CHAPTER II

REVIEW OF RELATED LITERATURE AND RESEARCH

The study is designed to evaluate the effects of cooperative learning method on students' achievement and social skills. In connection with this study, review of the literature includes the following topics.

1. National curriculum (school curriculum) of Bhutan
   - 1.1 Aims of the national curriculum (school curriculum)
   - 1.2 Key objective of national curriculum (school curriculum)
   - 1.3 Structure of Schooling
   - 1.4 Instructional Time
   - 1.5 Learning standards at key stages of schooling for mathematics
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2. Fraction
3. Cooperative learning method
   - 3.1 Meaning and definition of the cooperative learning method
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   - 3.8 Cooperative learning groups
   - 3.9 Ways to approach the behavior problems in the cooperative learning team
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4. Cooperative learning and achievement
   4.1 Achievement from the point of view of construct representation
   4.2 Factor influencing students' learning
   4.3 How to improve students' learning achievement
   4.4 Ways to measure students achievement
   4.5 Related research on cooperative learning and achievement
   4.6 Related research on cooperative learning and mathematics achievement.
5. Social skills
   5.1 Meaning of social skills
   5.2 Importance of social skills
   5.3 Social skills interventions

National curriculum (school curriculum) of Bhutan

1. Aim of the national curriculum (school curriculum)

The entire foundation of school curriculum is based on the principles, culture and values and the objectives of Gross National Happiness that the country aspires for its citizens. The overall aim of school education is to enable the learners to discover their talents and develop their potentialities to the fullest. It aspires to develop their physical and interpersonal skills, cognitive abilities and subject-matter expertise, attitudinal and emotional predispositions, character formation and work habits. It further develops the social and human values needed for enhancing one's life-long well-being, functioning as responsible citizens, contributing to Bhutan's economic prosperity and to the social and cultural life of the community in which they live [31].

2. Key objectives of national curriculum (school curriculum)

Towards the ideal of enabling all children and young people in Bhutan to achieve the maximum benefit from their learning experience, the school curriculum will seek to develop and promote among learners the following:

2.1 Language abilities (listening, speaking, reading and writing) and communication skills needed for social living and further learning;

2.2 Mathematical abilities to develop a logical mind and enable learners to perform mathematical operations and their application in everyday life.

2.3 Scientific temper characterized by spirit of enquiry, courage to question, objectivity, divergent and independent thinking, and knowledge of scientific methods of enquiry and its use in solving problems; to uphold sovereignty, integrity and foster the development of the country; promotion of international understanding.

2.4 Knowledge and appreciation of the diverse cultural and social systems of people living in different parts of Bhutan and the country's composite cultural heritage.

2.5 Capability of appreciating and tolerating differences and diversities of various sorts/ideologies and the ability to choose between alternative value systems with strong commitment to the national goal of creating a vibrant democracy and an economically prosperous Bhutan.

2.6 Ability to appreciate and discover beauty in various life situations, including art forms, and to participate in activities that promote one's creative expression and capacity for aesthetic appreciation.

2.7 Capability of preserving Bhutan's national identity, and appreciation for the need of a balanced synthesis between the change-oriented technologies, modernity and the continuity of the country's traditions and cultural heritage.

2.8 Appreciation of the need for global fraternity and the positive and negative impact of the processes of globalization and localization in the context of Bhutan's drive for economic prosperity.

2.9 To develop the knowledge, skills, attitude and values required for entrepreneurship and self employment.

2.10 To develop dignity of labor and a healthy attitude amongst students towards work and life [32].

3. Structure of Schooling

The entire schooling till class 10^{th} is organized into three key stages with certain underlying principles. The stages are elaborated as follows:

Key Stage 1: This stage ranges from early childhood education to Grade 2. In the early years (4 to 8 years) children learn through exploration and concrete experience and their different abilities progress at different pace. While their physical growth and language develops faster in the preschool years, their thinking is still based on perceptual cues and cannot take others perspective into account. This period is best

termed as the "period of symbolic mastery". In the early years what is most crucial is the opportunity to explore, to work intensively with materials that nourish the human intelligences and combination of intelligences. The developmental tasks expected from children are developmentally organized. Children at age 8 are ready to respond to the demands of formal schooling [31].

Key Stage 2: In the Primary Years (8-12 years) when children move towards age 7 to 8 there is a new quality of mind that emerges and they can take perspectives, two sided thinking emerges and their memory capacity increases. What we expect children to learn also varies at each stage. The curriculum is organized based on how children learn at each stage. Children are capable of making mental operations, think logically and ready for a deeper understanding of different subject areas. As children move towards middle childhood children they are exposed to a broad range of disciplines in a systematic way; they aim to achieve excellence in different skills [31].

Key Stage 3: In the Adolescent years (12 to 16 years), one of the significant aspect is the movement towards abstract thinking, dealing logically with multifaceted situations and the development of metacognitive abilities. For older students education for understanding, disciplinary mastery and apprenticeship is the goal. At this stage students complete their basic education and are ready to make decisions about their way forward [31].

Higher Secondary Stage: At this stage (16 to 18-19 years) the young mind is moving towards making critical decisions about one's career and physically and cognitively ready to enter into the world of work. Diversification of curriculum at this stage is important and necessary so that students are maturationally ready to enter the world of work, and make informed choices and be a productive member of the society. The pedagogical practices required at each stage is aligned to the needs of the children and how children learn at each stage. In the early years the organizing principle of the curriculum is the physical environment of the program. The caregiver/teacher creates a warm, inviting environment, ensures that children are safe, and follows practices that promote children's physical and mental health and learning. For example in the key stage 1 teacher provide routines and structures; consider what

children already know about a given subject and how to help them to construct new understandings based on that knowledge [31].

By organizing into key stages it is easy to have attainment targets at each key stage as a checkpoint to see how children are doing. Children progress at different pace and reach the level of expectation at different time. Children take time and need space to reach the level of expectation. The key stages give the children a range of time and opportunity to achieve their goals. Also it is a checkpoint for the teachers and relevant adults to know the progress and developmental delays if any [31]. It is table illustrates below in the table:

Table 2 Structure of schooling

Key stage	Age	Subject
Early Childhood Care and Development:	(2 years) Ages-2-4 (Home Based Stimulation)	(2 years) Ages-2-4 (Home Based Stimulation) Physical and Motor Dev, Cognitive/ Intellectual Dev, Language Dev, Social and Emotional Dev, Creative Expression and Aesthetic Appreciation
ECCE: Foundation Stage: K1 and K2 (Integrated and localised Curriculum)	(4 years) Ages 4 to 6	Physical and Motor Dev, Cognitive/ Intellectual Dev, Language Dev, Social and Emotional Dev, Creative Expression and Aesthetic Appreciation
Key Stage 1: Early Childhood Education, Class I-II	(2 years) Ages 6 to 8	**Core subjects:** Eng., Dz., Math, Environment Studies, Art, Music and Movement, Health and Physical Education, Values and life skills, Cross Curricular Goals
Key Stage 2: Primary Education, Class III to VI	(4 years) Ages 6 to 8	**Core subjects:** Eng., Dzo., Math, Science, Social Science, Art, Music and Movement, Health and Physical Education , Values and life skills, Cross Curricular Goals

Table 2 (cont.)

Key stage	Age	Subject
Key Stage 3: Basic Education, Class VII to X:	(4 years) Ages 12-16	**Core subjects:** Eng., Dz., Math, Science, Social Science, Art, Music and Movement, Health and Physical Education, Values and life skills, ICT, Cross Curricular Goals
Higher Secondary School Class 11-12	Ages: 17-18	**Foundation Studies:** Dzongkha, English language, Quantitative reasoning, Writing, Combined Humanities and/or Combined Sciences Elective Studies: **Humanities-** sociology, geography, history, economics, psychology, political science, development studies. **Languages:** Dzongkha, english and literature. Sciences-biology, physics, mathematics, chemistry, computer science, design and technology, environment and ecology. Commerce-accounts, business mathematics, finance. Foundation Studies: Dzongkha, english language, quantitative reasoning, writing, computer literacy.
Vocational and Technical Institutes	Ages: 17-18	**Elective Studies:** Health, applied services, business, financial, applied services hydro electric power, applied services information, communication technology, applied services tourism, applied services manufacturing civil, applied services education and applied Services.
Post Secondary School	(3-4 years)	Universities, Vocational institutes/Job

Source: Royal education council, 2009

4. Instructional Time

The following table shows the organization of the school year, which includes when the school starts, the number of terms and the length of holidays. It is not an exact representation because it may vary in different key stages and the location of places in Bhutan, and accessibility to schools. However it is important to have a minimum amount of student engaged time to improve the teaching learning process. In total there is 180 working days a year. The formal schooling has 900 to 1100 hours of teaching time a year. Furthermore research on teachers' effectiveness has revealed a concept that teachers and supervisors can use to improve student learning. It is academic learning time, defined as the amount of time the student spends engaged in an academic task that he or she performs with high success. The basic component of academic learning time are allocated time, student engagement and student success rate16. Decisions about time allocation are usually made by the teacher, but in some cases it can be jointly done by the students and the teachers depending on the needs of the student and the tasks involved. For the amount of student learning is not only influenced by the engaged time, but also by the match between the task and the particular student. This means that academic learning time can be interpreted as an ongoing measure of student learning. Using this system teacher can modify their learning time, the related tasks, their teaching so the students learn more and build their own capacity to change [31]. Furthermore, the tables below provides the detail instructional time.

Table 3 Instructional time and vacation in the school

Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan
Term 1 begins mid Feb					Vacation from 1-15	Term 2 begins				Vacation	Vacation

Source: Royal education council, 2009

Table 4 Instructional time for respective grades

Grades	Days per week	Periods per week	Hours per week
KG1and KG2	5	30	4hrs
1st and 2nd	5	40	5:20hrs
3rd to 10th	$5\frac{1}{2}$	44	5:30hrs
11th and 12th	18 credit per semester × 4 semester 1credit 30 hrs -18hrs contact time and 12 hrs self study		

Source: Royal education council, 2009

5. Learning standards at key stages of schooling for mathematics

The learning standards gives broad descriptors of what the children should be expected to achieve by the end of each key stage:

Table 5 Learning standard at key stages of schooling for mathematics

Key Stage 1(K1 – Grade 2nd) Age 4 to 6	Key Stage 2 (Grades 3rd to 6th) Age 8 to 12	Key Stage 3 (Grades 7th to 10th) Age 12 to 16
• Exploring, investigating and communicating about quantity and their representations, attributes of objects and collections. • Counting and using numbers up to 10 in familiar contexts • Addition and subtraction using concrete materials •Demonstrate conservation of number • Investigating and communicating about movement, position and direction. • Recognizing and describing shapes and size of solid and flat shapes • Using vocabulary related to position and direction • Use pictures and objects to solve practical problems • Direct comparison of length and weigh Age 6 to 8	**Reasoning, Problem Solving and Communicating** • Problem solving (numbers, data, situations) in all strands • Solving complex problems by breaking down into simpler steps • Make mental estimates of the solutions and check the results • Use different approaches to problem solving, explain the methods used and give reasons for problem solving • Communicate using mathematical language, symbols and notations and diagrams • Make connections while solving problems of different strands and search for patterns in results **Numbers and Operations** • Count on and back in tens or hundreds from	**Reasoning, Problem Solving and Communicating** • Use alternate approaches to problem solving, explain the methods used and give reasons for problem solving • Make connections in mathematics to develop flexible approaches to problem solving • Make mental estimates of the solutions and check the results and monitor accuracy • Communicate using mathematical language, symbols and notations and diagrams • Critically examine and justify and reason out the choices of mathematical presentations **Numbers and Number system** • Develop an understanding of irrational, real and complex numbers • Develop an understanding of the properties

Table 5 (cont.)

Key Stage 1(K1 – Grade 2nd) Age 4 to 6	Key Stage 2 (Grades 3rd to 6th) Age 8 to 12	Key Stage 3 (Grades 7th to 10th) Age 12 to 16
Reasoning, Problem Solving and Communicating • Problem solving (numbers, data, problem situations) in all strands • Making decisions as to which operation to use • Explain the methods used and give reasons for problem solving • Express and communicate using objects, pictures, mathematical language and symbols **Numbers and Operations** • Count, read, write, order numbers upto 20 at first and then upto 100 or beyond • Represent the place value of a digit (ones, tens hundreds) • Represent number patterns upto 100 and beyond	two/three digit number, continue number sequences from any integer, extending to negative number when counting backwards. • Represent whole numbers, place value, multiply or divide whole numbers with up to 4 digits by a 2 digit whole number • Understand and find prime numbers, factors, multiples, prime factors, HCF, LCM. • Know and Use divisibility properties by 2,3,4,5,6,10 **Algebra** • Generate sequences and find missing term • Read and write algebraic expressions, simplify expressions and translate between verbal and algebraic expressions. • Solving algebraic equtions in one variable	of real and complex number systems • Use their knowledge and understanding of integers and place value to deal with different aspects of number system • Know the use of square root, cube, cube root, index notation for small integer powers, index laws for multiplication and division of positive integer powers • Draw on their knowledge of the number operations and the relationships between them to solve different kinds of numerical problems **Fractions and Decimals** • Use fraction notations, understand equivalent fractions, simplify fractions, and order fractions • Use decimal notations and recognize that each terminating decimal is a fraction

Table 5 (cont.)

Key Stage 1(K1 – Grade 2nd) Age 4 to 6	Key Stage 2 (Grades 3rd to 6th) Age 8 to 12	Key Stage 3 (Grades 7th to 10th) Age 12 to 16
• Understand addition and its related vocabulary, addition facts to 20, addition of 3 digit numbers without regrouping Understand subtraction and its related vocabulary, subtraction facts upto 20, subtraction of 3 digit numbers without regrouping • Know multiplication as equal grouping, multiples of 2,5,10, multiplication as repeated addition • Know that division is equal sharing • Recognize the inverse relationship of addition and subtraction, halving and doubling (upto 20) **Fractions** • Recognize simple fractions, meaning of equal part of whole and part of a collection	**Fractions and Decimals** • Understand unit fractions, simple equivalent fractions, compare and order fractions, explain their methods and reasoning • Convert fractions to decimals and vice versa • Addition and subtraction of proper fractions, multiplication of a fraction by a proper fraction, division of a fraction by a whole number. • Understand and use decimal notations for tenth and hundredth in a context. • Round a number with one or two decimals places to the nearest integer. • Solving operations with decimals (addition and subtraction) **Percentages, Proportion and Ratio** • Recognize that percentage is number of parts per hundred, find percentage of whole number quantities	**Geometry** • Create angles at a point, angles on a straight line, alternate and corresponding angles, make formal arguments to establish congruency of two triangles, use congruency of two triangles to generate further knowledge • Use their knowledge of essential properties of special types of quadrilateral and classify according to their properties • Understand and use Pythagoras theorem Understand regular polygons and their exterior and interior angles, explore the geometry of cuboids, use 2 Drepresentations of 3 D shapes and analyse 3 D shapes through 2 D projections and cross sections • Properties and terms related to circle (pie) • Know the properties of transformation (rotations, reflection, and symmetry), of shapes

Table 5 (cont.)

Key Stage 1(K1 – Grade 2nd) Age 4 to 6	Key Stage 2 (Grades 3rd to 6th) Age 8 to 12	Key Stage 3 (Grades 7th to 10th) Age 12 to 16
Geometry, Patterns and Measures • Use geometric propertiesto explore, sort , create and describe 2D and 3D shapes • Observe and describe position, direction and movements of objects using appropriate vocabulary • Create geometric patterns using objects (one or two shapes, size, colour, orientation). • Know the relationship of objects or numbers using patterns and simple rules (order, sequence, arrangement and equivalence). • Estimate and measure length and weight using non standard and standard units of measurement; capacity using non standard units of measurement. • Compare duration of events using standard units of time	• Convert percentage to decimals and fractions and vice versa and understand their relationship • Solve simple problems of ratio and direct proportions **Geometry, Patterns and Measures** • Understand the properties of shapes, visualize and describe 2 D and 3 D shapes using geometrical language • Make and draw 2 D and 3D shapes with increasing accuracy, visualize 3 D shapes from 2 D drawings • Recognize right angles, perpendicular and parallel lines, vertically opposite angles; find the sum of all angles of triangles • Measure and draw 2 D shapes, angles, and lines, squares and rectangles, triangles, circles • Find perimeters and areas of simple shapes	and that these transformations preserve the length and angle so that the figure is congruent to its image under transformation • Construct enlargement of objects using positive integer scale factors greater than one, then positive scale factors less than one, and make derivations about squares and rectangles. • Understand the usage of one, two and three coordinates, find coordinates of line segments and do the calculations • Interpret scales on a range of measuring instruments, know that measurements depend on the units chosen, convert measurements, and make sensible estimates of range of measures in everyday settings • Constructions using straight edge and compass, measure and draw lines and angles with accuracy

Table 5 (cont.)

Key Stage 1(K1 – Grade 2nd) Age 4 to 6	Key Stage 2 (Grades 3rd to 6th) Age 8 to 12	Key Stage 3 (Grades 7th to 10th) Age 12 to 16
• Recognize units of money (negultrums) • Solve problems related to money or measures, explain their methods or reasoning **Data Handling** • Collect, organize and interpret data	using a formulae Visualize, describe movements using appropriate language, transform objects and images, predict the position of a shape following a rotation or a reflection, recognize symmetry and tessellations • Recognize the need for standard units of measurement, use and convert one metric unit to another • Read time from analogue and digital clocks, elapsed time, know the relationship between the units of time. • Record measurements with increasing accuracy • Solve problems related to money or measures, explain their methods or reasoning **Data Handling** • Process, represent and interpret given data, solve problems involving data. Represent and Interpret different types of graphs and charts	• Perimeters, areas of rectilinear and circular shapes, and volumes of rectilinear solids, cones, cylinders and spheres • Find loci both by reasoning and by using ICT to produce shapes and paths **Data Handling** • Calculate measures of central tendency, and represent the results in the form of tables, diagrams and graphs. • Use statistical data collected from samples to make inferences about the whole population • Interpret Scatter diagrams between two random variables, understand elementary qualitative discussion of correlation, drawing a line of best fit by eye through the scatter points where there appears to be some correlation

6. Mathematics curriculum

Mathematics is an exploration of patterns and relationships of quantities, space and time. To achieve these students need to think and act mathematically and develop intuition to apply concepts to explore and solve everyday problem situations. Study of mathematics equips students with a powerful set of tools that include logical reasoning, problem solving skills and the ability to think in abstract ways. Statistics focuses on the use of patterns and relationship in the data. Both help in interpreting, explaining and making sense of the world around [32].

7. Five stands of Mathematics curriculum

The content of mathematics curriculum is organized based on the following stands:

1. Numbers, Number systems and Operation
2. Algebra, Geometry and patterns
3. Measurement
4. Data handling

By engaging in relevant mathematical learning experiences students will:

1. Develop relevant concepts, skills and dispositions to operate confidently in the areas of numbers, algebra, measurement, geometry and data handling.

2. Develop the ability to think critically, strategically and logically in varying contexts.

3. Develop the skills to structure and organize, work out procedures and represent and communicate information effectively.

4. Create models and predict outcomes to reason and justify, seek patterns and generalizations [32].

8. Importance of studying mathematics in Bhutan

The study of mathematics equips students with a powerful set of tools. It allows for logical, rational, abstract and strategic thinking. Students develop the ability to think in a clear-cut, structured fashion, apply reasoning, formulate problems and find solutions to them. It hones higher order problem-solving and analytical skills and the ability to think in 'out-of-the-box' ways. Statistics focus on the use of patterns and finding relationships in data. Both help in interpreting and making sense of the world around, in everyday situations, the workplace and real-life contexts. A universal subject,

mathematics transcends boundaries of culture and language, promotes students' intellectual growth and makes them, more complete and well-rounded persons. At the professional level, basic mathematical skills with their close link to ICT equip the individual with the capability to focus on problems, to have the discipline to persist and prevail in the task at hand, and to strategise. Mathematics helps to inculcate the basic capabilities important for the Bhutanese citizen [32].

9. Class VI mathematics curriculum

In this new mathematics curriculum of class six many things are changed. For many of the topics that students learn about geometry and data are new to class six students. With this mathematics curriculum students will learn mathematics students will lean differently. They no more need to memorize and follow the rules. Students will do much more explaining and making sense of mathematics; students will find mathematics interesting and easier [28]. The class six whole syllabus is mentioned below:

Table 6 Class six mathematics curriculums in Bhutan

Units	Chapters	Content
UNIT 1	Chapter 1	1. Relating Mixed Numbers to Improper Fractions
FRACTIONS	Relating	2. Comparing and Ordering Fractions
AND DECIMALS	Fractions	3. EXPLORE: Adding and Subtracting Fractions
		4. Adding Fractions
		CONNECTIONS: Fractions Between Fractions
		5. Subtracting Fractions
	Chapter 2	6. Naming Decimals as Fractions
	Relating	GAME: Fraction Match
	Fractions to	7. Naming Fractions as Decimals
	decimal	UNIT 1 Revision

Table 6 (cont.)

Units	Chapters	Content
UNIT 2 GEOMETRY	Chapter 1 2-D Geometry:	Getting Started Transformations 1. Rotations 29 2. Rotational Symmetry 3. Combining Transformations GAME: Transformation Challenge 4. EXPLORE: Tessellations
	Chapter 2 2-D Geometry: Shapes and	CONNECTIONS: Escher-type Tessellations Properties 1. Measuring Angles 2. Bisectors 3. EXPLORE: Sorting Quadrilaterals
	Chapter 3 3-D Geometry	GAME: Go Fish 1. EXPLORE: Planes of Symmetry 2. EXPLORE: Cross-sections 3. Interpreting Orthographic Drawings 4. Creating Orthographic Drawings UNIT 2 Revision
UNIT 3 DECIMAL COMPUTATION	Chapter 1 Multiplication	Getting Started 1. Estimating a Product 2. Multiplying a Decimal by a Whole Number 3. Multiplying Decimals
	Chapter 2 Division	GAME: Target 1. Estimating a Quotient 2. Dividing a Decimal by a Whole Number 3. EXPLORE: Dividing by 0.1, 0.01, and 0.001 4. Dividing Decimals
	Chapter 3 Combining Operations	1. Order of Operations 2. Solving a Problem Using all Four Operations CONNECTIONS: Decimal Magic Squares UNIT 3 Revision

Table 6 (cont.)

Units	Chapters	Content
UNIT 4	Chapter 1	Getting Started
MEASUREMENT	Area	1. Area of a Parallelogram
		CONNECTIONS: Changing a Parallelogram
		2. Area of a Triangle
	Chapter 2	GAME: Grid Fill
	Volume	3. EXPLORE: Relating Areas
		1. Volume of a Rectangular Prism
		2. Relating Volume to Capacity
	Chapter 3	1. The 24-hour Clock System
	Time and	2. The Tone
	Mass	UNIT 4 Revision
UNIT 5	Chapter 1	Getting Started
RATIO, RATE,	Ratio and	1. Introducing Ratios
AND PERCENT	Rate	2. Equivalent Ratios
		3. Comparing Ratios
		4. EXPLORE: Similarity
		5. Introducing Rates
	Chapter 2	1. Introducing Percent
	Percent	2. Representing a Percent in Different Ways
		GAME: Ratio Match
		3. EXPLORE: Writing a Fraction as a Percent
		CONNECTION: Map Scales
		UNIT 5 Revision
UNIT 6	Chapter 1	Getting Started
NUMBER	Large Whole	1. EXPLORE: Solving Problems With Large
RELATIONSHIPS	Numbers	Numbers
		2. Place Value With Large Whole Numbers
		3. Renaming Numbers
UNIT 6	Chapter 2	1. Place Value With Decimal
NUMBER	Decimals and	2. Comparing and Ordering Decimals
RELATIONSHIPS	Integers	Introducing Integers

Table 6 (cont.)

Units	Chapters	Content
UNIT 6	Chapter 3	1. Prime Numbers
NUMBER	Number	CONNECTIONS: Sieve of Eratosthenes
RELATIONSHIPS	Theory	2. EXPLORE: Square and Triangular Numbers
		CONNECTIONS: Triangular Numbers as Products
		3. EXPLORE: Factors
		GAME: Down to Prime
		4. Common Factors
		UNIT 6 Revision
UNIT 7	Chapter 1	Getting Started
DATA AND	Collecting	1. Choosing a Sample
PROBABILITY	Data	2. EXPLORE: Sample Size
	Chapter 2	1. Double Bar Graphs with Intervals
	Graphing Data	2. Stem and Leaf Plots
		3. Line Graphs
		CONNECTIONS: Telling a Story about a Graph
		4. Coordinate Graphs
		GAME: Four in a Line
	Chapter 3	1. Mean, Median, and Mode 209
	Statistics and	2. Theoretical Probability
	Probability	UNIT 7 Revision

Source: Understanding mathematics, text book for class VI 2008

Fraction

Many learners identify fraction as an area of mathematics that they find difficult, despite often using concept of sharing effectively in their daily lives. The key question as to why so many people perceive fractions as difficult is something we need to consider. One reason may be the notion of fractions. Another may be the formal vocabulary. Learners may be drowning in the language of fractions, even before thinking about their properties. Learners may be able to draw and label fraction correctly, but nor be able to put them in order or size, or use them to solve problems.

Fraction may be confusing because they do not behave like 'normal' numbers. Fraction sometimes represent an amount, something that can be visualized, and sometime an operation, example ¾ can mean a shape with 3 equal pieces shaded out of 4; it can mean the result of dividing 3 by 4, or part of an instruction to find, say, ¾ of 16.Approaches of teaching about fraction need to give learners a chance to explain how they see them, and the teacher needs to take this into conversation in their approach [29].

Cooperative learning method

1. Meaning and definition of the cooperative learning method

Crandall [33] stated that "Cooperative learning is more than just small group activity. In a well-structured cooperative task, there is a genuine information gap, requiring learners to both listen and contribute to the development of an oral, written or other product which represents the group's efforts, knowledge and perspectives". As per Tarim [6] Cooperative learning is one example of an instructional arrangement that can be used to foster active student learning, which is an important dimension of mathematical learning and is highly endorsed by mathematics educators and researchers. Children can be given tasks to discuss, problems to solve, and goals to accomplish.

Cooperative learning is an instructional use of small groups so that children work together to maximize their own and each other's learning; it has been broadly used in many fields and at different grades [34]. The common idea that lies behind cooperative learning is that children work together to learn and that, when they do, they feel responsible for one another's learning as well as their own [35]. In the cooperative learning, the teacher maintains complete control of the class, even though the children work in groups to accomplish a goal of a course [36]. As cited in Sharan [37] the important reason for the wide use of cooperative learning could be its positive effect on academic achievement, peer relations, inclusion of children with special needs, self-esteem, attitude, and anxiety. Slavin [38] stated that cooperative learning has been used extensively in every conceivable subject from kindergarten through college, and in all kinds of schools throughout the world.

Similarly, Askew and Wiliam [39] emphasized that the positive effects of the cooperative learning activities did not depend on children's ages, skills or school types (state school, private school, central school, etc.). It has been agreed that preschoolers' cognitive growth may also be supported by mutual cooperative interactions [40, 41]. Many school programs reinforce cooperation in classrooms to raise interest and to develop children's mathematical, reading, and problem-solving skills [42, 43].

By means of cooperative tasks, children are given a chance to interact and improve their overall communicative skills with their friends [41]. Cooperative interactions promote learning and cognitive development because children teach, guide, and assist one another when solving problems and completing tasks together [42].

The above literature states that cooperative learning is an instructional use of small groups so that the children work together to maximize their own and each other's learning. The common idea that lies behind cooperative learning is that the children work together to accomplish a common goal.

2. Importance of the cooperative learning method

Close interaction with the instructor also helps to engage students and encourages them to become an active partner in the learning process [43]. Unfortunately, large class sizes and the many demands placed on instructors make it difficult to devote even small amounts of time to single students. The reality is that many college-level science classes are taught almost exclusively using a lecture format even though lectures by themselves are relatively ineffective at engaging students and promoting learning [44].

Johnson and Johnson [45] suggested that mathematics problem solving is a personal investment. They also state that among more conceptual learning, and learning that requires a lot of analysis, it is necessary to discuss, explain, and elaborate what is being learned. In order to create an environment that facilitates problem solving, children should interact within a cooperative context. Cooperative Learning is a teaching arrangement that refers to small, heterogeneous groups of students working together to achieve a common goal [46].

According to Johnson, et al., cooperative learning is the "instructional use of small groups so that student's work together to maximize their own and each other's learning." It is a basic idea of cooperative learning that when group members are linked together in such a way so they perceive that they cannot succeed unless they all do, they will actively assist each other to ensure that the task is completed and the group's goal obtained [47]. They achieve this by providing help and assistance with the task, sharing resources, and encouraging each other's efforts. As a consequence, group members who work in cooperative groups outperform students who work by themselves or in competition with each other (as they do in traditional classrooms) [48]. Furthermore, cooperative learning, as a teaching pedagogy, capitalizes on adolescents' desires to engage with their peers exercise autonomy over their learning, and express their desires to achieve [49]. In fact, it has been argued that cooperative learning experiences are crucial to preventing and alleviating many of the social problems related to children, adolescents, and young adults [24].

Cooperative learning is a versatile procedure and can be used for a variety of purposes. Cooperative learning groups may be used to teach specific content (formal cooperative learning groups), to ensure active cognitive processing of information during a lecture or demonstration (informal cooperative learning groups), and to provide long-term support and assistance for academic progress (co-operative base groups) [50].

According to Gupta [51], cooperative learning was very well received by students, and expressed willingness to join cooperative learning groups in studying the other subjects. Students also reported a positive attitude towards cooperative group learning and rated their work in groups as effective [52]. Burron, et al. [53], indicated that the cooperative learning students exhibited significant gains in collaborative skills and indicated a high comfort level for the practical studies. Moreover, properly applied cooperative strategies will also contribute to student socialization within the culture of professional industry, better preparing them for the expectations of the professional world [54].

Cognitive development is an outcome of cooperative learning, wherein constructivist knowledge development and transformation result from collaborative attempts to discover, comprehend, and decipher [55, 56].

To sum up the researchers above has stated in what ways the cooperative learning is important. The ways in which the cooperative learning is important:

1. When there is large size and the demands placed on instructs is difficult to devote even small amounts of time to single students, the cooperative learning method serves the best.

2. Cooperative learning is very effective in mathematics as mathematics problem solving is personal investment. Cooperative learning creates an environment that facilitates problem solving by interacting within a cooperative context.

3. Cooperative learning enhances the social relation or interpersonal relation among the learners.

4. Cooperative learning experiences are crucial to preventing and alleviating many of the social problems related to children adolescents and young adult.

5. It is a versatile procedure and can be used for variety of purposes.

6. Cooperative learning is very well received by students and they express willingness to join cooperative learning groups in studying the subjects.

7. It will lead to cognitive development.

All these importance of cooperative learning signifies the need of incorporation of cooperative learning method in various subjects for the betterment of teachers and students.

3. How children learn

Vosniadoy [57] stated that there are twelve principals of learning that the teachers should be taking care, to construct learning in the classroom. The twelve principals are active involvement, social participation, meaningful activities, relating new information to the prior knowledge, being strategic, engaging in self regulation and being reflective, reconstructing prior knowledge, aiming towards understanding rather than memorizing, helping students learn to transfer, taking time to practice, developmental and individual differences and creating motivational learners. As described below:

3.1 Active involvement

In order to help the learner to learn, there should be active involvement of the learner in the learning. Learning requires many things such as

attention, observation, understanding, setting goals and aiming responsibility or their own learning. This is not possible unless there is active involvement of learners in the learning. Therefore the teachers should take a challenge to create an active learning environment.

3.2 Social participation

Social participation is something that has to be taken care, to encourage active learning. According to the psychologist [58], the way children learn is by internalizing the activities, habits, vocabularies and ideas of the members of the community in which they grow up. The establishment of a fruitful collaborative and co-operative atmosphere is an essential part of school learning. Research has shown that social collaboration can boost students' achievement, provided that the kinds of interaction that are encouraged contribute to learning. Finally social activities are interesting in their own right and help to keep the students involved in the academic work. The students work harder to improve the quality of their products when they know that they will be shared with other students.

3.3 Meaningful activities

Learner learns best when they participate in the activities that are perceived to be useful in real life and are culturally relevant. Teachers can make classroom activities more meaningful, by situating them in more authentic context and by relating new information to prior knowledge.

3.4 Relating new information to prior knowledge

The ideas that people's ability to learn something new follows from what they already know is not new, but research findings have shown that the ability to relate new information to prior knowledge is critical for learning. It is possible for someone to understand, remember or learn something that is completely unfamiliar. Some prior knowledge is necessary to understand the task at hand. But having prerequisite prior knowledge is still not sufficient to ensure adequate results. People must activate their prior knowledge in order to be able to use it for understanding and learning. Students do not consistently see the relationship between new material that they read and what they already know. Learning is enhanced when teachers pay close attention to the prior knowledge of the learner and use his knowledge as the starting point for instruction.

3.5 Being strategic

Children develop strategies to help themselves solve problems from an early age. The children have discovered rehearsal as strategy to improve their memory without anybody telling them to do so. When they go to school, children need help from teacher to develop appropriate strategies for solving mathematics problems, when they understand text, learning from other student etc. When teachers make systematic gains can result. Strategies are important because they help students understand and solve problems in ways that are appropriate for situation at hand. Strategies can improve learning and make it faster. Teachers must recognize the importance of students knowing and using varieties of strategies.

3.6 Engaging in self- regulation and being reflective

The term self regulation is used here to indicate students' ability to monitor their own learning, to understand when they are making error, and to know how to correct them. Self regulation is not same as being strategic. People can use strategies for learning mechanically without being fully aware of what they are doing. Self regulation involves the development of specific, check their understanding and correct errors when appropriate. Self regulation requires reflection in the sense of being aware of one's own beliefs and strategies. Teacher should encourage them to set their own goal of learning and find the most effective strategy to achieve the goal.

3.7 Restructuring prior knowledge

Sometime existing knowledge can stand in the way of understanding new information. While this is often the case in the learning of science and mathematics, existing knowledge can stand in the way of understanding new information it can apply to all subject matter areas. Existing knowledge can stand in the way of understanding new information because our current understanding of the physical and social world, of history, of theorizing about numbers, etc., is the product of thousands of years of cultural activity that has radically changed intuitive ways of cultural activity that has radically changed intuitive ways of explaining phenomena.

3.8 Aiming towards understanding rather than memorization

All teachers want their students to understand what they are learning and not to memorize facts in a superficial way. Research shows that when information is superficially memorized it is easily forgotten. On the contrary, when something is

understood, it is not forgotten easily and it can be transferred to other situations (see also the next principle on transfer). In order to understand what they are being taught, students must be given the opportunity to think about what they are doing, to talk about it with other students and with teachers, to clarify it and to understand how it applies in many situations.

3.9 Helping students learn to transfer

Students often cannot apply what they have learned at the school to solve real world problems. For example they may learn about Newton's law in the school but, fail to see how they apply in real life situations. Transfer of learning is very important. It the responsibility of the teachers to teach them in such a way that they can apply in the real world.

3.10 Taking time to practice

Research shows that people must carry out a great deal of practice to acquire expertise in an area. Even small differences in the amount of time during which people are exposed to information can result in large differences in the information they have acquired. Students from disadvantaged environments who have fewer opportunities to learned who miss school because of work or illness will not be expected to do as well at school compared to children who had more time to practice and acquire information.

3.11 Development and individual differences

Research shows that there are major development differences in learning. As children develop, they form new ways of representing the world and they also change the processes and strategies they use to manipulate these representations. In addition, there are important individual differences in learning. Development psychologist Howard Gardener has argued that there are many dimensions of human intelligence other than the logical and linguistic skills that are usually valued in most school environments. Some children are gifted in music, others have exceptional spatial skills (required, for example, by architects and artists), or bodily/ kinesthetic abilities (required by athletes), or abilities to relate to other people, etc. Schools must create the best environment for the development of children taking into consideration such individual differences.

3.12 Creating motivated learners

Motivated learners are easy to recognize because they have a passion for achieving their goals and are ready to expand a great deal effort. They also show considerable determination and persistence. This influences the amount and quality of what is learned. All teachers want to have motivated learners in their classrooms. Psychologists distinguish between two kinds of motivation: extrinsic motivation and intrinsic motivation. Extrinsic motivation results when positive rewards are used to increase the frequency of target behavior. Praise, high grades, awards, money and food can be used for that effect. Intrinsic motivation is when learners actively participate in activities without having to be rewarded for it. The child who likes to put together puzzles for the fun of it are intrinsically motivated. An important characteristic of intrinsically motivated learners is their belief that effort is important for success. Teachers can influence students' determination to achieve by their behaviour and the statements they make.

4. Theory underlying cooperative learning method

4.1 Social constructivist learning theory

Social constructivism is a variety of cognitive constructivism that emphasizes the collaborative nature of much learning. Social constructivism was developed by post-revolutionary Soviet psychologist Lev Vygotsky. Vygotsky was a cognitivist, but rejected the assumption made by cognitivists such as Piaget and Perry that it was possible to separate learning from its social context. He argued that all cognitive functions originate in, and must therefore be explained as products of social interactions and that learning was not simply the assimilation and accommodation of new knowledge by learners; it was the process by which learners were integrated into a knowledge community [56].

Social setting leads to cognitive development. Human beings are social creature. We like and learn in social setting. If we human being are kept in isolation then learning would not have taken place. Even a simple word that we hear today can lead to new learning tomorrow. Vygotsky believed that learning takes place in social activity. Learners develop their attitude in social interaction and communication with peers and member of society and they learn by observing the activities and the interactions of other. Vygotsky's social learning theory shows the

importance of language and communication. In his opinion language and thinking is inescapably linked [59].

In essence, Vygotsky recognizes that learning always occurs and cannot be separated from a social context. Consequently, instructional strategies that promote the distribution of expert knowledge where students collaboratively work together to conduct research, share their results, and perform or produce a final project, help to create a collaborative community of learners. Knowledge construction occurs within social context that involves student-student and expert-student collaboration on real world problems or tasks that build on each person's language, skills, and experience shaped by each individual's culture" [59].

4.2 Vygotsky's theory of cognitive development

Central to Vygotsky's theory of cognitive development is his theoretical construct of the zone of proximal development. Vygotsky proposed that a child's immediate potential for cognitive growth is bounded on the lower end by that which the child can accomplish on their own and on the upper end by that which the child can accomplish with the help of a more knowledgeable other, such as a peer, tutor, or teacher (Doolittle).

Vygotsky [56] defined the zone of proximal development as 'the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more knowledgeable others".

In addition, the social context of the zone of proximal development suggests that the zone must be viewed as not solely relative to the child, nor to the teacher, but of the child immersed in a cooperative activity within a specific social environment. The essence of the zone of proximal development is the social system in which the child learns; a social system that is actively constructed by both the child and the teacher. It is this interdependence that is central to a Vygotskian view of the educational process [58].

Basically what he is trying to say is that social context of the zone of proximal development suggests that the zone must be viewed as not solely relative to the child, nor to the teacher, but of the child immersed in a cooperative activity within

a specific social environment. The essence of the zone of proximal development is the social system in which the child learns; a social system that is actively constructed by both the child and the teacher.

4.3 Piaget's theory

According to Piaget, the progressive differentiation of interests, feelings, and values, and the increasing stability and coherence of affectivity are bound up with intellectual development, and both depend on social relations of reciprocity. Piaget pointed out that the process of coordinating different points of view and co-operating with others includes all aspects of development. Personality is the result of continuous interaction with others comparison, opposition, and mutual adjustment. For affective and personality development, as in the development of reasoning and moral judgment, Piaget argued that heteronymous relationships are counterproductive, and that co-operative relationships are necessary. For Piaget, therefore, co-operation is an essential. Characteristic of developmentally-oriented education not simply because it is a culturally valued virtue, but because of its psychodynamic developmental significance.

4.4 Bandura's Social cognitive theory

The social cognitive theory explains how people acquire and maintain certain behavioral patterns, while also providing the basis for intervention strategies [60]. Evaluating behavioral change depends on the factors environment, people and behavior. Social cognitive theory provides a framework for designing, implementing and evaluating programs. Environment refers to the factors that can affect a person's behavior. There are social and physical environments. Social environment include family members, friends and colleagues. Physical environment is the size of a room, the ambient temperature or the availability of certain foods. Environment and situation provide the framework for understanding behavior [61].

The situation refers to the cognitive or mental representations of the environment that may affect a person's behavior. The situation is a person's perception of the lace, time, physical features and activity [62]. Any factor that influences choice behavior can profoundly affect the direction of personal development. This is because the social influences operating in selected environments continue to promote certain

competencies, values, and interests long after the decisional determinant has rendered its inaugurating effect [63].

Salvin [64] Social cohesion theorists tend to downplay or reject the group incentives and individual accountability held by motivational researchers to be essential. For example, Cohen [65] states "if the task is challenging and interesting, and if students are sufficiently prepared for skills in group process, students will experience the process of group work itself as highly rewarding. Never grade or evaluate students on their individual contributions to the group product."

The above literature enrich us with the insight of maintaining certain behavioral pattern, how to evaluate the behavior change and it alerts us not to evaluate students in their individual contribution to the group product. Furthermore he also tells significant role of learning environment, as effects the students learning.

4.5 Social Interdependence Theory

In the early 1900s, one of the founders of Gestalt Psychology, Kurt Kufka, proposed that groups were dynamic wholes in which interdependence among members could vary. One of his colleagues, Lewin [66] refined Kofka's notion in the 1930s and 1940s and proposed that (a) the essence of a group is the interdependence among members (created by common goals) that results in the group being a "dynamic whole" so that a change in the state of any member or subgroup changes the state of all other members or subgroups and (b) an intrinsic state of tension in group members motivates movement toward the accomplishment of the desired common goals. One of Lewin's graduate students, Deutsch [67, 68] extended Lewin's notions to the relationship among the goals of two or more individuals. In doing so, he developed social interdependence theory. One of Deutsch's graduate students, David W. Johnson (collaborating with Roger Johnson and colleagues such as Karl Smith), extended social interdependence theory and developed procedures for instructors Social interdependence exists when the accomplishment of each individual's goals is affected by the actions of others [67, 68]. There are two types of social interdependence, positive (cooperation) and negative (competition). Positive interdependence exists when individuals perceive that they can reach their goals if and only if the other individuals with whom they are cooperatively linked also reach their goals and, therefore, promote each other's efforts to achieve the goal.

The researchers brings our attention to the importance of interdependence of the member in the group, the change in the state of any member changes the state of all other member and adds further that an intrinsic state of tension in the group members motivates movement toward the accomplishment of the desired common goal.

4.6 Motivational theory

Salvin [64] motivational perspectives on cooperative learning focus primarily on the reward or goal structures under which students operate [69]. From a motivational perspective [70] cooperative incentive structures create a situation in which the only way group members can attain their own personal goals is if the group is successful. Therefore, to meet their personal goals, group members must both help their group mates to do whatever helps the group to succeed and, perhaps even more importantly, to encourage their group mates to exert maximum efforts. In other words, rewarding groups based on group performance (or the sum of individual performances) creates an interpersonal reward structure in which group members will give or withhold social reinforces (e.g., praise, encouragement) in response to group mates' task-related efforts [71]. One intervention that uses cooperative goal structures is the group contingency in which group rewards are given based on group members' behaviors [42]. The theory underlying group contingencies does not require that group members be able to actually help one another or work together. The fact that their outcomes are dependent on one another's' behavior is enough to motivate students to engage in behaviors which help the group to be rewarded, because the group incentive induces students to encourage goal-directed behaviors among their group mates [38]. A substantial literal- 44 research for the future in the behavior modification tradition has found that group contingencies can be very effective at improving students' appropriate behaviors and achievement [72, 73].

The researchers are talking about how important the motivation in the cooperative is learning. They also talks about the role of motivation in achieving personal goal through group goal and to meet their personal goals, group members must both help their group mates to do whatever helps the group to succeed and, perhaps even more importantly, to encourage their group mates to exert maximum efforts.

4.7 Empirical support for the motivational perspective

Salvin [64] evidence from practical applications of cooperative learning in elementary and secondary schools supports the motivationalist position that group rewards are essential to the effectiveness of cooperative learning, with one critical qualification. Use of group goals or group rewards enhances the achievement outcomes of cooperative learning if and only if the group rewards are based on the individual learning of all group members [39]. Most often, this means that team scores are computed based on average scores on quizzes which all teammates take individually, without teammate help. For example, in Student Teams-Achievement Divisions, or STAD [74], students work in mixed-ability teams to master material initially presented by the teacher. Following this, students take individual quizzes on the material, and the teams may earn certificates based on the degree to which team members have improved over their own past records. The only way the team can succeed is to ensure that all team members have learned, so the team members' activities focus on explaining concepts to one another, helping one another practice, and encouraging one another to achieve. In contrast, if group rewards are given based on a single group product (for example, the team completes one worksheet or solves one problem), there is little incentive for group members to explain concepts to one another, and one or two group members may do all the work [38].

The researchers above supports that the evidences from practical application of cooperative learning in the elementary and secondary schools supports the motivational position that group rewards are essential to the effectiveness of cooperative learning, with one critical qualification. Use of group goals or group rewards enhances the achievement outcomes of cooperative learning if and only if the group rewards are based on the individual learning of all group members.

5. Group behavior in the cooperative learning

Cooperative learning has been found to be a successful teaching strategy at all levels, from pre-school to post secondary. The developmental characteristics of middle school students make cooperative learning a good fit of teaching strategy for the needs of the students. 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 [75]. Research has shown that students who work in cooperative groups do better on tests, especially with regard to reasoning and critical thinking skills than those that do not [76].

Slavin [77] review of 67 studies, 61% of the cooperative-learning classes achieved significantly higher test scores than the traditional classes. He notes that the difference between the more and less effective cooperative-learning classes was that the effective ones stressed group goals and individual accountability.

Slavin [49] further argues that "cooperative learning has its greatest effects on student learning when groups are recognized or rewarded based on the individual learning of their group members". Dahley [78] cooperative learning produces greater student achievement than traditional learning methodologies [79]. Slavin found that 63% of the cooperative learning groups analyzed had an increase in achievement. Students who work individually must compete against their peers to gain praise or other forms of rewards and reinforcements. In this type of competition many individuals attempt to accomplish a goal with only a few winners. The success of these individuals can mean failures for others. 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.

From the above researchers we can conclude that in the cooperative learning the learners 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. They also agree that the difference between the more and less effective cooperative-learning classes was that the effective ones stressed group goals and individual accountability.

6. Elements of cooperative learning method

Johnson and Johnson [45] have established a definition of cooperative learning which identifies five basic elements necessary for definition procedure to be considered cooperative. They also define structures and evaluation procedures within which any content may be taught, rather than defining procedures based upon specific curriculum. They have developed an extensive set of worksheets for teachers and students to use in establishing the five elements. The Johnson's five items are as follows.

6.1 Positive Interdependence

Positive Interdependence refers to students working together in supportive (positive) ways and being accountable and caring for one another. Positive Interdependence does not always occur naturally. Accordingly, a teacher can select from a number of ways to increase the chances students will be interdependent in a positive way. In the positive Interdependence Students perceive that they need each other to complete the group's task ("sink or swim together"). Teachers may structure positive interdependence by establishing mutual goals (learn and make sure all other group members learn), joint rewards (if all group members achieve above criteria, each will receive bonus points), shared resources (one paper for each group or each member receives part of the information), and assigned roles (summarizer, encourager of participation, recorder, time keeper etc.).

6.2 Face-to- Face promotive Interaction

Face-to- Face promotive Interaction refers to setting up the group environment so that it encourages students to interact and dialogue with one another. That means they need to be sitting in groups that are approximately two to four in size, are close enough to one another to easily hear each other's voices, and see each other's faces. Obviously a circle or square shape facilitates face-to-face interaction. The larger the group the easier it is for students to hide on the edge of the group. They can escape being responsible or being involved.

6.3 Individual Accountability

Individual Accountability refers to making sure each student in the group is responsible for their own learning and willing to encourage and support the learning of others in the group. This is one of the most important concepts. If a student

can hide, or hitchhike off the efforts of others, or take over and do all the work, then the group will not function effectively. Each students' performance is frequently assessed and the results are given to the group and the individual. Teachers may structure individual accountability by giving an individual test to each student or randomly selecting one member of the group to give the answer.

6.4 Interpersonal and small group Skills

Interpersonal and small group Skills refer to the social, communication, and critical thinking skills the students need to work effectively in groups. We see this as a hierarchical sequence. Communication is hard if one does not have the requisite social skills; and likewise, thinking critically is hard if one has neither the social skills nor the communication skills. Groups cannot function effectively if students do not have and use the needed social skills. Teachers teach these skills as purposefully and precisely as academic skills. Collaborative skills include leadership, decision making, trust building, communication, and conflict-management skills.

6.5 Group Processing

Group Processing refers to reflection, and assessing the group's effort both in terms of academic and collaborative interaction. This meta cognitive function is very important. Without it, groups do not develop as effectively over time which negatively impacts social and academic learning. Groups need specific time to discuss how well they are achieving their goals and maintaining effective working relationships among members. Group members assess their co-operative efforts and target improvements. Teachers monitor the groups and give feedback on how well the groups are working together and the class as a whole.

In the above literature the researcher has clearly explained the five elements of cooperative learning. From this literature it is very clear that cooperative learning is not possible without these five elements of cooperative learning. Thus all these five elements will be implemented in cooperative learning lesson as an indicator of cooperative learning.

7. Cooperative learning strategy or techniques of cooperative learning method

Magre and Joshi [80] suggested that there are many variations within the Cooperative Learning Strategy. The selection of the method depends on the target group, purpose, context, teachers' personality etc. the following are the some of the techniques of the Cooperative Learning Strategy:

7.1 Team accelerated instruction (TAI)

Slavin [38] explained that in team accelerated instruction (TAI), students encourage one another to work hard because they want their teams to succeed. Individual accountability is assured because the only score that counts is the final test score and students take final test without the help of their teammate. Students have equal opportunities for success because all have been placed according to their prior knowledge.

7.2 Think-Pair-Share

It is a method that allows students to engage in individual and small-group thinking before they are asked to answer questions in front of the whole class. There are four steps to this method. The first step, groups of four students listen to a question posed by the teacher. Secondly, individual students are given time to think and then write their responses. Thirdly, pairs of students read and discuss their responses. Finally, a few students are called on by the teacher to share their thoughts and ideas with the whole class. This method can be very useful and work well in the science classroom due to the continual request of science teachers having students formulate hypotheses about the outcome of an experiment before it is done.

7.3 Three-Step Interview

It is a strategy that is effective when students are solving problems that have no specific right answers. Three problem-solving steps are involved in this process. In step one the teacher presents an issue about which varying opinions exist and poses several questions for the class to address. Step two, the students, in pairs becomes the interviewer and the interviewee. Step three, after the first interview has been completed, the students' roles are switched. After each student has had a turn, the pairs read their interviews to the class. After all interviews have been done, the class writes a summary report of the interview results. Round Table or Rally Table It is

simple cooperative learning structures that cover much content, builds team spirit, and incorporates writing. The roundtable has three steps to it. In the first step, the teacher poses a question that has multiple answers. Step two, the first student in each group writes one response on a paper and passes the paper counterclockwise to the next student. Finally, in step three, teams with the greatest number of correct responses gain some type of recognition. This type of cooperative learning can easily be used in the science classroom. For example, the students may be asked to write as many reptile names as they can. At the end the group with the most reptiles written down is rewarded.

7.4 Group Investigations

They are structured to emphasize higher-order thinking skills such as analysis and evaluation. Students work to produce a group project, which they may have a hand in selecting. STAD (Student Teams-Achievement Divisions) it is used in grades 2-12. Students with varying academic abilities are assigned to 4 or 5 member teams in order to study what has been initially taught by the teacher and to help each student reach his or her highest level of achievement. Students are then tested individually. Teams earn certificates or other recognition based on the degree to which all team members have progressed over their past records.

7.5 Round Robin Brainstorming or Rally Robin

They are strategies when the class is divided into small groups of 4 to 6 students per group with one person appointed as the recorder. A question is posed by the teacher with many possible answers and students are given time to think about answers. After the "think time," members of the team share responses with one another round robin style. The recorder writes down all the answers of the group members. The person next to (clockwise) the recorder gives their answer and the recorder writes it done then the each person in the group in order (clockwise) gives an answer until time is called. This strategy is very similar to round table. The main difference is that in round robin one student does all the recording for all members of his/her group.

7.6 Three-Minute Review

It is used when the teachers stop any time during a lecture or discussion and allows teams three minutes to review what has been said with their group. Students in their groups can ask a clarifying question to the other members or answer questions of others.

7.7 Jigsaw II

It is used with narrative material in grades 3-12. Each team member is responsible for learning a specific part of a topic. After meeting with members of other groups, who are the "expert" in the same part, the "experts" return to their own groups and present their findings. The Jigsaw method is a cooperative learning technique in which students work in small groups. Jigsaw can be used in a variety of ways for a variety of goals, but it is primarily used for the acquisition and presentation of new material, review, or informed debate. In this method, each group member is assigned to become an "expert" on some aspect of a unit of study. After reading about their area of expertise, the experts from different groups meet to discuss their topic, and then return to their groups and take turns teaching their topics to their group mates such different types of cooperative learning strategy can be implemented in to classroom teaching and many social skills can be developed in the students.

The researchers have clearly mentioned the various techniques of cooperative learning strategies. The technique chosen to teach each topic will be chosen amongst these techniques of cooperative learning, based on the appropriateness. The technique chosen for one topic can be used to teach another topic as well, in another word the respective technique will be used more than one time.

8. Cooperative learning group

According to Johnson and Holubec [81] there are three types of cooperative learning groups, which are as under:

8.1 Formal Cooperative Learning Groups

Formal cooperative learning groups last from one class period to several weeks. In Formal cooperative learning groups, students are actively involved in the intellectual work i.e. organizing material, explaining it, summarizing it and integrating it into existing phenomenon.

8.2 Informal Cooperative Learning Groups

Informal cooperative learning groups that last from a few minutes to one class period. Informal cooperative learning groups can be used during direct teaching (Lectures, demonstration). Informal use of cooperative learning groups may prove helpful to produce conducive environment for learning.

8.3 Cooperative Base Groups

Cooperative 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. Base groups provide students with long-term committed relationships.

Amongst these three types of cooperative learning groups formal cooperative learning group will be chosen for the formation of the group in the cooperative learning method. Formal cooperative learning group will be chosen because this type of cooperative learning group lasts for the duration of one class period to several weeks, which is very much in line with the experiment period. Furthermore this type of cooperative learning group will enable the participants or group members to actively involved in the intellectual work such as organizing material, explaining it, summarizing it and integrating it to the existing phenomenon.

The most important thing about the grouping is that the groups should be heterogeneous. Whereby, cooperative learning group should be comprised of all three ability groups (high achievers, average achievers and low achievers). Further the groups should have both the gender (male and female).

9. Ways to approach problem behavior within cooperative teams

Dishon and Leary [82] described and discussed how to handle the four most common behavioral problems which occur during cooperative learning (especially when students are first learning how to work as a team). These are as follows:

9.1 Passive un involvement

Passive un involvement is expressed by students turning away from their group, not paying attention to the group, saying little or nothing, not bringing materials and work to the group, etc. When these behaviors occur, you may try to:

Jigsaw tasks so that each team member has needed information. Then, if the uninvolved team member does not voluntarily contribute information, the other members will actively involve the student.

1. Assign the uninvolved member a role which is crucial to the group's success and is implicitly involved, such as reader or secretary.

2. Reward teams for their average performance. This will motivate teams to actively involve an uninvolved member.

9.2 Active noninvolvement

Active noninvolvement is occurring when a student is doing and talking about everything but the group task. He or she may be leaving the group and walking around, purposely giving wrong answers, and refusing to do group work or to work with specific team members. In such cases, you may offer some sort of positive reinforcement that is especially preferred by the uninvolved student or the group which is contingent upon group success.

9.3 Independence

When you see a student working alone and independently of the team, you can:

Limit the resources of the group, for example, provide only one pencil and piece of paper or one newspaper. In this way, the student will be forced to work with the group.

Jigsaw tasks so that each team member has needed information. The student must then work with group members in order to complete the task.

9.4 Taking charge

When a student "takes charge," you will observe him or her refusing to let other group members do work, ordering other team members around, doing all the work, bullying other members, or making team decisions without the input of other members. In such cases, in such cases, you can:

1. Jigsaw materials and resources so that the student cannot complete the task without input from other members.

2. Assign group roles so that other group members have more powerful roles such as reader, secretary, summarizer, etc.

3. Reward the group on the basis of the lowest group score(s). This will pressure the student to help and cooperate with others so that they learn the material.

The researchers has clearly mentioned about the four most common behavioral problems that can be observed during learning through cooperative learning. Furthermore he has also mentioned the ways to solve those problems. Thus these are the behavior that will be observed and corrected through the method that he has suggested.

10. Skills are necessary for cooperative learning to be a success

Johnson and Johnson [83] outlined the following skills that must be taught and practiced in cooperative learning teams.

10.1 Goal setting

The first step to creating an atmosphere of positive interdependence is setting a mutual goal which is reachable only if all members of the team participate. The goal should be structured so that every team member is responsible for learning the material and ensuring that every other group member learns the material.

10.2 Leadership skills

There are three general leadership skills that are necessary for cooperative learning. **Giving directions** encompasses being able to review the instructions, call attention to time limits, and offer ideas on how to most effectively proceed with the task. **Summarizing** involves the ability to review aloud what has just been read or discussed, referring to notes or the original material as little as possible. **Generating answers** refers to coming up with as many possible answers from which the team can choose the best answer.

Cooperative and interpersonal skills: Some students may already be, to differing degrees, proficient in some of these skills. It is through monitoring and observing that you will see which skills students lack and need to develop. There are four levels of these skills.

10.3 Forming skills

Forming skills involves being able to quietly come together as a group, to stay with the group, to quickly attend to the task, use quiet voices, and take turns.

10.4 Functioning skills

Functioning skills are what help the group develop and maintain an effective working relationship. These include sharing ideas and opinions, asking each other and the teacher for facts and reasoning, giving direction to stay on task, encouraging participation of other group members, expressing support and acceptance of other group members' ideas and contributions, offering to explain one's ideas, and paraphrasing one's own and others' ideas.

10.5 Formulating skills

Formulating skills are cognitive skills which stimulate and develop the use of higher quality reasoning skills. These are: the ability to summarize ideas and material aloud, seeking accuracy of these summaries, seeking elaboration by relating material to what is already known, developing ways of remembering information (mnemonic devices, for example), checking other group members' understanding by asking for verbalization of their reasoning processes, and asking others to plan out loud.

10.6 Synthesizing

Synthesizing involves skills necessary to dispute and reconceptualize material and conclusions. These skills are necessary in thinking more divergently about an issue and arguing constructively about differences. Students need to learn to: criticize ideas while expressing respect for the person with the idea, differentiate between group members' ideas and reasoning, ask for rationalization of ideas, extend other members' ideas by adding one's own information, integrate differing ideas into a single position, generate more than one possible answer, and check the group's work against the original instructions and timelines

Cooperative learning and achievement

1. Achievement from the point of view of construct representation

Achievement is the competence of a person in relation to a domain of knowledge. What we can externally observe is performance. The current view states that to reach a specific level of performance it may be necessary to bring into play complex cognitive tools like strategies, heuristics or skills. No doubt that the end result and the type of means to reach it must be correlated, a fact often overlooked. A difficult problem can only be solved after a well organized body of knowledge is consulted and the appropriate cognitive skills are used to reach a solution. The question then is what can be gained or lost, when taking into account the whole process, as when an open response is assessed, or just the final solution, as in multiple choice. From the point of view of measurement instrument, one can argue that if there is no compromise in reliability; that is, if the evaluation of the whole open response is carried out with a high level of precision, the measurement of the open response will increase validity. However, a more critical point has to do with the consequences of focusing, from an educational perspective, on the cognitive processes supposedly involved in the final performance. If the cognitive processes that lead to expert performance must be taken into account, the definition of achievement from a complex cognitive view has long reaching consequences, because by emphasizing these aspects we are promoting a level of expertise not reachable by other means. This is the position of most proponents of the new educational movements which try to reform the testing procedure [84].

2. Factor influencing students' learning

According to Traylor [21] following are the factors that influence students' learning:

2.1 Socio-economic factors

Students come from various backgrounds. Some are poor while others come from affluent households. They may come from strong family structures in which the parents are professionals or are highly educated, while other students may come from a single parent household or have parents with a limited educational background.

Students from affluent neighborhoods will most likely have more educational support and resources to help them through school. Often, these neighborhoods have more tutoring companies, afterschool activities and education stores than the working class or poor neighborhoods.

Also, an affluent neighborhood will be filled with highly educated people. In many respects, students in these neighborhoods are expected to continue their education at college or university level. In struggling, impoverished neighborhoods, education may be seen more as a way to get a job after high school. In some cases, the idea of getting an education is secondary. Economically surviving is more important.

2.2 Parents' education

Often, the affluent parent will have access to educational resources for his/her child. Also, the parent from this sector of society will most likely educate his/her child directly or indirectly. It is more likely that these parents will have higher regards for education, set educational goals for the child and be good role models.

Also, it is more likely a child with doctors as parents will end up pursuing higher education-and possibly medical school-than the child whose parents' education stopped at a high school diploma. This is not to say that a child's education is predetermined by the parents' education; however, it is merely one factor that can affect the students' desire to learn.

2.3 School structure and resources

The condition and availability of resources at a school can play a major factor. One classroom this writer had comes to mind: It was small, cramped and its entrance was through another classroom. On top of that, it was near the train tracks on one side and the wood and metal shop on the side. It was noisy, and students were easily distracted. Teaching in this classroom was equally tough. A well equipped class with space and the least amount of distractions will usually help students-especially those with learning disabilities-to focus on instructions.

2.4 Safety

Safety, or the sense of feeling safe, can affect student learning. Having taught at a school that was once plagued by riots, student fights, and gang problems, this writer had seen what happened when student safety has been compromised. While

some students sought refuge in teachers' classes during lunch or when these incidents occur, others simply stopped coming to school. If students feel safe, they will not have to worry about conflicts on campus. If they are the target of bullying, afraid of being caught up in an upheaval such as school-wide fights or riots, then they will be more worried about these problems rather than what's being taught in English or Math class.

2.5 Learning disabilities

Learning disabilities can affect the way a student learns. A disability may affect a students' ability to either learn visually or audibly. Also, a students' memory, attention and capacity to retain information can be greatly affected.

2.6 Language barriers

If students' language abilities are affected, they will have trouble retaining the lesson. In many cases, students labeled as English Language Learners may not grasp the language well enough to understand what is being taught. Sometimes, this refers to students who have had the ability to acquire the language but have not learned the rules associated with it. Communication between the teacher and students can be greatly hindered by this particular factor.

2.7 Teachers and administration

A teacher's skills, expertise, and willingness can help students learn. In the art of teaching, anything a teacher does is going to be scrutinized by the students. If the teacher serves as an ideal role model, demonstrates competence, as well as confidence, in the subject he or she is teaching, the students will respond positively. This rule applies to administrators as well.

Still, there's another factor that doesn't always get raised. In secondary schools (high school and middle school), in which teachers are expected to teach a particular subject and be an expert in it - administrators will often place these teachers in unfamiliar subjects. Sometimes, a Math teacher discovers one year he has to teach Social Science, or English must teach Science. This can cause confusion and unfamiliarity among these teachers. On top of that, it can affect students' abilities to learn the subject if the teacher is not an expert in it.

2.8 Students' willingness to learn

Up to this point, most of the factors that may affect student learning dealt with external causes, language barriers, and learning disabilities. However, a

very critical factor-some may say the most important one is the students' willingness to learn. If a student is eager, motivated, or goal oriented, the likelihood is that student will learn. If not, the student may regurgitate the education given to him or her but not retain it. Student learning is a multi-faceted system. A student may prosper when several of these factors are in play. Even if one factor is missing, he or she will be able to learn. However, in the long run, the willingness to learn may trump all other factors, for it is up to the individual to overcome difficulties and reach the educational goal that he or she wants.

In the above mentioned literature the author has very rightly stated the factors that influence the students' learning. It is very clear that students' learning is multi-faced system. However, in long run it is the students' willingness to learn will have major influence on learning.

3. How to improve students' learning achievement

3.1 Parent's involvement

Epstein [85] stated that the stage by defining parent involvement as families and communities who take an active role in creating a caring educational environment. She further asserts that parents who are involved with their children's education are those who consistently demonstrate good parenting skills, communicate with the school staff, volunteer their time in the school, help their children learn at home, take an active role in school-related decision making, and who regularly collaborate with the school community.

Christensen and Cleary [86] suggested that parents' active involvement results in greater recognition of teachers' skills, better teacher evaluations from their principals, enhanced parental understanding of the inner workings of the school, and higher school ratings in effectiveness and program success.

3.2 Relationship between teachers and students

Parents and educators quickly accept that students need to be taught from an effective curriculum in order to be successful in school. However, although most parents would say that they would want their children to have positive relationships with their teachers, they may view a close teacher-student relationship as less than necessary. Research suggests that this variable has a significant influence on

student achievement. In order for students to learn what is offered from an effective curriculum, they must be able to access support from their teachers [87].

In schools it is important for administrators to realize that although students who have positive relationships with their teachers will benefit, students who have experienced conflict with their teachers will be at a profound disadvantage without the ability to experience a clean slate with a new teacher [88].

3.3 Use of Information communication technology

"Information communication technology can lead to tremendous gains in student learning, for example, significant improvements in examination or statutory test performance, development of broader forms of social, cultural and intellectual capability". He furthers his claims by noting that with such changes in educational resources, teaching styles must also change whereby teachers must create "new contexts as well as new learning processes to support learning with information communication technology" [89].

Fuchs and Wosesman [90] reported a positive relationship between information communication technology use and academic achievement based on analysis of data from Programmed for International Student Assessment (PISA). With the rapid application of new technology in education, information communication technology allows students to explore information from nonlinear sequences, cross-explore new information, improve understanding with the aid of visualization tools, and study at any time and at any place.

All above mentioned are very effective ways to improve the achievement of the students but to improve the achievement of the students in mathematics; cooperative learning method is the best as per the many researchers.

4. Ways to measure the students' achievement.

Attainment and gain are two basic methods of measuring student achievement. States have relied on attainment indicators to demonstrate progress under No Child Left Behind (NCLB). Some states have moved to gain scores to measure the annual change in student or educator effectiveness [91].

According to Scott [91] Stated educational agencies (SEAs), local educational agencies (LEAs), and schools can use many approaches to measure student achievement and educator effectiveness. Seven of the primary approaches include

attainment, gain, student percentile growth, standard value-added, customized value-added, student learning objectives (SLOs), and teacher portfolios, as mention in detail below:

4.1 Attainment scores

Attainment scores focus on student performance at one point in time, and are thus cross-sectional measures of performance; gain measures take a longitudinal approach. Gain in student test scores is the difference between student performance on a post-test and the same group of students' performance on the corresponding pre-test.

4.2 Growth Models

Gain scores are only effective at capturing changes in student or educator achievement when the assessments measure some of the same content across grades. If this is not the case, then growth models may be a more effective measure of performance. Growth scores, which account for the potential differences between tests across grades, use statistical models to compare the difference between actual and expected growth. The following three examples provide a summary of growth models SEAs, LEAs, and schools use in educator evaluation systems.

4.3 Student Percentile Growth

Student growth percentiles allow SEAs and/or LEAs to compare test score growth across groups of academic peers, which are students with similar test score histories in the same grade and subject. SEAs and LEAs calculate percentile growth scores by ranking each students' growth with all other students who have similar student achievement histories. For example, students who grow at the median rate would earn a rank of 50, indicating that they performed better than half of their academic peers.

4.4 Standard Value-Added

Standard value-added models attempt to capture the contribution of a school, classroom/teacher, or other education unit to growth in student achievement. By controlling for prior student test scores, standard models will take into account some of the nonschool factors that contribute to student achievement. However, standard models may exclude certain factors that affect student achievement (e.g., student demographics), which could threaten an SEA's, LEA's, or school's ability to

compare student outcomes across schools, grades, and/or classrooms. Despite leaving out some factors that may contribute to student achievement, standard models still provide a more valid comparison of student outcomes than attainment or gain-score models.

4.5 Customized Value-Added

Similar to the standard value-added model, customized value-added models can capture the contribution of a school, classroom/teacher, or other educational unit to growth in student achievement. However, unlike standard value-added models, customized value-added models may consider the effects of nonschool factors that contribute to student achievement in specific states and/or districts, such as:

1. Differences in prior student achievement
2. Student, teacher, and principal mobility
3. Student demographics (e.g., race, ethnicity, sex, free or reduced-price lunch, English language learner, special education) and
4. Student attendance data

In addition to considering the nonschool factors, value-added may also take into account many LEA, school, and classroom-level factors, such as:

1. District and/or school resource allocation
2. Principal characteristics (e.g., level of education, years of experience) and
3. Teacher characteristics (e.g., level of education, years of experience).

4.6 Student Learning Objectives

Student learning objectives (SLOs) are goals set by teachers that specify what students will know, or be able to perform, after completing a quarter, semester, or school year. Teachers set SLOs at the beginning of the quarter, semester, or school year in order to assess whether students achieved the set goals (SLOs). Teachers set their targets based on a thorough review of available data reflecting their students' baseline skills. Most often teachers' targets are set and approved after collaboration and consultation with colleagues and administrators.

4.7 Teacher Portfolios

Teacher portfolios are a set of materials that represent teachers' practice as it relates to student learning. Teacher practice extends beyond simply teaching a class and includes all activities that affect student learning. For example, teacher portfolios may include, but are not limited to, a summary of a teacher's experiences and responsibilities, examples of the teacher's students' work, statements about the teacher's goals and objectives for the course, a discussion of the teacher's instructional methods and strategies, statements about the teacher's future goals, and a summary of the teacher's professional development activities. Administrators base their evaluation of educator effectiveness on the commitments educators make in their portfolio.

From the above literature the researcher can conclude that both attainment and gain method are in practice in Bhutan, as Bhutan has adopted international benchmarks for educating Bhutanese students and establishes achievement levels against those standards. Bhutan has National Education Assessment (NEA) to measure the students' achievement on various subjects, students' achievement on various subjects are compared over the period of time [2]. But in this study the researcher is trying to find the effect of cooperative learning on students' mathematics achievement over the given period of time so the method that the researcher is using to measure the achievement is similar to the kind of growth method known as Customized Value-Added, similar to the standard value-added model, customized value-added models can capture the contribution of a school, classroom/teacher, or other educational unit to growth in student achievement [91].

5. Related research on cooperative learning and achievement.

Cooperative learning method is much more effective in cognitive development compared with the traditional method. Both of these methods were found to be beneficial to develop the formative achievements of the students in cognition. Yet, cooperative method showed relatively much more benefits in cognitive domain as compared with the traditional one [92].

As stated in Dotson [93] a synthesis of research about cooperative learning finds that cooperative learning strategies improve the achievement of students and their interpersonal relationships. In 67 studies of the achievement effects of cooperative

learning 61% found significantly greater achievement in cooperative than in traditionally taught control groups. Positive effects were found in all major subjects, all grade levels, in urban, rural, and suburban schools, and for high, average, and low achievers [23].

As mention by Ebrahim [20] and Slavin [23] found over 70 high qualities studies that assessed CLS over a period of at least 4 weeks at elementary and secondary school levels. All of these studies compared the effect of cooperative learning and teacher centered method on students' achievement in various content areas. He concluded that in 67 studies of achievement effects cooperative learning. 41 (61%) found significant greater achievement in cooperative learning than in control class. 25 (37%) found no differences and in only one study (4%) did the control group outperform the experimental group's 76.

Furthermore, Johnson, Johnson and Stanne [24] summarized that cooperative learning strategies are widely used because they are based on theory, validated by research, and almost any teacher can find a way to use cooperative learning methods that are consistent with personal philosophies. In a meta-analysis of 158 studies, Johnson and Johnson reported that current research findings present evidence that cooperative learning methods are likely to produce positive achievement results.

In the above lines the researchers has provided various finding proving that the cooperative learning has improved the students achievement significantly when compared to traditional method of learning. Bernero [94] conducted research to generate more interest in mathematics, reduce math anxiety, and make mathematics more enjoyable for the students through implementing cooperative learning. The findings of this research proved that cooperative learning can generate more interest in mathematics, make it more enjoyable for both teachers and students and improve students academically, socially and also improve their self- esteem.

Cooperative learning is one of the most widespread and fruitful areas of theory, research, and practice in education. Gillies [95] investigated the effects of cooperative learning on junior high school students who worked in structured or unstructured cooperative groups and found that that the children in the structured groups were more willing to work with others on the assigned tasks and they provided

more elaborate help and assistance to each other than their peers in the unstructured groups. Furthermore, as the children in the structured groups had more opportunities to work together, they developed a stronger perception of group cohesion and social responsibility for each other's learning than their peers in the unstructured groups.

Wang [96] studied the effects of cooperative learning (CL) on achievement motivation of female college students, and compares the difference in the achievement motivation between the female college students learning through cooperative learning and those learning through the traditional learning pattern. The results showed that the cooperative learning classes to improve the achievement motivation among the female college students.

Ajaja [11] tried to determine how the adoption of cooperative learning as an instructional strategy for teaching Integrated Science influences students' achievement and attitude towards studies. He also determined how moderating variables like sex and ability affect students' achievement in Integrated Science when cooperative learning is used as an instructional strategy.

The major findings of the study included: a significant higher achievement test scores of students in cooperative learning group than those in traditional classroom; a significant higher attitude scores of students in cooperative learning group than those in traditional classroom; a significant higher achievement test scores of all students of varying abilities in cooperative learning group than those in traditional classroom; a non-significant difference in achievement test scores between the male and female students in the cooperative learning group, and non significant interaction effect between sex and ability, sex and method, ability and method and among method, sex and ability on achievement.

Iyer [12] analyzed 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. The result of the study indicated cooperative learning promotes thought provoking and interactive environment for the students. The instruction and activities based on cooperative learning are creative, thought provoking and interactive and offer ideas for how the children can live the value in practice and find the answers from within themselves. Cooperative learning can be utilized to enhance and promote higher student achievement.

Zakaria [97] determined 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.

Hanze and Berger [98] compared the jigsaw classroom method of cooperative instruction with traditional direct instruction. resulr showed that the basic needs partially mediated the effects of method of instruction on cognitive activation and intrinsic motivation. Increases in feelings of competence with cooperative learning were associated with better performance in physics. When controlling for competence, however, direct instruction had a facilitating effect on physics performance. Four aspects of students' personal learning characteristics (previous knowledge, academic self-concept in physics, academic goal orientation, and uncertainty orientation) were assessed.

6. Related research on cooperative learning and mathematics achievement.

Whicher [17] conducted research on effect of cooperative learning on student achievement and attitude in secondary mathematics classroom. The research result revealed that the cooperative learning increases the students' achievement then the students in comparison group.

Bush [18] investigated the effectiveness of mathematics integrated learning curriculum with the context of cooperative learning in the elementary school. The subjects in the experiment were the students of 5^{th} grade math class. Amongst these mathematics classes two classes emphasized cooperative learning activities. And the third class emphasized traditional, individualized activities. The result of this study clearly showed that the students from the experimental group with superior performance on standardized mathematics inventories when compared to the student belonging to the control group i.e individual oriented classroom. The students learning with cooperative learning also showed the positive attitude toward mathematics.

Rucker [19] researched on impact of cooperative; earning on the attitude, confidence and performance of the students in under graduate discrete mathematics courses. The result strongly supported that students learning eigtht cooperative learning performed significantly better in mathematics, attitude and confidence on mathematics. Similarly, Vaughan [99] also conducted research on effect of cooperative learning on the achievement and attitude toward mathematics. From the result of this research he could also conclude that cooperative learning has positive impact on achievement and attitude toward math.

Sharma [7] conducted the research to study the effect of cooperative learning strategies on students' achievements in mathematics at elementary level. Finding of the research revealed that the children who studied in collaborated collectively in the cooperative learning strategy obtained a significantly higher achievement in mathematics than the students who exposed through traditional method of teaching. He further states that it may be concluded that in order to develop mathematics as well as achievement in mathematics, mathematics teachers must employ effectively the cooperative learning strategies in the classroom at particularly elementary and secondary level.

Rahim and Al-Shakili [13] conducted research to determine the impact of the cooperative education strategy on academic achievement and retention of the information and trends of student. From this research he could conclude that there is no significant statistical difference in achievement or retention between cooperative learning group and traditional learning group but there is a significant statistical difference in the trends towards the teaching method for the benefit of cooperative learning group. Moore [14] investigated the impact of cooperative learning calculus experience of non Asian ethnic minority engineer students. Findings of the study indicated the cooperative learning calculus program has been successful in improving retention and academic achievement rates for colored freshmen engineering students.

Panitz [15] conducted research in line to the cooperative learning, with the hope of encouraging teachers to use cooperative learning. From the result of this research he could conclude that a cooperative learning technique, when used extensively in mathematics classes, generates many advantages for teachers and students.

Iqbal [5] and Johnson and Johnson [76] reported that in 1989, in an extensive review of research they found 17 studies that compared cooperative and competitive math learning and contain enough data to compare effect-size (average effect size = 0.55) and 31 studies that compared cooperative and individualistic math learning and contain enough data to compute effect size (average size = 0.68). These results indicated that students at 50^{th} percentile in cooperative condition would perform at the 71^{st} percentile in the competitive condition ant at the 75^{th} percentile of the individualistic condition.

Social skills

1. Meaning of social skills

Social skills are not the same thing as behavior. Rather, they are components of behavior that help an individual understand and adapt across a variety of social settings. Walker [100] defined social skills as "a set of competencies that 1) allow an individual to initiate and maintain positive social relationships, 2) contribute to peer acceptance and to a satisfactory school adjustment, and 3) allow an individual to cope effectively with the larger social environment". Social skills can also be defined within the context of social and emotional learning recognizing and managing our emotions, developing caring and concern for others, establishing positive relationships, making responsible decisions, and handling challenging situations constructively and ethically [101]. With this understanding, researchers and educators seek to evaluate and build students' social skills within a variety of social contexts.

The classroom is one such environment children must learn to navigate. Successful learning requires students to interact closely with teachers and peers. In addition to their general importance for daily interaction, social skills can have a big impact on a child's ability to succeed in an academic setting. The classroom becomes both a training ground for development of social skills and an arena in which those skills are put to use. Furthermore according to Canney and Byrne [30] stated that social skills can be categorised into four levels according to the levels of complexity and interaction as clearly mentioned below in the table.

Table 7 Social skills A

Skill Set	Used for	Examples
Foundation Skills	Basic social interaction	Ability to maintain eye contact, maintain appropriate personal space, understand gestures and facial expressions
Interaction Skills	Skills needed to interact with others	Resolving conflicts, taking turns, learning how to begin and end conversations, determining appropriate topics for conversation, interacting with authority figures
Affective Skills	Skills needed for understanding oneself and others	Identifying one's feelings, recognizing the feelings of others, demonstrating empathy, decoding body language and facial expressions, determining whether someone is trustworthy
Cognitive Skills	Skills needed to maintain more complex social interactions	Social perception, making choices, self-monitoring, understanding community norms, determining appropriate behavior for different social situations.

Source: Canney and Byrne, 2006

2. Importance of social skills

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

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

Christine and John [103] stated that adequate social skills need to be acquired while students are still enrolled in school and further supported and refined in postsecondary, community, and work settings.

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

When social skills are absent, educators cannot fully engage students in a variety of learning experiences, especially those that are cooperative. As secondary teachers increasingly use cooperative learning strategies across their curriculum, the need for students to have strong social skills is evident. To participate fully in cooperative learning, some students with disabilities need training in skills such as giving and receiving feedback, listening, and appropriate self-disclosure.

In community life, appropriate social behavior may be even more important than academic or job skills in determining whether one is perceived as a competent individual [105].

They noted that workers with intellectual disabilities who demonstrate competence in social skills are generally perceived more positively than those who lack such skills, regardless of task-related skill level [106]. The notion that competence in using social skills will lead to positive perceptions of persons with disabilities can be extended to other community settings such as postsecondary education, neighborhoods, and places of worship.

3. Social skills intervention

Research on effective social skills instruction can provide guidance when trying to help children build social skills [107, 108, 109, 110]. Researchers have also studied particular social skill interventions in a variety of settings, as well as for children of different age levels and abilities1. Findings suggest that quality interventions and related instructional strategies might:

3.1 Focus on social and emotional learning strategies that encourage reflection and self-awareness

3.1.1 Encourage children to consider how individual actions and words have consequences.

3.1.2 Develop children's ability to take different perspectives and viewpoints.

3.1.3 Teach students to think through situations and/or challenges by rehearsing possible outcomes.

3.2 Create opportunities to practice effective social skills both individually and in groups

3.2.1 Model effective social skills in the classroom and at home through praise, positive reinforcement, and correction and redirection of inappropriate behaviors.

3.2.2 Discuss effective interactions with specific attention to the steps involved. For example, discuss the process of a conversation, showing how effective listening makes such interaction possible.

3.2.3 Role-play scenarios that build social skills.

3.3 Adjust instructional strategies to address social skills deficits

3.3.1 Arrange the physical environment effectively.

3.3.2 Clearly state instructional objectives and behavioral expectations throughout each lesson.

3.3.3 Simulate "real life" challenges students may encounter at school, home, and in the community to place social skills in their practical contexts.

4. Tailor social skill interventions to individual student needs.

4.1 Refer to assessment and diagnostic results when deciding upon an intervention.

4.2 Investigate strategies designed to meet particular social skill deficits.

4.3 Make sure the duration and intensity of the intervention are appropriate for the child's need.

5. Findings on social skills.

Blog [111] responded that Rao and Murry [112] had come up will the mentioned findings about social skills:

5.1 Social skills in childhood linked to positive outcomes.

5.2 Children who are deficient in social skills lack the behavioral repertoire necessary to interact with others according to social conventions; a deficit affects both academic and social development.

5.3 Neurotypical preschool children can observe the social challenges of their peers who have social learning disabilities.

5.4 Some of our students can have a strong awareness of their own social skills deficits.

5.5 Our students don't outgrow their challenges; they have them throughout adulthood.

5.6 Most social skill programs are designed for a broader application to different types of students; few are specifically designed for students with ASD.

5.7 Now that more children are fully included in regular education classrooms, they are more consistently exposed to social pressures and demands than their lower functioning counterparts (those who have ASD, but are lower functioning according to cognitive and language development). Thus, despite the small literature base on this topic, a thoughtful examination of the efficacy of social skills trainings is warranted at this juncture, particularly for this higher functioning population.

5.8 Studies don't control for poor motivation... there is not a common definition of social skills. While certain skills appear to be universally included in social skills curriculum (greeting, initiation of conversations...), others appear to be more idiosyncratic and often represent complex behavior patterns (problem solving, self-control/self-regulation). The lack of agreed upon group of behaviors considered within the domain of social skills teachings represents challenges for the scientific literature.

5.9 Few groups use design to control for maturational development over time. Most data (behavioral) doesn't show strong ability for our students to generalize what they are learning.

5.10 Most social skills studies don't look at follow up to see stabilization of skills learned over time, if they do explore generalization. The only way to study this is through exploring treatment efficacy through single subject design.

6. Related research on cooperative learning and social skills.

Ebrahim [20] conducted research to study the effect of cooperative learning strategies on elementary students' science achievement and social skills in Kuwait. From the result of this research he could conclude that cooperative learning has positive effect on both achievement and social skills of the students. These result provided an evidential base to inform policy decisions and encourage and persuade teachers to implement cooperative learning method in Kuwaiti classroom.

Lavasani [113] studied the effect of cooperative learning on the social skills of first grade elementary school girls. The result of the research could conclude these three findings:

1. Students, whom are taught by cooperative learning method in comparison with students whom are taught by traditional method, indicated better social skills. This result conformed the following two hypotheses.

2. Students whom are taught by cooperative learning method in comparison with students whom are taught by traditional method, displayed suitable social behavior.

3. Students whom are taught by cooperative learning method in comparison with students whom are taught by traditional method, less unsuitable behavior (impulsive and assertiveness).

Goudas and Magotsiou [114] conducted research to examine the effect of a cooperative physical education program on students' social skills and attitudes toward group work. Results showed gains of the experimental classes on social skills and on preferences for group work.

Cavalier [115] conducted the study to investigate the effects of cooperative learning strategies on performance, attitude toward working in teams, and group interaction behaviors in a technical training context. From the research he could

conclude that a cooperative manner had a significant effect on performance and group behaviors. Participants in the cooperative teams performed better on the posttest, enjoyed working in teams, perceived more accomplishment, and displayed higher levels of social and cognitive interaction than participants who worked in unstructured small groups.

Stauffer [116] conducted research to explore the effects of cooperative learning on the academic achievement, social interaction, behavior and effect of secondary level English and Social studies. The result of the study suggests that cooperative learning has positive effects on academic achievement when students are accountable only to themselves, when they are accountable to both themselves and their group, and when they are solely accountable to their group. It also suggests that students who engage in cooperative learning are more likely to work with others even when not told to. Other research suggests that students who work in cooperative settings are more likely to accept peers of different ethnicity, class, race, and abalones.

Although there is not much research conducted to explore the effect of cooperative learning on social behavior, from the above mentioned researches we can conclude that cooperative learning has positive effect on the social behavior of the students. However, there is a need to conduct research in the Bhutanese context, to provide the assurance to the teachers of Bhutan, that cooperative learning is the best strategy to bring the positive chances in the students' behavior during learning.