broad categories for cooperative learning groups and they are formal cooperative learning groups used to teach content and problem-solving skills, informal cooperative learning groups that ensure active cognitive processing during a lecture, and cooperative base groups that provide long-term academic support. According to Johnson & Johnson, (1984) to be genuinely cooperative, each type of group requires the presence of five basic elements. These are positive interdependence, individual accountability, interpersonal skills, face-to-face promotive interaction, and processing

Cooperative learning is a teaching arrangement that refers to small, heterogeneous groups of students working together to achieve a common goal, Kagan, (1994). Johnson, Johnson, & Holubec (1998 p: 1-5) defines cooperation learning as working together to accomplish shared goals. Cooperative learning is the instructional use of small groups so that students work together to maximize their own and each other's learning. A.Walmsley, (2003,p:112-116), stated that the terms group learning and cooperative learning are often used as if they meant the same thing and in fact, group work means several students working together and working together doesn't necessarily involve cooperation. Cooperative learning is an arrangement in which students work in mixed ability groups and are rewarded on the basis of the success of the group.

Cooperative learning may best be defined as small heterogeneously mixed working groups of learners learning collaborative/social skills while working toward a common academic goal or task according to (Jones, et al., 1994). In cooperative learning students work with peers to accomplish a shared or common goal. The goal is reached through interdependence among all group members rather than working alone. Each member is responsible for the outcome of the shared goal. Office of Educational Research and Improvement (OERI) of the U.S. Department of Education stated that cooperative learning is a successful teaching strategy in which small teams, each with students of different levels of ability, use a variety of learning activities to

improve their understanding of a subject. Each member of a team is responsible not only for learning what is taught but also for helping teammates learn, thus creating an atmosphere of achievement.

2.1.1 PRINCIPLES OF COOPERATIVE LEARNING

Positive Interdependence

Students must feel that they need each other in order to complete the group's task, that is, they sink or swim together. Positive interdependence can be built into the task by jigsawing information, by limiting materials, by having a single team product, through team roles (recorder, reporter), or by randomly selecting one student to answer for the team. It can be built into a reward structure by assigning team points based on team averages, on members reaching a predetermined criterion, or on team improvement rather than outright grades. Positive interdependence is linking students together so one cannot succeed unless all group members succeed. Group members have to know that they sink or swim together, (Johnson, and Holubec, 1984, p: 47).

When students clearly understand positive interdependence, they understand that each group member's efforts are required and indispensable for group success and that each group member has a unique contribution to make to the joint effort because of his or her resources and/or role and task responsibilities (Johnson, Johnson, & Holubec 1988). Positive goal interdependence ensures that the group is united around a common goal, a concrete reason for being, such as learning the assigned material and making sure that all other members of your group learn the assigned material.

Interpersonal and Collaborative Skills

These include skills for working together effectively as well as group maintenance skills. Ways to foster skill development include teacher modeling, brainstorming characteristics of good skills, direct practice, process observing, and

reflection. Skill practice can be tacked on to academic lessons through games or by making social skills a separate objective to be practiced and observed.

Face to Face Promotive Interaction

By using face to face promotive interaction, learning becomes active rather than passive. Teams encourage discussion of ideas and oral summarization. Peer assistance clarifies concepts for both helper and the student being helped. Cooperative team's help students learn to value individual differences and promote more elaborate thinking. The Learning Together model calls for Face-to-Face interaction whereas Kagan emphasizes Simultaneous Interaction. This apparently minor difference has important implications. Kagan defines simultaneous interaction as the percentage of learners overtly engaged at any one moment. This is an important definition because the percentage figure tells us clearly that a group of four will create more interaction than a group of five, and that pair work doubles active participation compared to square work. There is nothing in the call for face-to-face interaction that tells us that a group of four is better than a group of five, or that pair work is better than square work. Without calculating the percentage of active participants at any one moment, the teacher might think that a group of five is as good as a group of five for promoting active, engaged interaction. In fact, in the same amount of time in the group of three each student talks almost twice as much as in a group of five.

Accountability/ Personal Responsibility

Students must feel that they are accountable for helping to complete a task and for mastering material. Ways to build in individual accountability includes students take individual quizzes, each student is responsible for a specific portion of a task, each must be able to summarize another's ideas and any student may be called on at random to answer for the team.

Reflection/Group Processing of Interaction

Processing of interaction refers to giving students the time and procedures to analyze how well their groups are functioning and how well they are using the

necessary collaborative skills. Processing can be individual, team-wide, or at the whole collaborative class level. Examples include, How well did I listen? Did we take turns and include everyone? How could we have coached each other better? How can the class function more smoothly?

COOPERATIVE LEARNING PRINCIPLES (JACOBS, G. M. 2004)

According to Deci and Ryan (1985), all human beings have three basic needs and they are ratedness, competence, and autonomy. Cooperative learning principles stem from this primarily psychological standpoint. Because all students are humans, teachers can use cooperative learning teaching methodologies to help students satisfy the three needs of relatedness, competence, and autonomy in the classroom. Teachers who do so will be able to create a more effective environment for learning and thus can help students reach their learning potential. The eight basic principles of collaborative learning in the classroom according to Jacobs, Power, & Loh, 2002 are;

Heterogeneous Grouping

This principle means that the groups in which students do cooperative learning tasks are mixed on one or more of a number of variables including sex, ethnicity, social class, religion, personality, age, language proficiency and diligence.

Collaborative Skills

Collaborative skills, such as giving reasons, are those needed to work with others. Students may lack these skills, the language involved in using the skills, or the inclination to apply the skills. Most books and websites on cooperative learning urge that collaborative skills be explicitly taught one at a time.

Group Autonomy

This principle encourages students to look to themselves for resources rather than relying solely on the teacher. When student groups are having difficulty, it is very tempting for teachers to intervene either in a particular group or with the entire class. We may sometimes want to resist this temptation, because as Roger Johnson writes, Teachers must trust the peer interaction to do many of the things they have felt responsible for themselves.

Maximum Peer Interactions

In classrooms in which group activities are not used, the normal interaction pattern is that one person speaks at a time, either the teacher or a student selected by the teacher. In contrast, when groups of 2-4 students cooperate, we maximize the quantity of peer interactions. When students work together on thinking tasks, when they elaborate on their answers and ideas and when they utilize cooperative skills, we maximize the quality of peer interactions.

Equal Opportunity to Participate

A frequent problem in groups is that one or two group members dominate the group and, for whatever reason, impede the participation of others. Cooperative learning offers many ways of promoting more equal participation among group members by attempting to structure interaction so that all group members have chances to participate.

Individual Accountability

When we try to encourage individual accountability in groups, we hope that everyone will try to learn to share their knowledge and ideas with others.

Positive Interdependence

This principle lies at the heart of cooperative learning. When positive interdependence exists among members of a group, they feel that what helps one member of the group helps the other members and that what hurts one member of the

group hurts the other members. It is this All for one, one for all feeling that leads group members to want to help each other, to see that they share a common goal.

Cooperation as a Value

Cooperation as a value involves taking the feeling of all for one, one for all and expanding it beyond the small classroom group to encompass the whole class, the whole school, on and on, bringing in increasingly greater numbers of people and other beings in to students' circle of one with whom to cooperate.

ADVANTAGES OF COOPERATIVE LEARNING

Cooperative learning enhances greater student achievement than traditional learning methodologies (Slavin 1984). Slavin found that 63% of the cooperative learning groups analyzed had an increase in achievement. There are more winners in a cooperative team because all members reap from the success of an achievement. Low achieving students tend to work harder when grouped with higher achieving students. There is competition among groups in cooperative learning. Some forms of group competition promote cohesiveness among group members and group spirit.

Cooperative learning has social benefits as well as academic. One of the essential elements of cooperative learning is the development of social skills. Children learn to take risks and are praise for their contribution. They are able to see points of view other than their own. Such benefits contribute to the overall satisfaction of learning and schooling. Students work with classmates who have different learning skills, cultural background, attitudes, and personalities. Heterogeneous groups promote student learning. These differences force them to deal with conflicts and interact with others. Social interaction improves communication skills that become a necessity to functioning in society. One of the social skills taught in cooperative learning is sharing. Teachers usually purchase a class set of materials for the groups to share. Reduction of materials does not hinder the educational process but teaches children the value of time, division of work, or and sharing. By using cooperative

learning less equipment is necessary therefore money is saved without sacrificing the quality of education.

According to Johnson, Johnson and Holubec (1998), cooperative learning has three major positive results:

1. Greater efforts to achieve, including higher achievement by all students, long-term retention, intrinsic motivation, more time spent on task, development of higher-order reasoning and critical thinking (p.1- 7).

2. More positive relationships among students, including caring and committed relationships, personal and academic social support, valuing of diversity, and cohesion (p.1- 7).

3. Greater psychological health, general psychological adjustment, ego-strength, social development, social competencies, self-esteem, self-identity, and ability to cope with adversity and stress (p.1-7)

According to Dr. Spencer Kagan (Kagan Online Magazine, Winter 1999), the advantages of cooperative learning are;

Academic Achievement

Over 500 research studies back the conclusion that cooperative learning produces gains across all content areas, all grade levels, and among all types of students including special needs, high achieving, gifted, urban, rural, and all ethnic and racial groups. In terms of consistency of positive outcomes cooperative learning remains the strongest researched educational innovation ever with regard to producing achievement gains.

Ethnic/Race Relations

Not as many studies here, but the effect sizes are even greater and more consistent than with academic achievement. Heterogeneous cooperative teams are the single most effective tool we as educators and we as a nation have to transform race relations in positive ways. In classrooms without cooperative learning, there is

increasing polarization along race lines over time and in classrooms with cooperative learning, there is increasing cross-race friendships and mutual understanding.

Self-Esteem

Students in cooperative learning teams increase in feelings social and academic esteem. These increases in self-esteem are realistic as the students in fact do better academically and are accepted more by their peers.

Empathy

Students in cooperative learning teams gain in ability to take the role of the other and to understand and empathize with the point of view and feelings of others.

Social Skills

Cooperative learning increases a long list of social skills, including listening, taking turns, conflict resolution skills, leadership skills, and teamwork skills. Students coming from cooperative learning classrooms are more polite and considerate of others.

Social Relations

Students in classrooms in which there is cooperative learning feel accepted, liked, and cared for. Again, these feelings are realistic as in fact cooperative learning results in more mutual acceptance and caring among students. They have more friends.

Class Climate

Cooperative learning leads to increased liking for school, class, academic content, and the teacher.

Responsibility

Cooperative learning is associated with enhanced internal sense of control; students feel more like origins than pawns. They take more initiative and feel more responsible for the outcomes they receive. They feel more effective. Their increased sense of efficacy is realistic because in cooperative learning they make more choices and have more input into what and how to study. What they do makes a difference.

Diversity skills

As a result of working in heterogeneous cooperative teams, students learn to understand and work with others who differ from themselves. These skills are essential for the 21st century as we are becoming more and more diverse.

Higher Level Thinking Skills

One of the main roads to higher level thinking is interaction with points of view different from one's own. Each of us carries set of information and way of interpreting that information. We tend to persist in our own way of thinking until we are challenged by interacting with someone with different information and/or a different way of interpreting the information.

Individual Accountability

In a traditional classroom a student can dream, knowing they will not be held accountable if only they don't raise their hand to be called on. In a cooperative learning team there is not the luxury to slip through the cracks. As we do a Round Robin, for example, each student in turn is held accountable to make a contribution.

Equal Participation

Volunteer participation leads to some always raising their hands, and others volunteer seldom or never. In cooperative learning structures, there is not the luxury to slip through the cracks, making participation more equal. For example, in a Timed Pair Share each student has equal time to share.

Increased Participation

If we call on students one at a time, even if we said nothing, and transitions were done in no time, in a class of 30 it would take 30 minutes to give each student one minute to share his or her point of view. In pairs the same amount of participation can be accomplished in two minutes! Overall, therefore students in cooperative learning are engaged a far higher percent of the time.

Social Orientation

In the traditional classroom students see each other as an obstacle. They know there is a limited number of top grades, and the success of another decreases their own probability of success. In cooperative learning students know the success of a teammate will increase the probability of their own success. They begin to see others as someone to work with rather someone to beat.

Learning Orientation

Too often students in traditional classrooms do their assignments for a grade. In cooperative learning they more often do their work for the joy of working with others, accomplishing a challenging goal, and being of worth to their teammates and classmates.

Self-Knowledge and Self-Realization

Students in interaction with others learn about themselves. If I am dominant, shy, rude, or overly-helpful, I do not discover that until I interact with and get feedback from others. This self-knowledge leads to change and growth so I am more likely to realize my potential. Alone, in an important sense, we are stuck; in interaction we grow.

Workplace Skill

Students learn how to work in teams, preparing them for the interdependent team-based workplace of the 21st Century in which increased technology and complexity demands increasing use of interdependent teams.

2.1.2 THEORIES OF COOPERATIVE LEARNING

There are numerous theories which genuinely support the cooperative learning method. Cooperative Learning theory, a branch of Constructivism, incorporates the idea that the best learning occurs when students are actively engaged in the learning process and working in collaboration with other students to accomplish a shared goal. Cooperative learning utilizes not only the student's own experience to solidify knowledge, but also uses the experiences of others. In cooperative learning, the focus moves from teacher-centered to student-centered education. Instead of sitting in a lecture or reading text, students are given a task or problem and are asked to identify a possible solution on their own and with the help of others. Rather than disseminating information directly, the teacher guides students to the source of the information they may require. In contrast to traditional teaching methods where students are perceived to be empty vessels awaiting the teachers' knowledge, cooperative learning theory recognizes the importance of the student's existing knowledge and puts that knowledge to work.

Social Interdependence Theory

Human experience is inherently social. Much of life clarifies in the context of group interactions, many human traits have their origins in interpersonal experience, and the source of many powerful norms can be identified in the interdependent situations for which those norms provide good adaptations. To fully comprehend human behaviour it is necessary that we understand the nature and meaning of interpersonal interdependence. In an education setting, social interdependence refers to students' efforts to achieve, develop positive relationships, adjust psychologically,

and show social competence. Gestalt Psychologist, Kurt Koffka, proposed that groups were dynamic wholes in which the interdependence among members could vary. One of his colleagues, Kurt Lewin refined Koffka's notions stating that the essence of a group is the interdependence among members which results in the group being a "dynamic whole" so that a change in the state of any member or subgroup changes the state of any other member or subgroup, and an intrinsic state of tension within group members motivates movement toward the accomplishment of the desired common goals. The social interdependence perspective of cooperative learning assumes that the way social interdependence is structured determines the way persons interact which in turn, determines outcomes. Positive Interdependence results in promotive interaction as individuals encourage and facilitate each other's efforts to learn.

Constructivism Theory

Constructivism is an epistemological belief about what knowing is and how one comes to know. Constructivists' believe in individual interpretations of the reality that is the knower and the known are interactive and inseparable. Constructivism rejects the notions that

1. Knowledge is an identifiable entity with absolute truth value.
2. Meaning can be passed on to learners via symbols or transmission.
3. Learners can incorporate exact copies of teacher's understanding for their own use.
4. The whole concepts can be broken into discrete sub-skills, and that concepts can be taught out of context.

Constructivism, with focus on social nature of cognition, suggests an approach that

1. Gives learners the opportunity for concrete, contextually meaningful experience through which they can search for patterns, raise their own questions, and construct their own models.

2. Faciliates a community of learners to engage in activity, discourse, and reflection
3. Encourages students to take on more ownership of the ideas, and to pursue autonomy, mutual reciprocity of social relations, and empowerment to be the goals.

Piaget's theory is fundamental to constructivism. His central idea is that knowledge precedes neither solely from the experience of objects nor from an innate programming performed in the subject but from successive constructions, (Fosnot, 1996). Bruner (1986) claims that constructivism began with Kant's concepts of a priori knowledge, which focuses on the importance of prior knowledge to what we perceive from out interactions with the environment. Jonassen (1991) described Kant's ideas of individual construction of reality. Kant believed in the external, physical world but we know it only through our sensation how the world appears to us. TIP (Theory into Practice) described that Bruner's major theoretical framework is that learning is an active process in which learners construct new ideas or concepts based upon their current/past knowledge. In other words, Learning is an active social process in which students constructs new ideas or concepts based on current knowledge. The student selects information, originates hypotheses, and makes decisions in the process of integrating experiences into their existing mental constructs.

Vygostky's Sociohistorical Learning Theory

Vygotsky was disappointed with the overwhelming control of environment over human behavior that is represented in behaviorism. Vygotsky (1978) objected to any tendency to equate human beings with animals on the basis of innate reflexes and conditional reflexes. He recognized the higher psychological functions of humans, especially the distinguishing mental process of signification by which humans assign meanings to arbitrary stimuli and with which human learning is determined by the social and historical context. He believed that human development and learning occur through their interactions with the environment and the other people in it.

The concept of Zone of Proximal Development: to Vygotsky, learning is a continual movement from the current intellectual level to a higher level which more closely approximates the learner's potential. This movement occurs in the so-called "zone of proximal development" as a result of social interaction. The zone of proximal development is the distance between the actual independent development level and the potential development level under the guidance of or in collaboration with peers (Vygotsky, 1978). Vygotsky believes that human mental activity is a particular case of social experience. Thus, an understanding of human thinking depends in turn on an understanding of the mechanism of social experience; the force of the cognitive process deriving from the social interaction is emphasized.

Cognitivist Theory

Piaget (1970) proposed that children progress through an invariant sequence of four stages: sensorimotor, pre-operational, concrete operational and formal operational. Those stages are not arbitrary, but are assumed to reflect qualitative differences in children's cognitive abilities. Being controlled by the logical structures in the different developmental stages, learners cannot be taught key cognitive tasks if they have not reached a particular stage of development. Also, Piaget (1985) suggested that learning process is iterative, in which new information is shaped to fit with the learner's existing knowledge, and existing knowledge is itself modified to accommodate the new information. The major concepts in this cognitive process includes,

Assimilation

It occurs when a child perceives new objects or events in terms of existing schemes or operations. Children and adults tend to apply any mental structure that is available to assimilate a new event, and they will actively seek to use a newly acquired structure. This is a process of fitting new information into existing cognitive structures

Accommodation

It has occurred when existing schemes or operations must be modified to account for a new experience. This is a process of modifying existing cognitive structures based upon new information.

Equilibration

It is the master developmental process, encompassing both assimilation and accommodation. Anomalies of experience create a state of disequilibrium which can be only resolved when a more adaptive, more sophisticated mode of thought is adopted.

Dale's Cone of Learning

The core idea of Dale's cone of learning is learning by doing to maximise the retention of the content. There are various advantages to Dale's theory, as most of the children learn best by doing. This is going to be the strategy of discovery learning, where children learn by constructing knowledge's based upon their experiences. Edgar Dale believes that learning takes place when children are actively involved in their own learning. He believes that after two weeks, children will remember 10% of what is read or what is read to them. Children remember 20% of what they hear, when people are just talking to us, 30% of what we see and that can be by looking at pictures. We remember 50% of what we see and hear together, for an example watching a movie, looking at an exhibit, or watching a demonstration. We remember70% of what we say, this comes by being engaged in a discussion and giving opinion, ideas or examples that we come up with on our own. We remember 90% of what we say and do, by doing drama presentation or by stimulating the real experiences. The 10% of reading is looked at as verbal receiving, the 50% of hearing and seeing is looked at as visual receiving, and the 70% of what we say is looked at as receiving, participating and 90% of what we say and do is looked at as doing. Therefore cooperative learning method involves maximum participation of the

students in their activities and experience hand on experiences. They will also relate their learning's and practice in the real life situations.

Bandura's Social Learning Theory

Bandura, (1997) emphasized on the importance of observing and modelling the behaviours, attitude and emotional reactions of others. Social learning theory explains the human behaviour in terms of continuous reciprocal interaction between cognitive, behavioural and environmental influences. Bandura (1977) stated that there are four component processes underlying observational learning and they are attention, including modelled events, retention including symbolic coding, cognitive organization, symbolic rehearsal motor rehearsal, motor reproduction, including physical capabilities, self-observation of reproduction, and accuracy of feedback and motivation which includes external, vicarious and self-reinforcement. Since social learning theory includes attention, memory and motivation it covers both the cognitive and behavioural frameworks.

Socio-constructivism Theory

In the late 20th century, the constructivist view of learning was further changed by the rise of the perspective of situated cognition and learning that emphasized the significant role of context, particularly social interaction. Criticism against the information-processing constructivist approach to cognition and learning became stronger as the pioneer work of Vygotsky as well as anthropological and ethnographic research by scholars like Rogoff and Lave came to the fore and gathered support. The essence of this criticism was that the information-processing constructivism saw cognition and learning as processes occurring within the mind in isolation from the surrounding and interaction with it. Knowledge was considered as self-sufficient and independent of the contexts in which it finds itself. In the new view, cognition and learning are understood as interactions between the individual and a situation; knowledge is considered as situated and is a product of the activity, context and culture in which it is formed and utilized. This gave way to a new metaphor for learning as participation and social negotiation.

Experiential Learning Theory

Experiential learning theories build on social and constructivist theories of learning, but situate experience at the core of the learning process. They aim to understand the manners in which experiences whether first or second hand motivate learners and promote their learning. Therefore, learning is about meaningful experiences in everyday life that lead to a change in an individual's knowledge and behaviors. Carl Rogers is an influential proponent of these theories, suggesting that experiential learning is self-initiated learning as people has a natural inclination to learn; and that they learn when they are fully involved in the learning process. Rogers put forward the following insight: (1) learning can only be facilitated: we cannot teach another person directly, (2) learners become more rigid under threat, (3) significant learning occurs in an environment where threat to the learner is reduced to a minimum, (4) learning is most likely to occur and to last when it is self-initiated. He supports a dynamic, continuous process of change where new learning results in and affects learning environments. This dynamic process of change is often considered in literatures on organizational learning.

Multiple Intelligences Theory

Challenging the assumption in many of the learning theories that learning is a universal human process that all individuals experience according to the same principles, Howard Gardner elaborated his theory of multiple intelligences in 1983. His theory also challenges the understanding of intelligence as dominated by a single general ability. Gardner argues that every person's level of intelligence actually consists of much distinct intelligence. These intelligences include (1) logical-mathematical, (2) linguistic, (3) spatial, (4) musical, (5) bodily-kinesthetic, (6) interpersonal, and (7) intrapersonal. Although his work is speculative, his theory is appreciated by teachers in broadening their conceptual framework beyond the traditional confines of skilling, curriculum and testing. The recognition of multiple

intelligences, for Gardner, is a means to achieving educational goals rather than an educational goal in and of itself.

Situated Learning Theory and Community of Practice

Situated learning theory and community of practice draw many of the ideas of the learning theories considered above. They are developed by Jean Lave and Etienne Wenger. Situated learning theory recognizes that there is no learning which is not situated, and emphasizes the relational and negotiated character of knowledge and learning as well as the engaged nature of learning activity for the individuals involved. According to the theory, it is within communities that learning occurs most effectively. Interactions taking place within a community of practice. For example cooperation, problem solving, building trust, understanding and relations have the potential to foster community social capital that enhances the community members' wellbeing. Thomas Sergiovanni reinforces the idea that learning is most effective when it takes place in communities. He argues that academic and social outcomes will improve only when classrooms become learning communities, and teaching becomes learner-centered. Communities of practice are of course not confined to schools but cover other settings such as workplace and organizations.

2.1.3 STRUCTURES OF COOPERATIVE LEARNING

Student Team Achievement Division (STAD)

STAD is a cooperative teaching method which was developed by Slavin (1990) as part of a student learning approach program along with other cooperative methods such as Teams-Games-Tournaments, Jigsaw II (Slavin 1992), and Team Assisted Individualization (Slavin et al. 2013). In STAD, students are assigned to four- or five-member learning teams. The teams are composed of high, average, and low performing students, and of boys and girls of different racial or ethnic backgrounds. Thus, each team is a microcosm of the entire class. STAD have been used in a wide variety of subjects, from mathematics to language arts to social studies,

and have been used from second grade through college. The STAD method is most appropriate for teaching well-defined objectives with single right answers, such as mathematical computations and applications, language usage and mechanics, geography and map skills, and science facts and concepts. However, it can easily be adapted for use with less well-defined objectives by incorporating more open-ended assessments, such as essays or performances.

STAD (Students team achievement division) according to Rai (2007) is one of the many strategies in cooperative learning, which helps promote collaboration and self-regulating learning skills. The reason for the selection of STAD is good interaction among students, improve positive attitude towards subject, better self-esteem, increased interpersonal skills. STAD also add an extra source of learning within the groups because some high achievers act as a role of tutor, which result in high achievements. Finally, it enables the students according to the requirements of the modern society by teaching them to work with their colleagues competently and successfully.

Steps of Student Team Achievement Division (STAD)

1. Class Presentations. The teacher presents the material in front of the class in the classical style that focuses on the concepts of matter to be discussed only. Furthermore, students are small groups to work on tasks assigned by the teacher.

2. The formation of study groups (Teams). Students are organized into groups whose members are heterogeneous (both academic ability and gender). The trick with rank students based on grades or the last value obtained before the student STAD cooperative learning models. The function of this grouping is to encourage cooperation in the group study the material and complete the tasks assigned by the teacher.

3. Provision of test or quiz (Quizzes). After studying the group completed the test, quiz was held with the objective of identifying, or the ability to measure student learning of the material has been studied. In this case, the student was not allowed to work with his friend. The purpose of this test is to motivate students to try and individually responsible. Students are required to do my best as a result of group

learning. In addition to individual responsibility, the students also have to realize that businesses and their success will be very valuable to contribute to the success of the group. This test is performed after one to two servings of classes and learning in groups.

4. Improved scoring individual (Individual Improvement Scores). This is done to give the students a goal that can be achieved if they work hard and showed good results compared with previous results. Manager scores the results of the cooperation of students performed in the following order: score early, score tests, and score of the group increased.

5. Awards group (Team Recognition) award is given to the group to give a gift in appreciation of the efforts that have been made during the study. (Slavin, 1995 in Prilatama, 2008)

Three central concepts that characterize learning as expressed Slavin (1995) in Isjoni (2009: 33), namely:

1. Group awards, group awards are obtained if the group achieved scores above the specified criteria.

2. Individual responsibility, accountability focuses on the activities of each group member formatting in learning.

3. Equal opportunity to succeed, each student either low or high achievers alike the opportunity to succeed and do the best for the group.

PRINCIPLES AND CHARACTERISTICS OF STAD

1. Each member of the group (students) is responsible for everything that is done in a group.

2. Each member of the group (students) should know that all of the group members have similar goals.

3. Each member of the group (students) has to split the duties and responsibilities equally among group members.

4. Each member of the group (students) will be evaluated.

5. Each member of the group (students) to share leadership skills and need to learn together during the learning process.

6. Each member of the group (students) will be required to be individually accountable for the material is handled in a cooperative group.

Jigsaw Method

It is a cooperative learning technique that reduces racial conflict among school children, promotes better learning, improves student motivation, and increases enjoyment of the learning experience. The jigsaw technique was first developed in the early 1970s by Elliot Aronson and his students at the University of Texas and the University of California. Since then, hundreds of schools have used the jigsaw classroom with great success. The jigsaw approach is considered to be a particularly valuable tool in averting tragic events such as the Columbine massacre. The jigsaw classroom is a cooperative learning technique with a three-decade track record of successfully reducing racial conflict and increasing positive educational outcomes. Just as in a jigsaw puzzle, each piece--each student's part--is essential for the completion and full understanding of the final product. If each student's part is essential, then each student is essential; and that is precisely what makes this strategy so effective.

The jigsaw classroom is very simple to use. The steps are simple to follow

1. Divide students into 5 or 6-person jigsaw groups. The groups should be diverse in terms of gender, ethnicity, race, and ability.

2. Appoint one student from each group as the leader. Initially, this person should be the most mature student in the group.

3. Divide the day's lesson into 5-6 segments. For example, if you want history students to learn about Eleanor Roosevelt, you might divide a short biography of her into stand-alone segments on: (1) Her childhood, (2) Her family life with Franklin and their children, (3) Her life after Franklin contracted polio,

(4) Her work in the White House as First Lady, and (5) Her life and work after Franklin's death.

4. Assign each student to learn one segment, making sure students have direct access only to their own segment.

5. Give students time to read over their segment at least twice and become familiar with it. There is no need for them to memorize it.

6. Form temporary expert groups by having one student from each jigsaw group join other students assigned to the same segment. Give students in these expert groups time to discuss the main points of their segment and to rehearse the presentations they will make to their jigsaw group.

7. Bring the students back into their jigsaw groups.

8. Ask each student to present her or his segment to the group. Encourage others in the group to ask questions for clarification.

9. Float from group to group, observing the process. If any group is having trouble (e.g., a member is dominating or disruptive), make an appropriate intervention. Eventually, it's best for the group leader to handle this task. Leaders can be trained by whispering an instruction on how to intervene, until the leader gets the hang of it.

10. At the end of the session, give a quiz on the material so that students quickly come to realize that these sessions are not just fun and games but really count.

Think-Pair-Share

Think-pair-share was first proposed by Lyman (1981). This is a relatively low-risk and short collaborative learning structure, and is ideally suited for instructors and students who are new to collaborative learning. Think-Pair-Share is a cooperative learning strategy that can promote and support higher-level thinking. The teacher asks students to think about a specific topic, and then pair with another student to discuss

their thinking and, after that, share their ideas with the group. Think, Pair, Share is a structure first developed by Professor Frank Lyman at the University of Maryland in 1981 and adopted by many writers in the field of co-operative learning since then. It introduces into the peer interaction element of co-operative learning the idea of 'wait or think' time, which has been demonstrated to be a powerful factor in improving student responses to questions.

It is a simple strategy, effective from early childhood through all subsequent phases of education to tertiary and beyond. It is a very versatile structure, which has been adapted and used, in an endless number of ways. This is one of the foundation stones for the development of the 'co-operative classroom.' Think-Pair-Share (TPS) is a collaborative learning strategy in which students work together to solve a problem or answer a question about an assigned reading. This technique requires students to (1) think individually about a topic or answer to a question; and (2) share ideas with classmates. Discussing an answer with a partner serves to maximize participation, focus attention and engage students in comprehending the reading material.

Number Heads Together

Numbered Heads Together is a cooperative strategy that holds each student accountable for learning the material. Students are placed in groups and each person is given a number (from one to the maximum number in each group). The teacher poses a question and students put their heads together to figure out the answer. The teacher calls a specific number to respond as spokesperson for the group. By having students work together in a group, this strategy ensures that each member knows the answer to problems or questions asked by the teacher. Because no one knows which number will be called, all team members must be prepared. Numbered Heads Together (Kagan, 1992) has a variety of adaptations, but the basic gist is that students are given some time to talk about answers to questions so that all students in a pair, group, or class are able respond when called on. This builds some accountability within groups and provides opportunities for unbiased formative assessment of groups and individuals

Numbered Heads Together can also be defined as cooperative learning strategy that is especially helpful in reviewing concepts taught. Groups are formed and given a number 1-6. Then, within each group, members are given a number 1-6. (Ideally, you would have 6 groups of 6, but if you do not have 36 members in the class, divide the students into 6 groups, and some members of each group will have two numbers). Since the rules allow only the student whose number is rolled on the die to respond, group members tend to assure that everyone in the group knows the answer.

Rules and Procedures

Reveal a question. Group members put their heads together to discuss an answer and when the dice are rolled, all talking stops. Teacher calls a group (red die) and a group member (black die) Group 5 person 2. Only the student within the group whose number is rolled may speak. The student will stand and begin by saying, "WE decided the answer is ----"The answer is correct, the team scores a point. If the answer incorrect, the dice are rolled again. When a challenge question is asked, no dice are rolled. The teacher announces, Challenge! There is no consultation with other group members. Any student in any group may stand to answer. Note: If two students tie in standing to answer, roll a die to determine who will speak (odd or even). After a challenge question, all members of each group will put their heads together to see if the group wants to challenge the answer. Or we can follow the following steps;

1. Divide the students into groups of four and give each one a number from one to four
2. Pose a question or a problem to the class.

3. Have students gather to think about the question and to make sure everyone in their group understands and can give an answer.

4. Ask the question and call out a number randomly.

This is a flexible strategy that can be used at a variety of levels. The teacher may start with factual information questions, and as students become more familiar with the strategy, ask questions that require analysis or synthesis of information. Student groups can be given statements such as; School uniforms help to keep

students focused on academics. Students' task is to come to consensus on whether they agree or disagree, giving an explanation of their reasoning. After the students respond, have the other groups agree or disagree with the answer by showing thumbs up or thumbs down, and then explain their reasoning. Or, if the answer needs clarifying, ask another student to expand on the answer.

Inside-Outside Circle

Inside-Outside Circle (Kagan, 1994) is a summarization technique that gets students up and moving. It provides a way to get students who normally would not talk to interact with others. After students read a section of text, the teacher divides the group. Half of the students stand up and form a circle with their backs to the inside of the circle. They are partner A. The other halves of the students form a circle facing a partner from the first circle. These students are partner B. Partner A will speak first, quickly summarizing what they read. This takes about a minute. Then partner B speaks for the same length of time, adding to the summary. If the teacher stands in the center of the circle, he/she can easily monitor student responses.

Now it is time to move. Have the students who are partner A raise their right hands and then move two people to the right to meet with a new partner. Repeat the summary with partner B speaking first. For the third move, have all students who are partner B raise their right hand and move two people to the right. After they are with a new partner, they continue with the summary with partner A speaking first. Depending on the size of the class, teachers may have students move more or fewer times to complete the activity. Inside-Outside Circle holds all students accountable for having something to say. The teacher can use this activity as a formative assessment by standing in the center of the circle and listening to the conversations that take place during this strategy, students form two different circles: half of the group stands in a circle facing outward while the other half forms a circle around them facing inward. Students exchange information until the teacher signals the outer circle to move in one direction. The students now have a different partner with whom to exchange.

Steps

1. Decide which students will be in each circle (inside and outside).
2. Put a question or statement on the board.
3. Give students at least ten seconds to think on their own (think time).
4. Ask students in the inside circle to share their response with the classmate facing them in the outside circle. When they have done this, ask them to say pass, at which point the students in the outside circle will share their responses with the classmate facing them in the inside circle.
5. Have the outside circle move one step to the left or right and discuss the same question with the new partner. Option: post a new question for another discussion.

TYPES OF COOPERATIVE LEARNING

Johnson, and Holubec (1998) theory has identified three types of cooperative learning groups and they are formal, informal, and base groups.

Formal Cooperative Learning

Consists of students working together, for one class period to several weeks, to achieve shared learning goals and complete jointly specific tasks and assignments (Johnson, Johnson, & Holubec, 2008). Formal cooperative learning groups range in length from one class period to several weeks. The teacher can structure any academic assignment or course requirement for formal cooperative learning. Formal cooperative learning groups ensure that students are actively involved in the intellectual work of organizing material, explaining it, summarizing it, and integrating it into existing conceptual structures. They are the heart of using cooperative learning (Johnson, Johnson and Holubec, 1998, p. 1to7). While this method leads to less time for lecture, it will increase the amount of material retained by students as well as their comfort working with each other. (Johnson, et al., 2006, p.3 to 10)

Informal Cooperative Learning Groups

Informal cooperative learning consists of having students work together to achieve a joint learning goal in temporary, ad-hoc groups that last from a few minutes to one class period (Johnson, Johnson, & Holubec, 2008). The teacher uses them during direct teaching (lectures, demonstrations) to focus student attention on the material to be learned, set a mood conducive to learning, help set expectations about material, what the lesson will cover, ensure that students are cognitively processing the material being taught, and provide closure to an instructional session. This type of group forms the basis for most routine uses of cooperative learning. Groups are assembled for at least one class period and may stay together for several weeks working on extended projects. These groups are where students learn and become comfortable applying the different techniques of working together cooperatively. (Johnson, et al., 2006, p.2)

Cooperative Base Groups

Cooperative base groups are long-term, heterogeneous cooperative learning groups with stable membership (Johnson, Johnson, & Holubec, 2008). Base groups are long-term (lasting for at least a year), heterogeneous groups with stable membership whose primary purpose is for members to give each other the support, help, encouragement, and assistance each needs to progress academically. Base groups provide students with long-term, committed relationships. (Johnson, Johnson, & Holubec, 1998, p.1 to 8). Cooperative base groups are long-term, stable groups that last for at least a year made up of individuals with different aptitudes and perspectives. They provide a context in which students can support each other in academics as well as in other aspects of their lives. The group members make sure everyone is completing their work and hold each other accountable for their contributions. Implementing cooperative base groups in such a way that students meet regularly for the duration of a course completing cooperative learning tasks can provide the permanent support and caring that students need to make academic progress and develop cognitively and socially in healthy ways. (Johnson et al., 1998 , p.10 to 7)

2.1.4 ASSESSMENT OF COOPERATIVE LEARNING

Assessment is an integral part of instruction, as it determines whether or not the goals of education are being met. Assessment affects decisions about grades, placement, advancement, instructional needs, and curriculum. Assessments inspire us to ask these questions like Are we teaching what we think we are teaching? Are students learning what they are supposed to be learning? And is there a way to teach the subject better, thereby promoting better learning? Assessment must be planned with its purpose in mind. Assessment for, as and of learning all have a role to play in supporting and improving student learning, and must be appropriately balanced. The most important part of assessment is the interpretation and use of the information that is assembled for its intended purpose.

Assessment is embedded in the learning process. It is tightly interconnected with curriculum and instruction. As teachers and students work towards the achievement of curriculum outcomes, assessment plays a constant role in informing instruction, guiding the student's next steps, and checking progress and achievement. Teachers use many different processes and strategies for classroom assessment, and adapt them to suit the assessment purpose and needs of individual students. Assessment activities can be categorized as either formative or summative, both of which are appropriate for cooperative learning exercises as they provide opportunities to enhance key components of cooperative learning exercises such as positive interdependence and individual accountability

Formative Assessment

Activities are used to provide feedback, evaluating learning progress in order to motivate students to higher levels.

Summative Assessment

Activities are used to judge final products for completion, competency and/or demonstrated improvement.

Nearly any evaluation can be developed to fulfill either formative or summative assessment goal. For example, written reports can include a revise and resubmission process which provides students with feedback on which aspect of their work is in need of improvement prior to evaluation of the final product. Assessment activities can be implemented at different stages of the cooperative learning exercise and can be conducted by either the instructor, the student, or group peers.

Pre-Exercise Assessment

Developing assessment strategies that are implemented before the exercise is to take place are most appropriate when cooperative learning exercises are more complex, time intensive, and make use of more sophisticated content. The success of such exercises hinges, in part, on the preparation of students and pre-exercise activities can provide a signal as to the importance and complexity of this work to students. Tickets to participate are a form of assessment that requires individual students to complete a task prior to the start of the cooperative learning exercise. The purpose of these assignments is to prepare students, focusing their attention on content relevant to the exercise and reducing the likelihood of unprepared students. Those who fail to complete the assignment are placed in a group together and required to complete the exercise. In all likelihood, such unprepared students will create output that is of lower quality than their otherwise prepared peers resulting in a valuable lesson learned.

Assessment during the Exercise

Assessment can occur at either the individual or group level during the cooperative learning exercise, facilitated through careful monitoring and intervention or by a formal break in the exercise with all groups checking in on their progress. Assigning roles to group members, such as summarizer, reflector, elaborator, and/or recorder/secretary provides a more formal mechanism for evaluating the progress of the group. It is also possible to make individual accountability part of your group-work monitoring by periodically requesting random student reports or oral exams (graded at the instructor's discretion). When setting up groups, have the students

within each group count off. So in each group, one student has the number 1, another number 2, and so on. At an appropriate point in the exercise, walk up to a group and pick a number at random and that person must report on the group's progress or answer a question about what the group is doing.

Post-Exercise Assessment

In order to make sure that all students are working towards the same standards, it is helpful to provide a detailed description (possibly a rubric or checklist) of how the project will be graded. In many or most cooperative learning classes, students still take individual tests or quizzes (in part to make sure that everyone is doing the reading). Group projects can also result individual products. With the peer review method, for example, the paper is the responsibility of the author, and sometimes the reviewers comments on their own are also subject to grading.

Evaluation by Instructor

Evaluation by the instructor provides students with feedback on the understanding of content, concepts, and applications. It is the most traditional of all formats and typically is the primary basis for evaluation.

Individual, Self-Assessment

Students can develop a better understanding of their learning process, a metacognitive perspective which enhances future learning, through active reflection on their achievements. Such assessments also build writing and speaking skills as students demonstrate their knowledge of the subject, problem solving skills, and contributions to group processing.

Peers

Allowing the opportunity for group members to assess the work of their peers provides important feedback on the relative merits of contributions and promotes cooperation as students realize their accountability to the group. A word of caution is

appropriate, however, as the peer review process is complex, it relies on well-defined criteria and evidence-building that is clearly understood by all participants.

2.2 MATHEMATICS EDUCATION IN BHUTAN

School mathematics education in Bhutan was in the process of reform for grade PP to XII till 2013. Now the mathematics curriculum reform has been completed and already implemented in schools. The full cycle of new mathematics curriculum implementation will be completed by 2014.

According to (DCRD,2013), the new mathematics curriculum of Bhutan closely resembles with the New Brunswick's curriculum, Canada, which explicitly follows the principles and standards established by the National Council of Teachers of Mathematics (NCTM). The National Council of Teachers of Mathematics (NCTM) was founded in 1920. It has grown to be the world's largest organization concerned with mathematics education, having more than 80,000 members across the USA and Canada, and internationally. Mathematics is an exploration of patterns and relationships of quantities, space and time. Students build the rigor to think and work mathematically; use graphs, models, diagrams, and invented and conventional symbols; learn mathematical concepts and develop the intuition to apply concepts to explore and solve everyday problem situations; and find patterns and relationships both in the real and the world.

The objectives of mathematics curriculum reform according to the (Department of Curriculum and Research Division of Bhutan) 2005 were;

1. Make mathematics education in school relevant, both contextually and conceptually to the learners and the Bhutanese milieu at all levels of school education
2. Make the teaching and learning of mathematics meaningful so that the learners value the subject

3. Bring the standard of mathematics curriculum and instruction in Bhutanese school at par with international standards

According to the National Council of Teachers of Mathematics (NCTM; 1991), learning environments should be created that promote active learning and teaching; classroom discourse; and individual, small-group, and whole-group learning. Therefore Cooperative learning is one example of an instructional arrangement that can be used to foster active student learning, which an important dimension of mathematics is learning and highly endorsed by math educators and researchers. Students can be given tasks to discuss, problem solve, and accomplish. Cooperative learning activities can be used to supplement textbook instruction by providing students with opportunities to practice newly introduced or to review skills and concepts. Teachers can use cooperative learning activities to help students make connections between the concrete and abstract level of instruction through peer interactions and carefully designed activities.

2.3 RELATED RESEARCHES ON COOPERATIVE LEARNING

Cooperative learning is one of the most extensive and prolific areas of theory, research, and practice in education. Many researches had been conducted across the globe on the effects of cooperative learning method. Most of the research conducted found positive impact on the learning achievements of the students.

Tran (2013) conducted a research on Effects of Student Teams Achievement Division (STAD) on Academic Achievement, and Attitudes of Grade 9th Secondary School Students towards Mathematics. The study investigated the effect of cooperative learning on the academic achievement in mathematics and attitudes of 74 9th-grade mathematics students toward mathematics in a high school in Vietnam. The results of the study also reported that the experimental group had significantly higher scores than the control group on both Enjoyment and Value scales of attitudes toward

mathematics (t (72) = 2.81, df = 53.68, p < .05; t (72) = 2.86, df = 55.58, p < .05, respectively). The study concluded that cooperative learning was effective in improving the academic achievement level of participating students, and in promoting the positive attitudes of students toward mathematics in the level of Vietnamese high schools.

Dheeraj and Kumari (2013) conducted a research on Effect of cooperative learning on achievement in environmental science of school students. The methodology used was experimental research. It was found out that Mean achievement of the students exposed to cooperative learning differs significantly from the mean achievement of the study taught through traditional method (MI~42.8, M2=38; 't' value = 2.44, P<05). It implies that cooperative learning has a significant impact on the achievement of Class V students in EVS-2.Learning is very joyful under- cooperative learning system.

Iyer (2013) also conducted a research on Relation between Cooperative Learning and Student Achievement. He says Cooperative learning promotes thought provoking and interactive environment for the students. The purpose of the research was to analyze the effects of cooperative learning in a classroom to see its impact on student learning. Also, elements of cooperative learning are discussed and its influence on student achievement. In conclusion, cooperative learning provides a tool to the educators to incorporate values in providing quality education.

Hennessey and Dionigi in 2013 did a research on implementing cooperative learning in Australian primary schools, Generalist teachers' perspectives. This qualitative study examined 12 Australian generalist primary teachers', understandings of cooperative learning and perceived factors affecting its implementation. Using Johnson and Johnson's (1994) features of cooperative learning and Bain, Lancaster and Zundans' (2009) list of cooperative learning terms as a framework for analysis, they found that teachers' level of cooperative learning knowledge shaped their perceptions of the factors affecting its implementation in the classroom.

Zakaria1, Solfitri, Daud, and Abidin (2013) did a research on Effect of Cooperative Learning on Secondary School Students' Mathematics Achievement. Their purpose of this study was to determine the effects of cooperative learning on students' mathematics achievement in secondary school students in Pekanbaru, Indonesia. In addition, this study also determined students' perception concerning cooperative learning. The results showed that there was a significant difference of mean in students' mathematics achievement between the cooperative group and the traditional group. Content analysis data revealed that students in the cooperative group were able to increase their under-standing and to develop their self-confidence.

Awoderu, Bukunola and Idowu (2012) conducted a research on Effectiveness of Cooperative Learning Strategies on Nigerian Junior Secondary Students' Academic Achievement in Basic Science. The study investigated the effectiveness of cooperative learning strategies on Nigerian Junior Secondary students' academic achievement in basic science. The results of this study indicated that there were significant main effects of treatment on all the dependent measures. There were also significant main effects of anxiety on the students' post and delayed-post academic achievement scores in basic science. Furthermore, there were significant interaction effects of treatment and anxiety on the academic achievement of students at the posttest and delayed-posttest levels. Learning together and Jigsaw II cooperative teaching strategies were found to be more effective in enhancing students' academic achievement and retention in basic science more than the conventional lecture.

A Bhutanese researcher Rabgay (2012) conducted a research on the effects of cooperative learning method on learning achievenmet of seventh grade students towards science subject using experimental research design. The purpose of the research was to determine the effect of cooperative learning method on learning achievement and opinion. The researcher found out that cooperative learning method increases the learning achievement and there was a positive opinion in inclusion of cooperative learning method.

Chianson, Kurumeh, and Obida, (2010) conducted a research on the effect of cooperative learning strategy on students' retention in circle geometry in secondary schools in Benue State, Nigeria. This study investigated the effect of cooperative learning method compared with the conventional learning method in order to find out the retention level of students' in circle geometry. The findings of the study confirmed that students who were subjected to the cooperative learning strategy were able to retain the concepts of circle geometry more than those students who were taught using the conventional learning approach. Hence the recommendations were that, students would be able to retain taught and learnt concepts in mathematics for a longer period of time if mathematics teachers applied the cooperative learning strategy in teaching.

Goyak (2009) did a research on the topic the Effects of Cooperative Learning Techniques on Perceived Classroom Environment and Critical Thinking Skills of Pre service Teachers. This study analyzed the effects of cooperative learning techniques versus lecture techniques on the following aspects of a higher education classroom: (a) the perception of a student's learning environment and (b) a student's critical thinking skills. The outcomes of this study suggested that cooperative learning techniques have merit and profit in the undergraduate classroom.

Robyn and Boyle (2009) conducted a research on Teachers' reflections on cooperative learning: Issues of implementation. Data from the interviews indicated that while the teachers had positive experiences with cooperative learning, a number encountered difficulties with implementing it in their classrooms. Issues identified included students socializing during group activities and not working, managing time effectively, and the preparation required. Other issues that the teachers identified as being important for successful group work included the composition of the groups, the task the group was to undertake, the social skills training needed, and the assessment of the learning that occurred in the group.

Thanh (2008) conducted a research on cooperative learning and academic achievement of Asian students: A True Story. This paper reviews research examining the effects of cooperative learning strategies on the academic achievement of Asian students. Achievement outcomes are found mixed with 50 per cent of the studies

reporting neutral and negative findings and 50 per cent reporting positive findings. The paper also reveals mismatches between cooperative learning's principles and Asian cultures based on what was reported in the reviewed studies. Future research needs to further investigate this issue. Also, for cooperative to work more effectively in the Asian context there needs to be some further research that investigates how to change those principles of cooperative learning that may be inappropriate in the Asian context so they may be more compatible with Asian culture and conditions.

Snyder and Shickley, (2006) did a research on cooperative learning groups in the Middle School Mathematics Classroom. The purpose of this study was to investigate the effects that cooperative learning groups have on the middle school mathematics classroom. They found out that most students had a positive attitude toward mathematics when working cooperatively.

Nesrin and Nazlı (2004) conducted a research on the effect of learning together technique of cooperative learning method on student achievement in mathematics teaching seventh class of primary school .The purpose of this study is to determine the effect of learning together technique of cooperative learning method on student' mathematics achievement. The study was an experimental research in which pretest and posttest design with control group was applied. Conclusions showed that there is a significant difference between the results of experiment and control groups. Learning together technique of cooperative learning method is more effective than traditional teaching methods.

Iqbal (2004) conducted a research on the effect of cooperative learning in academic achievement of secondary school students in mathematics. He did an experimental research and found out that cooperative learning method was effective than the conventional method. Therefore all the researchers have found out that the cooperative learning approach had positive effects on students learning achievements towards learning mathematics and it's the 21st century teaching strategy over the conventional teaching method.

2.4 CONCLUSION

Cooperative learning has been an extensive topic in educational circles for more than a decade. Researchers and practitioners have found that students working in small cooperative groups can develop the type of intellectual exchange that fosters creative thinking and productive problem solving. Cooperative learning is believed highly desirable because of its tendency to reduce peer competition and isolation, and to promote academic achievement and positive interrelationships. Cooperative learning provides students who have math disabilities and social interaction difficulties, an instructional arrangement that fosters the application and practice of mathematics and collaborative skills within a natural setting.

Thus, cooperative learning has been used extensively to promote mathematics achievement of students (Slavin, Leavey, & Madden, 1984; Slavin, Madden, & Leavey, 1984). According to the National Council of Teachers of Mathematics (NCTM; 1991), learning environments should be created that promote active learning and teaching, classroom discourse, and individual, small group, and whole-group learning. Cooperative learning is one example of an instructional arrangement that can be used to foster active student learning, which an important dimension of mathematics is learning and highly validated by math educators and researchers. Students can be given tasks to discuss, problem solve, and accomplish.

The National Council of Teachers of Mathematics (NCTM) also recommends that students be provided opportunities to work together cooperatively in large and small groups on significant problems. Group assignments help learners combine new knowledge with prior knowledge, leading to the construction of new ideas within the group. Cooperative learning activities can be used to supplement textbook instruction by providing students with opportunities to practice newly introduced or to review skills and concepts. Teachers can use cooperative learning activities to help students make connections between the concrete and abstract level of instruction through peer interactions and carefully designed activities.

Lastly, cooperative learning can also be used to promote classroom discourse and oral language development. Wiig and Semel (1984) described mathematics as conceptually dense. That is, students must understand the language and symbols of mathematics because contextual clues, like those found in reading, are lacking in mathematics. Cooperative learning is a popular instructional arrangement for teaching mathematics to students. Together with direct instruction, cooperative learning holds great promise as a supplement to textbook instruction by providing students with opportunities to practice math skills and concepts, reason and problem solve with peers, use mathematical language to discuss concepts, and make connections to other skills and discipline

CHAPTER 3

RESEARCH METHODOLOGY

This chapter basically describes the research design, the subjects used for the study, experimental procedure, data collecting procedure, research instruments for collecting data, validity and reliability of the instrument and statistics for analyzing the data

3.1 The Research Design

3.1.1 Experimental procedure
3.1.2. Treatment procedure

3.2 Population and Sample

3.2.1 Population
3.2.2 Sample

3.3 Research Instruments

3.3.1 Lesson Plans
3.3.2 Achievement test
3.3.3 Opinion Questionnaire
3.3.4 Content Validity and Reliability

3.4 Data Collection

3.4.1 Approval from Concerned Authority
3.4.2 Anonymity of the Participants and Confidentiality of their Views

3.5 Data Analysis

3.5.1 Learning achievement analysis
3.5.2 Opinion towards learning mathematics analysis

This research was a quantitative research and it was a quasi-experimental design. The research design consisted of pretest and posttest to examine the students' learning achievement and questionnaire to examine their opinion towards mathematics using cooperative learning method. The pretest and posttest helped the researcher to compare the changes in scores and the questionnaire helped to find out

their opinion towards learning mathematics after using cooperative learning approach. Descriptive statistics like frequency, mean, standard deviation and inferential statistics (paired sample t-test) was used to analyze the data.

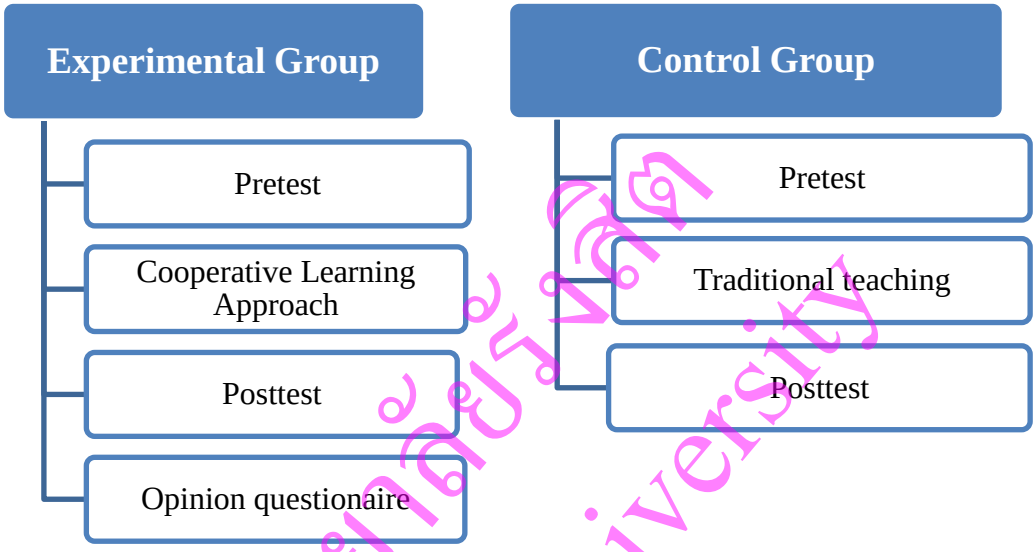

Figure 3.1 Research design

EXPERIMENTAL PROCEDURE

The students were divided into two equal groups based on purposive sampling. One group was used as experimental group and another as the controlled group. The pretest was conducted to both of the groups. A questionnaire was administered to only the experimental group to study the opinion towards learning mathematics. Then the experimental group was treated with various cooperative learning structures while the control group was taught using conventional method. Both of the groups were taught the same topic “Fraction” and five lessons were used with five cooperative learning techniques to teach the experimental group.

TREATMENT PROCEDURE

Since the students in the experimental group had no prior experience of learning in cooperative groups, the researcher firstly familiarized students of experimental group on cooperative learning. This was done in the outset meeting with the students of treatment time. Here the researcher basically explained how the cooperative learning approach works and is carried out and helped them adjust, acquaint and work among friends.

3.2 POPULATION AND SAMPLE

Population

The population of the study comprised of 394 students studying in the 8th grade in Dagana Province.

Sample

The sample of the study comprised of 72 students studying in the 8th grade at Tashiding Lower Secondary School. Purposive sampling was done since the school had only two sections of 8th grade with 36 students and each all students were included for the study.

3.3 RESEARCH INSTRUMENTS

Researcher used two research instruments to collect the data for the study and they were achievement test and opinion questionnaire

Achievement test

In the research, 25 achievement questions were used to assess and compare the achievement of the subject within the experimental group in mathematics before and after implementing cooperative leaning approach. The test was administered twice as pretest and posttest to measure achievement in mathematics in experimental group before and after treatment procedures.

Opinion Questionnaire

Questionnaire was used to study the effect of cooperative learning on students' opinion towards learning mathematics. The questionnaire was administered once after experiment to the experimental group only. The questionnaire were sorted in four categories and they were (1) Opinion on enjoyment of mathematics, (2) Opinion on value of mathematics, (3) Opinion on motivation to study mathematics, and (4) Opinion on belief about mathematics.

CONTENT VALIDITY AND RELIABILITY

The two essential characteristics of the measurement instruments that must be considered in establishing the appropriateness and usefulness of measurement instruments are validity and reliability according to Jurs and Wiersma (2005:p.324).

Content Validity

According to Joppe, 2000, content validity is the extent to which an instrument measures what it is supposed to measure and perform as it is designed to perform. Validity also refers to appropriateness, meaningfulness and usefulness of any references a researcher draws based on data obtained through the use of instrument. In this research the instruments were validated by experts form Rangsit University, Thailand and two mathematics teachers from Bhutan by using the index of item-objective congruence. Content experts rated the items regarding how well they do or do not match with the established objectives. The result index ranges from -1 to +1, if the rating is

1. +1 The item clearly matches objectives or ensure that the following measures meet the objectives stated
2. 0, unclear or unsure whether the measures meet the objectives or not
3. – 1 item clearly does not match objectives or ensure that the measure does not meet the stated objectives reality. The formula for calculating the IOC $= \frac{\sum R}{N}$

Where R= sum of the scores of individual experts, N = number of experts.

(Source: Rovinelli & Hambleton, 1977)

Indexes of item-objective congruency (IOC) was computed for three instruments, achievement test, opinion questionnaire and lesson observation form. The IOC of learning achievement test was in between 0.67 to 1 and the average was 0.93, the IOC for opinion questionnaire was in between 0.67 to 1 and the average was 0.89 and for lesson observation form the IOC was in between 0.67 to 1 and the average was 0.97. Therefore all the three values indicated that the items were valid and was very good (0.5-1: very good). List of experts who validated the instruments are shown in the appendix H.

Reliability

Reliability refers to the consistency of scores or answers provided by an instrument. Jurs and Wiersma, 2005 (p.324) stated that reliability is the consistency of the instrument in measuring whatever it measures. According to Anastasi (1968), reliability means consistency of scores obtained by same individual when re-examined with the test on different sets of equivalent items or under other variables examining conditions. To check the reliability of the instrument, test was conducted in another school (Namchella Lower Secondary School) and ChronBach's alpha (α) was computed using SPSS software.

Table 3.1Description of Internal Consistency using Cronbach's Alpha

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent (High-Stakes testing)
$0.7 \leq \alpha < 0.9$	Good (Low-Stakes testing)
$0.6 \leq \alpha < 0.7$	Acceptable
$0.5 \leq \alpha < 0.6$	Poor
$\alpha < 0.5$	Unacceptable

(Source: http://en.wikipedia.org/wiki/Cronbach's alpha)

It was noted that an alpha of 0.8 is probably a reasonable goal and it should also be noted that while a high value for Cronbach's alpha indicates good internal consistency of the items in the scale, it doesn't mean that the scale is one dimensional.

Table 3.2 Reliability statistics for learning achievement test

Reliability Statistics for learning Achievement Test		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	Number of items
0.92	0.92	25

The Cronbach's alpha coefficient for the achievement test questions was 0.92 which indicated that the instrument was reliable.

3.4 DATA COLLECTION

Approval from Concerned Authority

Prior to carrying out the study the researcher obtained the approval from the Ministry of Education, the District Education Officer, the school principal and finally got approval from class teachers and subject teacher of Tashiding Lower Secondary School.

Anonymity of the Participants and Confidentiality of their Views

The researcher ensured that anonymity and confidentiality of participants were observed. The opinion, views and thoughts shared by the participants were kept secret and confidential except for the researcher.

Data Analysis

Data analysis was done in two areas namely the learning achievement test and opinion questionnaire analysis and the data analysis was done in the following ways;

Learning Achievement Analysis

The mean and the standard deviation of pretest and posttest of both groups were computed. The means were compared between the groups and then within the groups using paired samples t-test. The values of the 2-tailed significance (p-value) were referred to determine the significance difference between the means.

Opinion Towards Mathematics Analysis

The data analysis of students' opinion was done based on the four components of the questionnaire. Then the mean and standard deviation were computed. Each mean indicated their opinion on the scale. The frequencies and percentage were also computed for clear analysis.

CHAPTER 4

RESULT OF DATA ANALYSIS

This chapter presents demographic profile of the sample followed by the results of data analysis which is done in three parts.

1. Achievement test score analysis
2. Opinion questionnaire analysis
3. Lesson observation analysis

4.1 DEMOGRAPHIC PROFILE OF THE SUBJECTS

A total of 72 eighth grade students of Tashiding Lower Secondary School were the subjects for the study. They were divided into two groups, the experimental group and the control group. Table 4.1 shows the demographic information of the subjects.

Table 4.1 Demographic information of the subjects

Groups	Gender		Total	Age Group			Total
	Male	Female		10-12	13 - 15	16 - 18	
Experimental group	18	18	36	0	26	10	36
	50%	50%	100	0%	72%	28%	100%
Control group	18	18	36	0	28	8	36
	50%	50%	100	0%	78%	22%	100%

Form the table researcher concluded that, in the experimental group, out of 36 students, 18 (50%) were male and 18 (50%) were female. There were equal numbers of male and female in the experimental group. Most of the students in the class, 26

(72%) were in the age range of 13- 15 years. Only 10 (28%) students were in the age range of 16-18. There were no students in the age range of 10 -12 years.

Similarly in control group, out of 36 students, 18 (50%) were male and 18 (50%) were female. Most of the students, 28 (78%) fell in the range of 13-15 years. There were only 8 (22%) of them in the age range of 16 to 18 and no students were there in the age range of 10 – 12 years.

4.2 ACHIEVEMENT TEST SCORE ANALYSIS

The first objective of the study was to find out the effectiveness of cooperative learning approach on students learning achievement. A comparative statistical analysis was done using paired sample t-test to this objective. The comparison was first done within the group by comparing the pretest and posttest of each group and then between the groups by comparing pretest and pretest and posttest and posttest of the two groups. The comparison was mainly done in terms of mean, standard deviation and significance value.

4.2.1 Pretest-Posttest Comparison (within the groups)

Firstly the pretest and posttest scores of each group were compared. Table 4.2 shows the result of paired samples t-test of the pretest-posttest comparison of both groups in terms of mean and standard deviation.

Table 4.2 Pretest and Posttest Comparison

Groups	**Experimental group**		**Control group**	
	Pretest	**Posttest**	**Pretest**	**Posttest**
Mean	10.92	22.28	11.17	14.89
Standard Deviation	3.61	2.3	3.73	2.24
Mean difference	22.28-10.92= **11.36**		14.89-11.17=**3.72**	

From the table the result shows that the mean in the pretest of the experimental group was 10.92 and the standard deviation was 3.61. In the posttest the mean was 22.28 and the mean has increased by 11.36. The standard deviation was 2.3.

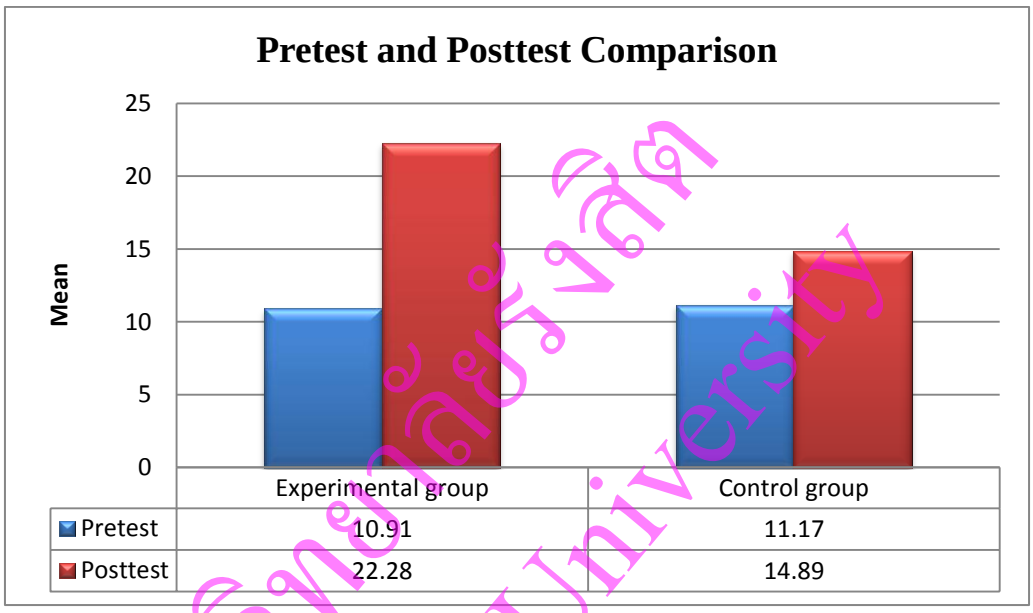

Figure 4.1 Pretest and Posttest Comparison of the two groups

From the graph it was concluded that in the control group the mean of pretest was 11.17 and the standard deviation was 3.73. The mean of the posttest was 14.89 and the standard deviation was 2.24. The mean had increased by 3.72.

From the results of the comparison it was seen that there was an increase in the mean of the posttest of both the groups. It was also noted that the mean difference in the experimental group was significantly higher than that of the control group.

4.2.2 Pretest-pretest and Posttest Comparison

Table 4.3 shows the comparisons of the pretests and posttests of the experimental and control group.

Table 4.3 Pretest-pretest, Posttest-posttest Comparison

Pretest	Pretest	SD	Posttest	SD
Mean of experimental group	10.92	3.61	22.28	2.3
Mean of control group	11.12	3.73	14.89	2.24
Mean difference	**0.2**		**7.39**	
2-tailed significance	**0.65**		**0.00**	

Significance level :> 0.05-not significant, <0.05-significant

From the table the researcher concluded that the pretest mean of experimental group was 10.92 and the mean of the control group was 11.12. It was noted that they were almost equal and the 2-tailed significance value was 0.65 which indicated that there was no significant difference between the pretest means of the two groups. Thus it indicated that the two groups had equal learning abilities in the beginning of the experiment.

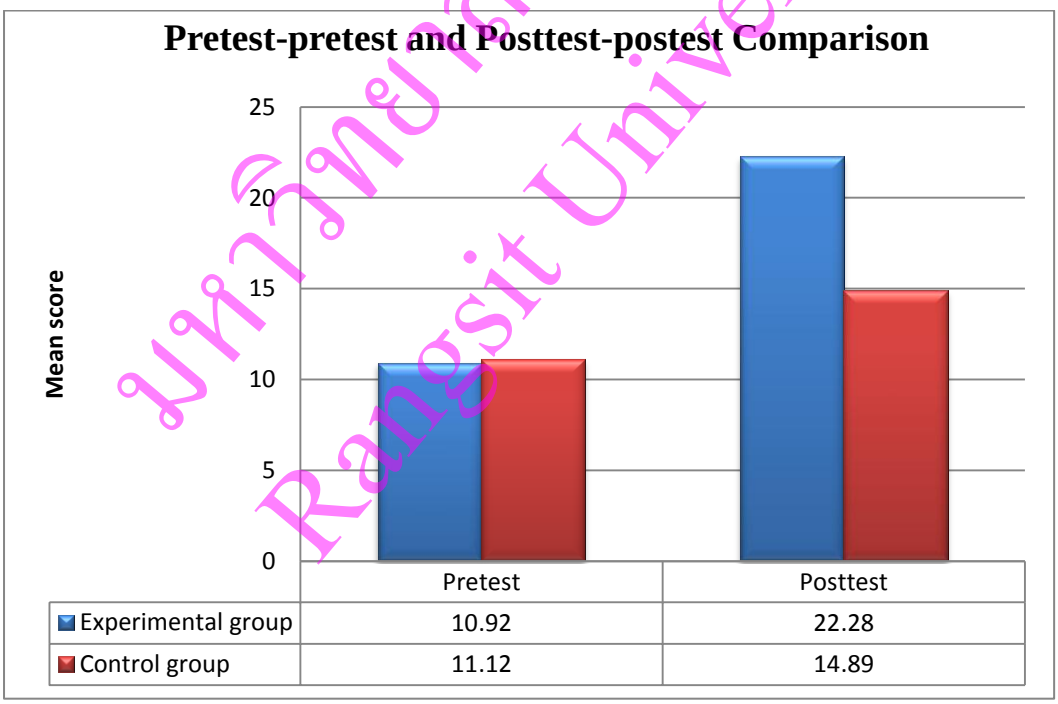

Figure 4.2 Pretest-pretest and Posttest-posttest Comparison of the two groups

From the graph it was concluded that the posttest mean of the experimental group was 22.28 and 14.89 for the control group. The 2-tailed significance was 0.00 which indicated that the mean of the posttest of the experimental group was

significantly higher than the mean of the posttest of control group. This is illustrated in figure 4.2.

4.3 STUDENTS OPINION ANALYSIS

The second objective of the study was to determine if cooperative learning brought about any changes in students opinion about learning mathematics. The data was collected by using opinion questionnaire. It was administered only to the experimental group after the treatment was done. The opinion questionnaire comprised of four components. They were; (a) opinion on enjoyment of mathematics, (b) opinion on value of mathematics, (c) opinion on motivation to study mathematics, (d) opinion on belief about mathematics. The mean and standard deviation were computed of the four components. Table 4.4 shows the mean and the standard deviation of the four components after the treatment.

Table 4.4 Mean and standard deviation of students' opinion questionnaire

A. Opinion on enjoyment of learning mathematics	**Mean**	**S.D**	**Level of opinion**
1.Mathematics is an interesting subject	4.72	0.45	Strongly Agree
2. I find mathematics not a boring subject	4.72	0.45	Strongly Agree
3. I like solving mathematics problems on my own	4.69	0.47	Strongly Agree
4. I enjoy my mathematics lessons	4.72	0.45	Strongly Agree
5. I wish we were only taught mathematics at school	3.86	0.71	Agree
Subtotal	**4.54**	**0.51**	**Strongly Agree**
B. Opinion on value of mathematics			
6.I need mathematics in my daily activities	4.56	0.61	Strongly Agree
7. Mathematics can be used in situations outside classroom	4.00	1.04	Agree
8. I find mathematics useful to me	4.97	0.17	Strongly Agree
9. I find mathematics useful to others in their daily life	4.47	0.70	Strongly Agree
10. I have used my school mathematics to solve problems outside school	4.39	0.64	Strongly Agree
Subtotal	**4.48**	**0.63**	**Strongly Agree**

C. Opinion on motivation to study mathematics	Mean	S.D	Level of opinion
11.I would like to develop my mathematical skills	4.69	0.52	Strongly Agree
more	4.58	0.55	Strongly Agree
12. I would always want to learn more about mathematics	4.5	0.51	Strongly Agree
13. I study mathematics when I am going to have a test	3.97	1.21	Agree
14. I feel we should be given more homework in mathematics	4.34	0.73	Strongly Agree
15. I intend studying as much mathematics as I can in future			
Subtotal	**4.42**	**0.70**	**Strongly Agree**
D. Opinion on belief about mathematics			
16.In our class the teacher is not only the one who knows mathematics	4.4	0.61	Strongly Agree
17. Methods that are used in our mathematics textbooks are the best to solve mathematical problems	4.13	0.68	Strongly Agree
18. I learn mathematics when I have to revise for test	4.56	0.50	Strongly Agree
19. I not only learn my mathematics at school	4.86	0.35	Strongly Agree
20. For me to do well in mathematics, I have to memorize theorems and formulas	4.44	0.73	Strongly Agree
Subtotal	**4.48**	**0.59**	**Strongly Agree**

Level of opinion: 0.00-1.00-strongly Disagree. 1.1-2.00-Disagree. 2.1-3.00-Undecided. 3.1-4.00-Agree. 4.1-5.00- Strongly Agree.

From the table the researcher concluded that in the first component of the student's opinion questionnaire, 'opinion on enjoyment of learning mathematics' almost all the students strongly agreed that they enjoy learning mathematics after treating with the cooperative learning approaches. The highest mean was 4.72 with the standard deviation 0.45 for the three statements and the lowest mean was 3.86

with the standard deviation 0.51 for the fifth statement. The reason might be that felt other subjects important as well.

In the second component of the students' opinion questionnaire, 'opinion on value of mathematics' students have strongly agreed with almost all the statements. The total mean was 4.48 with the standard deviation of 0.63. The highest mean was 4.97 for the third statement and the lowest mean were 4.00 for the second statement. Therefore it indicated that cooperative learning approaches really increased their opinion on value of mathematics.

For the third component of the opinion questionnaire the subtotal mean was 4.42 with the standard deviation 0.70. Almost all the students strongly agreed with the statements which indicated that cooperative learning approaches motivated them to learn mathematics. The lowest mean was 3.97 for the statement 'I feel we should be given more homework in mathematics' which indicated that they do not want more home works since they might be getting in other subjects too.

In the fourth component, opinion on belief about mathematics, all the students strongly agreed with all the students. The subtotal mean was 4.48 with the standard deviation 0.59. This clearly indicated that students had developed positive belief on mathematics after treating with the cooperative learning approaches. The highest mean was 4.86 with the standard deviation of 0.73 and the lowest mean was 4.13 with the standard deviation of 0.68.

CHAPTER 5

CONCLUSION, DISCUSSION AND RECOMMENTATIONS

This chapter presents the conclusion from the analysis of data, the discussions of the findings, recommendations for practice and future research.

5.1 CONCLUSION

The study had two objectives, to study the effects of cooperative learning approach on learning achievement of eighth grade students towards mathematics and to study the effectiveness of cooperative learning approach on students' opinion towards learning eighth grade mathematics. The quasi experimental design was carried out to achieve the objectives with pretest and posttest to both the experimental group and the control group. There were 72 students who participated in the study as subjects of the study. The research instruments used were learning achievement test and opinion questionnaire. Descriptive statistics and paired sample t-test were computed to analyze and determine the significant levels of both the variables. Two conclusions were drawn from the results of data analysis.

5.1.1 Conclusion from the Learning Achievement Test

For the first objectives the test scores were analyzed and the results of the analysis showed that means of the posttest of both the groups were higher than the means of the pretest (table 4.2). However the mean difference of pretest and posttest of experimental group was much higher than that of pretest and posttest of control group. While comparing the posttest and posttest of the two groups the mean of the experimental group was significantly higher than that of control group since the 2-tailed significance value was 0.00. This result showed that students in the experimental group performed far better than the control group. Consequently the

study concluded that there was a significant gain in the test scores of experimental group as a result of inclusion of cooperative learning approaches.

5.1.2 Conclusion from Students' Opinion Analysis

The second objective of the study was to find out if cooperative learning approaches have changed students' opinion on learning mathematics. The opinion questionnaire was analyzed by finding means, standard deviations, frequencies and percentage. The opinion questionnaire had four components, They were; (a) opinion on enjoyment of mathematics, (b) opinion on value of mathematics, (c) opinion on motivation to study mathematics, (d) opinion on belief about mathematics. Table (4.4) undoubtedly showed that in almost all the components the students agreed with the statement and could see positive opinion towards learning mathematics. Thus the study concluded that students had positive opinion on, enjoyment, value, motivation and belief with the presence of cooperative learning approaches. From the means it is also concluded that they enjoy learning mathematics and find it less difficult.

5.1.3 Summary of the conclusions

Based on the results of the data analysis two major conclusions were drawn and they were;

1. Cooperative learning approaches have increased students learning achievement towards eighth grade mathematics.
2. Cooperative learning approaches had positive opinion towards learning eighth grade mathematics.

5.2 DISCUSSION

This study had two major findings; cooperative learning approaches have increased the learning achievement of eighth grade mathematics and students' positive opinion after teaching with cooperative learning approaches.

Cooperative learning approaches have increased students learning achievement of eighth grade students supported, Tran (2013) and Dheeraj and Kumari's (2013) view that students taught by cooperative learning approach learned, retained significantly more information and scored high in the tests than students taught by competitive, and individualistic strategies. The findings were also consistent with Snyder and Shickley, (2006) and Iqbal's (2004) findings that there were significant gains between the pretest and posttest scores in teaching mathematics using cooperative learning approach. It was also reliable with the findings of Sherman and Thomas (1986) who found similar results in a study that involved high school general mathematics class taught by cooperative learning and individualistic methods. Johnson, Maruyama, Johnson, Nelson, and Skon (1981) conducted a meta-analysis of 122 studies related to cooperative learning and found similar findings that there was strong evidence for the superiority of cooperative learning in promoting achievement over competitive and individualistic strategies.

According to Vygotsky, 1978, he stated that the possible reason to account for such significant gains in the test scores in the experimental group could be due to the socially oriented lessons taught and learned through small group interaction which stimulates cognitive skills. Students actively interacted, discussed, clarified ideas and acknowledge each other's ideas. The teacher observer had also noted the changes in students' behaviors. Johnson and Johnson (1990), identified, when students interacted, share ideas and points of views, gave and received support from each member and helped each other, it enabled them dig below the superficial level of understanding of the material they were learning. Another reason to account for increase in the test score could be due to the non-threatening learning atmosphere created by cooperative learning approaches.

In the experimental group students enjoyed greater degree of autonomy as compared to the control group where teacher dominates the classroom. It was noted that such freedom enabled the students to share ideas and interact among themselves. Johnson and Johnson (1990) again found that a non-threatening class allowed students to actively engage in the learning process and freely express their ideas, ask questions, clarify doubts and stimulates their cognitive skills which were attributed to increase in test score in the study.

In this study students' made sure that each member had learnt well and if anyone had problems they helped by encouraging and giving moral support to their friends. The lesson also provided equal opportunity for success among group members and these were evident form the observation analysis. Several learning theories accounted for the gain in the test scores in the experimental group. The first theory that supported was Vygotsky's theory of zone of proximal development. Vygotsky (1978) believed that learning is dependent on social interaction and that social learning actually leads to learning. He also believed that students learn better under adult guidance and with peer collaboration than alone.

Constructivist theory also supported gain in learning achievement. According to constructivist theory, learning increases with the amount of student involvement. In this study students were mostly engaged in learning themselves and most of the class time were used in activities that allowed students to discuss, share ideas, and provide feedback. They constructed their own knowledge and had clear understanding of what they learnt.

Dale's (1946) theory of learning which stated that students' retention rates increase with the amount of student involvement also supported the gain in test scores in the experimental group. According to Dale's cone of learning, the rates were highest with teamwork which included group discussion 50%, practice by doing 75% and teaching others, 90%. In contrast the retention rate of traditional ways for individual and passive learning, lecturing 5%, reading 10% and demonstration 30%

lasted no more than 30 %. It was obvious form the teachers observation analysis that students were most of the time engaged in group discussion, practice by doing and teaching peers. Thus the increase in the test scores was also attributed to students' active engagement in the learning process and most importantly the first finding was attributed to characteristics of cooperative learning approaches such as social learning context, non-threatening classroom, equal opportunity for success, students constructing their own knowledge. These characteristics marked the difference between teacher-centered learning and child centered learning.

The second finding of the study, cooperative learning approach increased students' enjoyment, value, belief and motivation was in the line with the findings of Zakaria1, Solfitri, Daud, and Abidin (2013) that did a research on Effect of Cooperative Learning on Secondary School Students' Mathematics Achievement. Their purpose of this study was to determine the effects of cooperative learning on students' mathematics achievement in secondary school students in Pekanbaru, Indonesia. In addition, their study also determined students' perception concerning cooperative learning. The results showed that there was a significant difference of mean in students' mathematics achievement between the cooperative group and the traditional group. Content analysis data revealed that students in the cooperative group were able to increase their under-standing and to develop their self-confidence. It was also in line with Robyn and Boyle (2009) conducted a research on Teachers' reflections on cooperative learning: Issues of implementation. Data from the interviews indicated that while the teachers had positive experiences with cooperative learning, a number encountered difficulties with implementing it in their classrooms. Issues identified included students socializing during group activities and not working, managing time effectively, and the preparation required.

Some possible reasons to account for the positive opinion were due to the enjoyable and less threatening learning environment created by cooperative learning approaches. Students share their ideas and points of views, gave and received positive feedback, encouragement, support and acceptance from other members. When they were rewarded they celebrated the accomplishment of the goal together.

According to Slavin (1995), such learning environment ultimately helped students in psychological wellbeing which could lead them to enjoy the lessons and increased their level of interest. Another reason of high level of interest was because of the equal opportunities for success in cooperative learning approach. As declared earlier members in a cooperative learning approach worked together on a common goal, task, in the spirit of 'sink or swim together', and develop good support system and positive interdependence (Johnson and Smith 1998). According to Slavin (1995), features such as equal opportunities for success in cooperative learning had a positive effect on motivation and students were more likely to attribute success to hard work and ability than to luck. In several studies he found students in cooperative groups had a stronger interest to come to school every day and worked hard in class than students in control group.

In this study it was also obvious from the results of teachers' observations analysis that students in cooperative learning groups had equal opportunities to succeed as the teacher observers agreed to most of the statements. As a result of helping each even the students' who cored lowest in the pretest scored high in posttest. There was an entertaining and fun in learning process which could be the reason to account for increased level of interest in learning mathematics. The researchers planned interesting games and worksheets at the end of the lesson to make the students interesting and enjoyable. These showed that entertaining games made liveliness of the cooperative learning lesson which increased their interest in learning mathematics. Another reason for positive change in opinion might be due to the pleasure and satisfaction students derived from understanding the concepts. Students in groups discussed and shared ideas, provided support, sought help and encouraged until all the group members understood the concepts clearly. These attributes of cooperative learning approach accounted for the second finding of the study that cooperative learning increased students' level of enjoyment, value, motivation and belief after treating with cooperative learning approach.

In Bhutan recently in the schools throughout the country, teachers are beginning to practice cooperative learning approaches to teach various subjects. The

Royal Education Council (REC) an autonomous body who initiates educational reforms in the country has started working with the Singaporean scholars to train teachers on cooperative learning approaches and piloted a few schools in some of the districts to implement with cooperative learning approaches. Therefore I hope this study will provide indications on the effectiveness of cooperative learning approaches in Bhutanese teaching-learning context and motivate teachers to use it as an alternative teaching approach in the mathematics classroom.

5.3 RECOMMENDATIONS

5.3.1 Recommendation for Practice

The conventional teaching and learning approach will still dominate the Bhutanese classroom if new teaching approaches are not applied by the teachers. Therefore cooperative learning is one approach which is child centered and applicable to all the subjects. The study found out that cooperative learning approach increases learning achievement and increase the level of enjoyment, value, motivation and belief, it can be used as alternative teaching method to conventional teaching method. Thus this study recommends teachers in Bhutan to use cooperative learning approach as an alternative teaching approach to teach mathematics.

1. It would be more reliable if the teacher investigates the effectiveness of cooperative learning approaches in other units of the eighth grade mathematics and also in other subjects as well
2. The teachers could also use time series to see the progress and opinion of the learners.
3. It is recommended that the teacher should develop positive relationship with students and stress classroom activities which involve active teaching and learning process and students' participation in the class.
4. The teachers must initiate to integrate cooperative learning approach in their lessons to make it interesting and enjoyable to bring positive change in students' behavior and to enhance their learning.

5. In any study of methods, students' factors such as motivation, interest in topics, prior experiences, and personal learning styles should also be considered to understand how they influence the students' achievement.
6. The finding from this research would be useful for mathematics teachers in Bhutan to improve their performance in teaching mathematics using cooperative learning approaches and also for the curriculum developers in reviewing the mathematics curriculum in future.
7. This study would serve as a reference for the Bhutanese researcher to research in related field of studies.
8. This study recommends that the school administration should focus on the cooperative learning approach and provide professional development to teachers and implement with the students.

5.3.2 Recommendation for Future Research

Considering some of the limitations of the study, the following are the recommendations for future research

1. Further research may be carried out to study the effectiveness of cooperative learning approach in primary and higher secondary schools and levels of education.

2. This study has used five cooperative learning approaches, Team Jigsaw, Think pair share, STAD, Round table and, Inside circle-outside circle. Researches may be conducted to study the effectiveness of each of these approaches in various subjects.

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APPENDIX

APPENDIX A

LETTER OF APPROVAL

LETTER OF APPROVAL

དཔལ་ལྡན་འབྲུག་གཞུང་། ཤེས་རིག་སྨྲའུ་ཁག།
Royal Government of Bhutan
Ministry of Education
Human Resource Division

MoE/HRD-HRDs/INSET/22/2014/6142

May 19, 2014

To Whom It May Concern

This is to certify that following teachers are currently pursuing Masters of Curriculum & Instruction at Rangsit University, Thailand starting 1st July 2013 for duration of 18 months under Trongsa Penlop Scholarship. As a partial fulfillment of the above Masters Programme they are required to conduct a research project on a selected topic respectively. The selected research topics are all related to the school curriculum and they wish to collect research data from the schools across the country.

- ***Mrs. Pema (EID# 200801330), Wolathang PS, Punakha;***
- ***Mrs. Kinley Wangmo (201001605), Gongthung MSS, Trashigang;***
- ***Karma Wangmo (EID# 201001673), Thinleygang PS, Punakha;***
- ***Mr. Sonma Penjor (EID# 201001669), Tsaphel LSS, Haa; &***
- ***Mr. Lobzang Namgyal (EID# 201001607), Tashiding LSS, Dagana.***

The concerned authorities are requested to kindly allow them to collect research data from the school and render necessary support to enable them to collect reliable data for successful completion of research project.

For clarification please contact HRD, MoE at +975-2-335402 during office hours

(Kinley Gyeltshen)
Chief HR Officer

APPENDIX B

LEARNING ACHIEVEMENT TEST

LEARNING ACHIEVEMENT TEST

Attention: This test paper is neither an examination nor related to your academic. The paper will never been shown to the teachers, parents, friends or anybody. Therefore please answer all the questions by selecting only one response for each question in the space provided.

Instructions: This questionnaire consists of two sections:

1. Personal information of respondent
2. Students' understanding of the unit.

Part A: Personal information
Select /cross[x] for the appropriate answer of your choice in the given box.
Gender
[ ] **Male** [ ] **Female**
Age ……years **Grade** (in figure)……..

Part B: Questions to test the students' understanding of the unit.
Total Mark: 25
Total number of questions: 25
Time: 1hour.
Directions: There are 25 questions in this test. Each question is followed by three possible choices of answers. Choose the correct answer and write down in the space provided.

Question1
If the numerator of a fraction is greater than the denominator the fraction is called as
A. proper fraction **B.** improper fraction **C.** mixed number

Ans:……..
Question 2
The sum of $5\frac{2}{12} + 3\frac{5}{12}$ is
A. $8\frac{1}{2}$ **B.** $8\frac{4}{12}$ **C.** $2\frac{6}{12}$

Ans:…….
Question 3
The difference between a third and a fourth is
A. $\frac{2}{7}$ **B.** $\frac{0}{1}$ **C.** $\frac{1}{12}$

Ans:…….

Question 4

The product of $\frac{3}{4}$ and $\frac{5}{12}$ in lowest term is

A. $\frac{15}{48}$ **B.** $\frac{5}{16}$ **C.** $\frac{8}{16}$

Ans:……

Question 5

John's bed takes up $\frac{1}{3}$ of the width of his room and $\frac{3}{5}$ of its length.What fraction of the floor area is covered by the bed?

A. $\frac{3}{15}$ **B.** $\frac{4}{8}$ **C.** $\frac{2}{2}$

Ans:……

Question 6

The following model shows the multiplication of

A. $3 \times 2\frac{3}{4}$ **B.** $\frac{2}{5} \times 2\frac{3}{4}$ **C.** $\frac{2}{3} \times 2\frac{1}{2}$

Ans:……

Question 7

How many eggs are there in $2\frac{3}{4}$ dozen?

A. 33 eggs **B.** 24 eggs **C.** 30 eggs

Ans:……

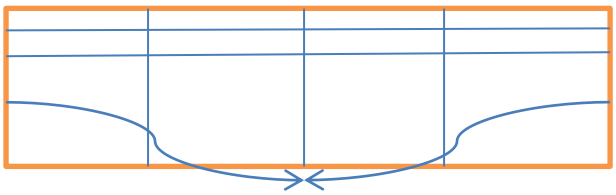
Question 8

The quotient of $\frac{5}{8}$ and $\frac{3}{8}$ is

A. $\frac{2}{0}$ **B.** $\frac{8}{16}$ **C.** $1\frac{2}{3}$

Ans:……

Question 9
What division equation does the diagram represent?



The large rectangle is the whole.

A. $\frac{3}{9}$ **B.** $\frac{3}{12}$ **C.** $\frac{3}{3}$

Ans:…….

Question 10
Jackson spent 2 hours studying for exams, for each, she studied $\frac{2}{3}$ hours. How many subjects did she study?

A. 2 subjects **B.** 3 subjects **C.** 4 subjects

Ans:……..

Question 11
The answer of $8\frac{4}{5} \div 2\frac{1}{5}$ is

A. 4 **B.** $\frac{484}{25}$ **C.** $6\frac{3}{5}$

Ans:……

Question 12
A number that can be written as a quotient of two integers is called

A. real number **B.** rational number **C.** irrational number

Ans:…….

Question 13
The order of $-\frac{9}{4}$, -3, $-\frac{4}{5}$, $-6\frac{1}{2}$ from least to greatest is

A. $-\frac{4}{5}$, -3, $-6\frac{1}{2}$, $-\frac{9}{4}$ **B.** $-6\frac{1}{2}$, $-\frac{4}{5}$, -3, $-\frac{9}{4}$ **C.** $-6\frac{1}{2}$, -3, $-\frac{9}{4}$, $-\frac{4}{5}$

Ans:……..

Question 14

When we multiply two negative integers the product is

A. negative **B.** positive **C.** both positive and negative

Ans:…….

Question 15

The solution of $-\frac{3}{8} \div (-1\frac{1}{4})$ is

A. $\frac{3}{10}$ **B.** $-\frac{3}{10}$ **C.** $\frac{15}{32}$

Ans:……..

Question 16

The answer for $\frac{2}{5} \times \frac{1}{2} + \frac{3}{4} \div 1\frac{1}{5}$ is

A. $\frac{19}{24}$ **B.** $-\frac{33}{40}$ **C.** $\frac{33}{40}$

Ans:……..

Question 17

The appropriate sign in the box of $23\frac{5}{9} \square 23\frac{2}{9}$ is

A. < **B.** > **C.** =

Ans:……

Question 18

A farmer has $9\frac{1}{2}$ hectares of land. He needs $1\frac{1}{4}$ hectares for each crop. How many different crops can he plant?

A. $10\frac{2}{6}$ crops **B.** 7 crops **C.** $11\frac{7}{8}$ crops

Ans:……

Question 19

The answer of – 5.86 - (-7.15) is

A. positive **B.** negative **C.** both positive and negative

Ans:…….

Question 20

A musical instrument is made from a $1\frac{1}{4}$ m length of wood. How many instruments can be made from 10 m of wood?

A. $9\frac{1}{4}$ instruments **B.** 12.5 instruments **C.** 8 instruments

Ans:……..

Question 21

How many $\frac{1}{5}$s are there in $\frac{8}{10}$?

A. 8 **B.** 4 **C.** 10

Ans: …….

Question 22

What equation does the number line shows?

A. $\frac{5}{6} \div \frac{1}{4} = 2\frac{1}{2}$ **B.** $\frac{2}{4} \div \frac{1}{8} = 4$ **C.** $\frac{5}{6} \div \frac{1}{3} = 2\frac{1}{2}$

Ans: ……..

Question 23

Robin worked for $7\frac{1}{2}$ hours. He spent $\frac{2}{3}$ of the time on his computer. How long was he on the computer?

A. 5 hours **B.** $\frac{45}{2}$ hours **C.** $\frac{41}{6}$ hours

Ans:……

Question 24

The product in lowest term of $4\frac{4}{7} \times 3\frac{1}{2}$ is

A. $7\frac{5}{9}$ **B.** 16 **C.** $12\frac{2}{7}$

Ans:……..

Question 25

A jug filled with juice holds 10 cups. Adam poured $3\frac{1}{3}$ cups of juice from the jug. Adam then poured another $2\frac{3}{4}$ cups of juice from the jug. How much juice was poured from the jug altogether?

A. $6\frac{1}{2}$ **B.** $3\frac{11}{12}$ **C.** $5\frac{4}{7}$

Ans:…….

APPENDIX C

IOC OF ACHIEVEMENT TEST QUESTIONS

IOC OF ACHIEVEMENT TEST QUESTIONS

Questions	**Expert 1**	**Expert 2**	**Expert 3**	**IOC**
Question 1	+1	+1	+1	1
Question 2	+1	+1	+1	1
Question 3	+1	+1	+1	1
Question 4	+1	+1	+1	1
Question 5	+1	+1	0	0.67
Question 6	+1	+1	+1	1
Question 7	+1	+1	+1	1
Question 8	+1	+1	+1	1
Question 9	+1	0	+1	0.67
Question 10	+1	+1	+1	1
Question 11	+1	+1	+1	1
Question 12	+1	+1	+1	1
Question 13	+1	+1	0	0.67
Question 14	+1	+1	+1	1
Question 15	+1	+1	+1	1
Question 16	+1	+1	+1	1
Question 17	+1	+1	+1	1
Question 18	+1	0	+1	0.67
Question 19	+1	+1	+1	1
Question 20	+1	+1	+1	1
Question 21	+1	+1	+1	1
Question 22	+1	+1	+1	1
Question 23	+1	+1	+1	1
Question 24	+1	+1	+1	1
Question 25	+1	0	+1	0.67
Average				**0.93**

APPENDIX D

STUDENTS OPINION QUESTIONNAIRE TOWARD LEARNING MATHEMATICS

STUDENTS OPINION QUESTIONNAIRE TOWARD LEARNING MATHEMATICS

Dear students
The purpose of this questionnaire is to study your opinion towards learning mathematic subject. Each of the statements expresses a feeling which a particular person has toward mathematics. You are to express, on a five-point scale, the extent of agreement between the feeling expressed in each statement and your own feeling. There is no right or wrong response to the statement.

Your responses will be kept confidential therefore please feel free and give your honest response to all the statements

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Part I: Demography

Direction: Put a check mark (√) in the [ ]

1. Gender [ ] Male [ ] Female

2. Age [ ] Between 10 - 12 [ ] Between 13-15 [ ] between 16-18

Part II: Opinion towards learning mathematics

Direction: Rate your response to each item on the scale of 1-5. The five points are:

Strongly Disagree 1
Disagree 2
Undecided 3
Agree 4
Strongly Agree 5

	A. Opinion on enjoyment of mathematics	**1**	**2**	**3**	**4**	**5**
1	Mathematics is an interesting subject					
2	I find mathematics not a boring subject					
3	I like solving mathematics problems on my own					
4	I enjoy my mathematics lessons					
5	I wish we were only taught mathematics at school					

	B. Opinion on value of` mathematics	1	2	3	4	5
6	I need mathematics in my daily activities					
7	Mathematics can be used in situations outside Classroom					
8	I do not find mathematics useful to me					
9	I find mathematics useful to me in my daily life					
10	I have used my school mathematics to solve problems outside school					
	C. Opinion on motivation to study mathematics					
11	I would like to develop my mathematical skills More					
12	I would always want to learn more about Mathematics					
13	I study mathematics when I am going to have a test					
14	I feel we should be given more homework in Mathematics					
15	I intend studying as much mathematics as I can in Future					
	D. Opinion on belief about mathematics					
16	In our class the teacher is not only the one who knows mathematics					
17	Methods that are used in our mathematics textbooks are the best to solve mathematical problems					
18	I learn mathematics when I have to revise for test					
19	I do not only learn my mathematics at school					
20	For me to do well in mathematics, I have to memorize theorems and formulas					

Any other opinion

……

……

……**Thank you for your kind cooperation.**

APPENDIX E

IOC OF OPINION QUESTIONNAIRE

IOC OF OPINION QUESTIONNAIRE

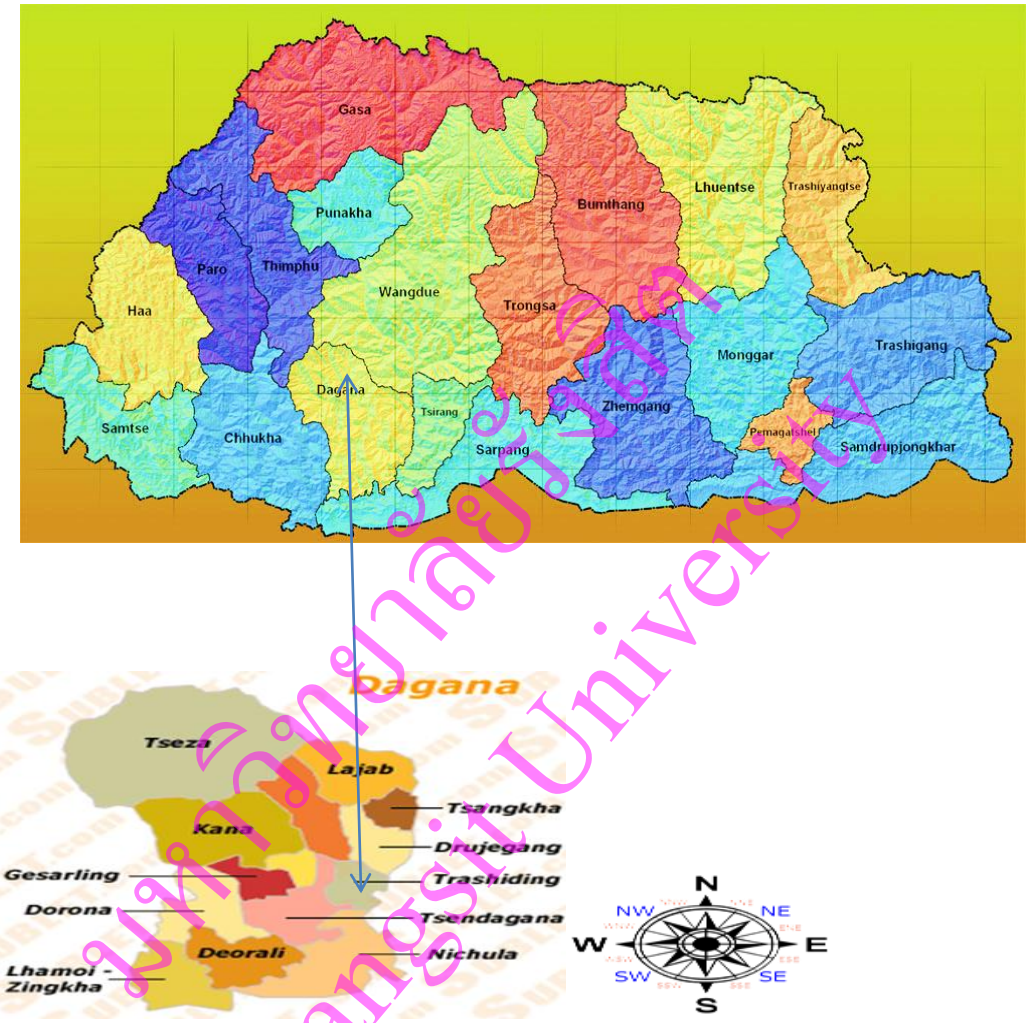
	A. Opinion on enjoyment of mathematics	**Ex.1**	**Ex.2**	**Ex.3**	**IOC**
1	Mathematics is an interesting subject	+1	+1	+1	1
2	I find mathematics not a boring subject	+1	+1	+1	1
3	I like solving mathematics problems on my own	+1	+1	+1	1
4	I enjoy my mathematics lessons	+1	+1	+1	1
5	I wish we were only taught mathematics at school	0	+1	+1	0.67
	B. Opinion on value of` mathematics				
6	I need mathematics in my daily activities	+1	+1	+1	1
7	Mathematics can be used in situations outside classroom	+1	+1	+1	1
8	I do not find mathematics useful to me	+1	0	+1	0.67
9	I find mathematics useful to me in my daily life	+1	+1	+1	1
10	I have used my school mathematics to solve problems outside school	+1	+1	+1	1
	C. Opinion on motivation to study mathematics				
11	I would like to develop my mathematical skills More	+1	+1	+1	1
12	I would always want to learn more about Mathematics	+1	+1	+1	1
13	I study mathematics when I am going to have a test	+1	0	+1	0.67
14	I feel we should be given more homework in Mathematics	+1	+1	0	0.67
15	I intend studying as much mathematics as I can in future	+1	+1	+1	1

	D. Opinion on belief about mathematics	**Ex.1**	**Ex.2**	**Ex.3**	**IOC**
16	In our class the teacher is not only the one who knows mathematics	+1	+1	+1	1
17	Methods that are used in our mathematics textbooks are the best to solve mathematical problems	+1	+1	+1	1
18	I learn mathematics when I have to revise for test	+1	+1	+1	1
19	I not only learn my mathematics at school	+1	+1	+1	1
20	For me to do well in mathematics, I have to memorize theorems and formulas	+1	+1	+1	1
	Average				**0.89**

APPENDIX F

THE LOCATION OF THE SCHOOL

THE LOCATION OF THE SCHOOL



APPENDIX G

SAMPLE LESSON PLAN

SAMPLE LESSON PLAN

Subject area: Mathematics

Date: 28/05/2014

Time: 90 Minutes

Topic: Adding and Subtracting Fractions Mentally

Cooperative Learning structure: Student team and achievement division

Academic Objectives:

1. Add fractions with same denominator
2. Subtract fractions with same denominator
3. Solve a few word problem questions including both addition and subtraction

Social Objectives:

1. Leadership
2. Decision-making
3. Communication
4. Trust-building
5. Conflict-management skills
6. Cooperation

Group Size: 4

Method of assigning students: Informal groups selected at random

Roles: Expert group leader, home group leader, presenters

Room arrangement: Tables and chairs arranged to face the front at diagonals allowing everyone a good view of the front- no one gives back to instructor

Materials: Chart paper, Marker pen, A4 size paper, scissors, textbook, notebook, chalkboard and chalks.

Activity: Groups will discuss on how to add the fractions with same denominators and how to subtract fractions having same denominators. And also they will discuss and find out how to add and subtract fractions having word problems. After doing these activities in group they will present their findings to the whole class.

Task and cooperative goal structure:

1. **Task:** In a timed exercise, working as individuals first to study individual mini handout that explains to each expert what his or her topic of expertise will be. Each expert will explain the topic to the group of four. Then they will go to their respective group to carry out the activities.
2. **Criteria for success:** Each group correctly presents to the class at large their works.
3. **Positive interdependence:** All group members receive a daily credit of 10 points for completing the activity. The whole group gets bonus points if they do all the activities correctly.
4. **Individual accountability:** Each expert group members is responsible for understanding their item and asking help from the instructor if necessary, and assisting others if they struggle to do the work. Each group member must prepare to be the presenter of the work to the class, and this person will be selected randomly by the instructor at the end of the lesson.
5. **Inter-group cooperation:** listening and observing to each groups presentation will allow members of the other groups to self-check their own works. They can ask questions of the presenters whenever clarification is needed.
6. **Expected behaviors:** Listening, assisting, explaining, and asking for help if needed.

Monitoring and Intervening

1. **Observation procedure:** Informal/ formal
2. **Observation by:** Instructor, subject teacher
3. **Intervening for tasks assistance:**
    1. Is each group members participating as an explainer during the first step of his or her expert information?
    2. Is each group members participating as a listener when other shares their expert information?
    3. Is each group reading the given questions when it is time to read?

Intervening for Team Assistance

Walk around listening closely to be sure that, each group is working to complete their task and each group is making sure that each member could potentially present the activity.

Assessing and Processing

1. Assessment of members ‘ individual learning: Observation of individuals within group in on-task discussion and completion of assignment.(10) points and all the activities correct (2points bonus)
2. **Assessment of group productivity:** observation that each group is on time, completing task, preparing to present and when the activity is completed each group will be given 2 marks as bonus on complication of time.
3. **Small group processing**: Each member tells on person in group one way in which their information was helpful. And questions like what are the two things did your group do well and tell one thing that you could do better in next time.
4. **Whole class processing:** Each group will present their works.
5. **Positive feedback to each student:** Verbal feedbacks while students are working and praise for their works.
6. **Goal setting for improvement:** Students will share their experiences and ideas for further improvement next time and reflect in their journals.
7. **Celebration:** after the class is over teacher will acknowledge all the students for their wonderful work and especially the group who did wonderful work without much mistakes.
8. **Others:** Extension and applications: students will look at the real application of adding and subtraction fractions in different fields. They would inquire to other students and teachers.

APPENDIX H

EXPERTS WHO VALIDATED THE INSTRUMENTS

EXPERTS WHO VALIDATED THE INSTRUMENTS

Experts	Profession
Dr. Jintavee Khlaisang	Associate Professor Department of Educational Technology and Communications Faculty of Education, Chulalongkorn University.
Mr.Phub Dorji	Mathematics teacher, Namchella Lower Secondary School, Bhutan.
Ms. Reshma Pradhan	Mathematics teacher, Tashiding Lower Secondary School, Bhutan.

APPENDIX I

T-TEST FOR THE PRETESTS OF BOTH THE GROUPS

T-TEST FOR THE PRETESTS OF BOTH THE GROUPS

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	VAR00001	10.9167	36	3.61248	.60208
	VAR00002	11.1667	36	3.73019	.62170

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	VAR00001 & VAR00002	36	.563	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		M	S.D	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	VAR00001 - VAR00002	-.25000	3.43407	.57235	-1.41192	.91192	-.437	35	.665

APPENDIX J

T-TEST FOR THE POSTTESTS OF BOTH THE GROUPS

T-TEST FOR THE POSTTESTS OF BOTH THE GROUPS

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	VAR00001	22.2778	36	2.30045	.38341
	VAR00002	14.8889	36	2.23961	.37327

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	VAR00001 & VAR00002	36	-.338	.044

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	VAR00001 - VAR00002	7.38889	3.71313	.61885	6.13255	8.64523	11.940	35	.000

BIOGRAPHY

NAME:	Lobzang Namgyal
DATE OF BIRTH:	30th October, 1985
PLACE OF BIRTH:	Samdrup Jongkhar, Bhutan
NATIONALITY	Bhutanese
INSTITUTIONS ATTENDED:	Samtse College of Education, Bhutan 2009 Bachelor's Degree in Education Rangsit University, Thailand (2013-2014) Master of Education in Curriculum and Instruction
SCHOLARSHIP:	Trongsa Penlop Scholarship, 2013
POSITIONS AND OFFICE:	The Ministry of Education Education and Training Services Teaching Services Position: Teacher since (2010…
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