CHAPTER I
INTRODUCTION

1.1 Back ground of the study

Mathematics directly deals with human life. It is believed that the development of mathematics and the development of human civilization were together. Mathematics was created to fulfill the human needs. Though mathematics was introduced later in the formal education system, it had been developed simultaneously with the development of society. Mathematics is not only taught and practiced through the formal institution (school), the contemporary society has been practicing it with own ideas and belief systems.

Regarding the origin and development of mathematics, H. Preston (in Adhikari, 2002P. 3) has expressed his view that mathematics was developed from the need of organized society of people. For instance the primitive tribes living by hunting and collecting the natural harvest of forest and field, they needed rudimentary knowledge of counting to communicate numbers to the tribes. This may be the number of animals in a hand or the numbers of people in a hostile tribe. Also needed were the measure of size, strength, distance and time, however crudely formulated they might be a certain primitive awareness of similarities of the shapes must be present in effort to duplicate arrowheads and implements, and it is also important to have some means of describing location involving both concepts, which later developed a into mathematics. From the above discussion very simple evidence about the origin of mathematics, was according to the need of human being in the process of civilization and has been an essential component of human civilization. So, the history of mathematics is a part of the history of human civilization. This view is further justified from the history that mathematics was originated in the river valley civilizations like the Tigris, the Nile, the Euphares, and Hwong Ho, the

Yangtze etc. By supporting these versions, Eves (1983) stated about the origin of mathematics as:

"Early mathematics required a partial basis for its development and such a basis arose with the evaluation of more advanced form of society. It was along some of great rivers of Africa and Asia, that the new form society made their appearance that Nile in Africa the Tigris and Euphrates in Western Asia, the Indus and then Ganges in south Central Asia and the Hwang Ho and then the Yangtze in Eastern Asia ……Thus early mathematics can be said to have originated in certain areas of agricultural and engineering pursuits."

Mathematical concepts develop from experience of and intelligent interaction with the environment. The main aspects of these experience and interactions are (i) repetition of objects and events,(ii) contrast between things and events, (iii) manipulation of thing or observation of their behavior (CERID,1990p.1).

The concept of number and process of counting developed so long before the time of recorded history that the matter of this development is largely conjectured. The need of number probably grew out of the desire of people for counting things and the necessity of keeping a record of their possessions. It is known that at the present time there are savage tribes that make very little use of numbers and interestingly enough the tribesmen have few possessions on the other hand, the demands of modern civilization for methods of dealing systematically and efficiently as well as precisely with numerous aspects of social affairs are so great that a simple number system is a vital necessity. It is known that primitive man can recognize small groups of objects and that he/ she has crude ways of identifying the numbers in the groups as long as they are small. For example, such a word as 'pair' means two, 'hand' means five and 'head' means one. In Tibet the word 'wing' means two when such expressions are as such as has been devised (CERID, 1990). This explanation depicts the

growth of mathematical concept resides in the culture of the people, the ethnic base.

In many tribes, tally marks painted on pieces of wood, and notches cut in sticks are used to keep permanent records. A tally mark matches each item recorded. A group of tally marks can be used to represent a relatively small number of items even when there is no to name the number of marks there are. Later mathematics is symbolized and structured as system. The invention of symbols helped to develop math processes, which utilize positional representation of number and operation of numbers. This made math's processes such as addition, subtraction, multiplication and division simple enough for common use. The number concepts, numeral system and math process that we commonly use today look simple and perfect. it is on them that modern mathematical theories and complex processes have developed. But one cannot, however, ignore the fact that the initial development of number counting and math's processes were based on simple interaction between people with regard to physical objects in their environment. today people have devised several forms (bases) of number counting. Some based on 2, some on 10, some on 20, and so on. Some ancient counting systems have already become obsolete and some others that have survived are gradually being replaced by new system (Bruckner et al. 1947 p. 24-26).

The development of methods used in measurement has been closely associated with the growth of numbers system. In order to carry on trade, crude systems of weights and measures were devised in the beginning. Measurement is essentially a process of making comparisons. If the reference and relation are judged to be equal, each may be used as the measure of the other. However if they are unequal, the relation may be structured into parts that are judged to be comparable to the referred, and the number of such parts may be noted. This is comparatively easy to do, when the relation is easily structured as for example,

a set of books in which each book is visible, or a pile of blocks wherein the blocks are easily separable (Spence et al. , 1976p. 18)

Nowadays, advanced mathematics can be obtained in different forms like concrete and abstract, analysis and synthetic, formal and informal, applied and pure etc. The main forms are applied and pure. Applied mathematics is the application of pure mathematics in the service of a given purpose. It has some direct or practical application to objects and happenings in the material world. It plays a great role in the development of various subjects. Every discovery science owes much to applied mathematics. It is the connecting link between pure mathematics on one side, physical, biological, social sciences and technology on the other. On another side, pure mathematics involves systematic and deductive reasoning. It treats only theories and principles without regard to their application to concrete things. It is developed on an abstract self contained basis without any regard to any possible kind of practical applications that may follow (Sidhu, 1995).

In the beginning, man studied mathematical structure as found in his culture. Either pure mathematics or applied mathematics, both of which roots are based on culture. Encounters with other people and other cultures all over the planet after the great navigations of the sixteenth century led us to identify mathematical practices and mathematical ideas mainly those relating to measurement, counting, classification, and modeling in every culture (D' Ambrosio, 1997, p. 245). In many instances, for example, in ancient India and the Mediterranean civilizations, mutual influences are noticeable and have been well known since antiquity. In other instance, no mutual influences are discernible, but there is a remarkable coincidence of practices, result and even ideas. In all these instances, equally remarkable differences are increasingly recognizing "different forms of doing mathematics" we are increasingly recognizing "different forms of doing mathematics" or" different practices of a mathematical nature".

We live in a global world. The economy is global, production is becoming increasingly global, communication systems are interconnected, and major political decisions are not taken unilaterally. But people continue to speak different languages, eat and dress differently, and adhere to different religions. Such diversity is normally seen and indicates that schools should respect different cultures, but schools expect students to learn the same mathematics developed by great mathematicians that legitation, arguing that otherwise students can hardly operate in the modern world. Mathematics is behavior science, also influenced by cultural rule. This view has been supported by many current historians and philosophers of mathematics (D' Ambrosio, 1997, p. 246) Hence different languages, dresses, foods and religions have made existence of different cultures. Culture influences the activities of people. Consequently mathematical ideas (measurement, counting, classification, modeling etc) may have in different way in every culture which leads that different nature of mathematical process is known as the term "Ethno mathematics or, "ethnic groups' mathematics".

D'Ambrosio (1984, 1985) has used the expression "Ethno mathematics" to refer to the forms of mathematics that vary as a consequence of being embedded in cultural activities whose purpose is other than "doing mathematics". Everyday activities such as building houses exchanging money, weighing products and calculating proportions for a recipe involve numbers, calculations and precise geometrical patterns. These applications of mathematics often look different from those used in school today. In the kitchen we often measure volume with spoons and cups, where as in school activities students typically measure volume in liters or cubic meters. These differences may be perceived as deep or surface. Students' differences depend on what views on holds of mathematical knowledge. (Nunes, 1988, p.557)

Ethno encompasses identifiable cultural groups such as notional tribal societies, labor groups, children of certain ages, professional classes etc, and included

their jargon, codes, symbols, myths and even specific ways of reasoning and inferring, (UNESCO,1989).

In 1985, D'Ambosio defines the Ethno mathematics in the following lines:

"*A relation between anthropological cultures, historical and mathematical is an important step towards the recognition of different ways of thinking which direct to different mathematical forms, this is what we call Ethno mathematics".*

Hunting (1985) defines the Ethnomathematics as *"Mathematics used by a defined cultural group in proceeding the problems and activities in content".*

Geraldo pompu, Jr, gives the definition of Ethno mathematics in the following lines:

"Ethno mathematics refers to any form of cultural knowledge or social activity. Characteristics of a social and / or cultural group, that can be recognized by other groups such as "Western" anthropologists, but not necessarily by the group of origin, as mathematical knowledge or mathematical activity."

It can be concluded that Ethno mathematics lies at the confluence of mathematics and cultural anthropology. At one level, it might be called maths in the environment maths in the community. At another related level, it's the way that specific cultural groups go about the task of ciphering and counting, measuring, classifying, ordering inferring and modeling (Gilmer, 1989, p. 105)

Twenty years ago, it was argued that the cultural placement of an educational system and of scientific structures is, probably, the most relevant fact in modern development of education mainly in "undeveloped countries" (D' Ambrosio, 1978). As far as mathematics is concerned, in the last two decades, many researchers have agreed that teaching must be related to its cultural and

geographical context (NCTM, 1997). The rise of Ethno mathematics an emerging field of mathematics, a strong means of mathematical education, must be considered as a good response to the problems regarding the cultural component of education. On the other hand the explosive way of communication media and information technology have created further cultural dependency to the north hemisphere (Euro centrism).This dependency is the major cause of the disappearance of traditional knowledge of many societies or identifiable groups of people, especially in the south hemisphere (Masingila, 1992 p. 245)

Different ethnic tribes have their own mathematics in the culture. In most Brazilian tribes, we can find some knowledge on geometry in body painting, handcrafts and in the building of their huts. Concepts such as parallelism perpendiculars are found in body paintings and are incorporated into the language. For "Tapirapes" from Mato Grosso, the parallelism 'axapayway' and the perpendicularism "axapankway". The circle and the sphere mean the perfect shape for the most Brazilian tribes as it did for the Greeks (Borda, 1987). Many of the geometrical concepts can be found in different culture. The Tshokwe people of southern African's Bantu culture have used graph theory principles in sand drawing (Ascher, 191). In Africa, circular houses are grouped in circular compounds, such as arrangement maximized living space, affords protection and minimized required building materials (Zaslavsk, 1973).

There are many mathematics notions in people of different cultures that written history has hidden, frozen or stolen. Even though oral history is becoming much important to study ethno mathematics (Gerdes, 1985). Nowadays many researchers have devoted to search the ethno mathematics ideas and structures that ethnic group has oral history or unwritten history.

1.2 Statement of the problem

Nepal is a multi ethnic, multi linguistic, multiracial and multi cultural country. Every ethnic group has their own religious, social and in cultural belief their cultural activities have own types of important role in the national culture. Gurung is one of the disadvantaged ethnic groups and has found to be using tribal economical activities the most backward group. Their cultural activities are different from the other castes.

Ethno mathematics is the study of mathematics which takes into consideration the culture in which mathematics arises. I.e. it is the study of relationship between human societies with mathematics (UNESCO, 1989). It is necessary to know the mathematical concepts and processes of ethnic groups of Nepal for the betterment of mathematical knowledge in people for country's development. The changes in the society or community affect their cultural system in the courses of development; it consequently directs to develop different units of the systems. But there still remains the use of traditional method in Gurung community–counting and measurement processes. No studies have been conducted dealing with cultural mathematics (i.e. Ethno mathematics) of any kind. Therefore, the researcher intended to study the basic mathematical concepts and processes of Gurung community. In this context, the study has focused on the following questions.

1. What is the counting system of Gurung community?
2. How do they perform the four basic fundamental operations (addition, subtraction, multiplication and division) in their real life?
3. What is the measurement systems practiced in Gurung community?

1.3 Objectives of the Study

By considering the above statement of the problem the following were the objectives of this study.

1. To explore the counting system of Gurung community.
2. To find out the ways of the four basic fundamental operations practiced by Gurung people.
3. To identify the measurement systems used in Gurung community.

1.4 Significance of the Study

The extent of development in basic mathematical concepts depends on the opportunity to handle different objects in the environment. A difference in the counting system is likely to produce different method and processed. In Nepal, the mathematical concepts and processes introduced in school education have some aspects, which are abstract in nature. The students, therefore, perform basic operations (addition, subtraction, multiplication and division) with out necessary conceptualization. There are still alive own traditional mathematical concepts and measuring system of different communities, especially in disadvantaged groups, which can be used in school curriculum.

Mathematics has always held a key position in the everyday activities and in the school curriculum. D' Ambrosio (1985) writes "if one asks about the expectation of children finishing compulsory primary education there is no answer than going on further education. Then, we have to agree with the two major objectives of post primary education (i) to facilitate the process of adjustment to adult economic and social roles and (ii) to offer opportunities for continuing education to those who have the motivation and the drive. Usually asking for better preparation to pass competitive examination schemes to enter the universities rather than to better fit the young individual to social and economic role. Particularly this cause a serious obstacle for the improvement of secondary school system. " This expression has revealed that primary education is most important for people on their daily jobs rather than for further education. According to NEC 1992, the seventh national educational objective is to bring the socially backward group of nation into the mainstream. Many of the countries in the world, like Brazil, Ghana, papua New Guinea, Somalia,

Spain etc. ethno mathematical practices have been conducted in school level. For instance IMP (1981) of papua New Guinea reported that a locally developed textbook would enhance mathematical learning particularly in remote rural areas where current teaching conditions and lack of materials interact with poor English skills to create an imbalance in a achievement. The teacher needs to be aware of the cultural background of his pupils to understand how the community uses mathematics in cultural activities. He needs to develop mathematical behaviors which is built by understanding rather than rote learning (Longdon, 1996). These facts reflect that ethno mathematical practice is the most important in primary level.

Recently Nepal has adopted a policy of free and universalization of primary education. NEC (1992) has recommended that primary education can be given in mother tongue. The subject, math's has been accepted as an important compulsory subject since grade one. No place is given in the curriculum to have ethnic maths. However, the new curriculum (NEC 1992) has opened an new policy to have a local curriculum. If primary education is given in the mother tongue, what should be the content of mathematical in primary level? This study is the study of indigenous counting and measuring system of Gurung community. The nature of mathematics if explored systematically can be used in the curriculum. This study in this direction will be culturally very important.

Nepal is the rural, multicultural and multilingual area. In this context, the result of this study will help for policy maker and curriculum designer how to consider ethnomathematics in curriculum. It will also be equally helpful for mathematics educators, mathematician and mathematics teacher to understand the artifacts of culture of Gurung that how they count, measure and calculate and use in classroom teaching to maths programmed. It will open a door of promising future researchers to seek problem for further study. Thus, it will add a new dimension in the field of cultural mathematics knowledge.

1.5 Limitation of the study

There are many communities in Nepal with own local mathematical system. The study was carried out in a disadvantaged community with a small number of respondents. The study was taken Ghandruk in kaski district in Gurung community. It concerns only the mathematical concepts of counting (number concept, grouping and recording system) measurement (length, distance, volume and weight) system and four basic operations on whole numbers. This study tries to explore out what mathematics and measurement system the Gurung community use at present. This does not give a complete account and formalization of the mathematics. It tries to explain in the form that is practiced as a part of there culture.

1.6 Definition of Terms

Mathematical concepts:

In this study mathematical concepts refer to the basic concept of number, length, distance, area, volume and weight.

Mathematical process

Numerical computation is essentially a set of procedures for determining where on the number scale the result of the operation is located (Spencer , 1976). The present study of mathematical process refers to computation with numbers.

Formal/ modern system

There is standard mathematical system accepted by all the nations in the world. Such a system is including in their national level curriculum our country has also adopted such universal and standard mathematical system which is known as formal modern system.

Traditional system

The system of mathematical calculation which is different from the formal system in concept, structure, process etc. and reflects the typical (mathematical) system of Gurung people is called traditional system.

Literate

According to NESP (1971), literate means being able to at least read and write general Nepal and perform fundamental mathematical operations in daily life.

Illiterate

Illiterate are those (persons) who can not be included in the minimum definition of literate.

CHAPTEP II
LITERATURE REVIEW

This chapter deals with some literatures, which are reviewed from different books, and reports related to the present study.

Gelman (1973) studied on of how do children develop counting skills. He specified from basic logical principles that the must be satisfied if an activity is to be classified as counting. These principles are (i) establishing one to one correspondence between the things to be counted and counting labels (ii) maintaining the counting labels in a fixed order, (iii) recognizing the irrelevance of the order in which the objects are counted, and (iv) applying the cardinality principle that is, using the last label to represent the number of objects in the set. This study can success to identify that logical principle has the systematic way of counting system.

Lacy (1983) and saxe (1989) studied on "how different cultures have addressed the problem of memory load in counting". They studied on Kewa and oksapmin people of Papua New Guinea. They identified that the kewa ad the oksapmin have developed numeration systems that help them maintain fixed order by using the names of body parts as labels in counting. The use of body parts labeled systematically allows the Kewa for counting to 68. This study shows that how these people solved the problem of memory load in counting. But it has not mentioned of higher than 68.

A base in a numeration system is a grouping scheme used to recognize counting. Luria (1969) stated a base- numeration system involves counting natural objects, organizing them in conventional groups that become new counting units, and grasping semantically complex structure underlying the numeration system. The number 343 expresses that there are three groups of one hundred, four groups of ten and three objects. It is significant in written

forms more than in oral. Fahrmeier (1984) described inventory taking in a milk factory in the United States which required assessment of quantities of some 100 products stored in a walk in refrigerator. He points out, these circumstances made counting different from putting items and number label into one to one correspondence. He describes five strategies that emerged in talking inventory under these circumstances, all of which involved the use of new units based on spatial grouping – stacks with known height in terms of number of cases. A traditional system of counting was adopted to better handle the requirement of the activity for counting procedure. Here study has only dealt with reinventing of grouping (counting unit) unit that is introduced into the indigenous system.

Saxe and Moylan (1982) studied the ability of Oksapmin children and adults to make transitive inferences and the influence of schooling ability when the children were using their indigenous measurement system for determining length. They had selected schooling children and unschooled adults. Two groups of tasks, unit measurement in constant and unit measurement in varied was given. Transitive inferences based measurement with a fixed unit measurement in varied was given. Transitive inferences based measurements with a fixed unit were observed among subjects with or without schooling. Schooling seemed to speed up the process of development of the ability to make transitive inferences. The study is silent about inferences of other property.

Moser (1982), Fuson (1982), Hughes (1986), saxe (1985) and cobb (1983) have shown that not everyone who can count can also use counting to solve problems. The ability to use counting to solve addition and subtraction problems increases with age, varies with situation, and is influenced by schooling. These studies indicate that something more than counting is going on when subjects use a counting strategy in problem solving. Gay and cole (1967) on their work on everyday mathematics among the kpelle, show that

despite to solve problems by putting like sets of object together and sharing objects, they have no abstract arithmetic operations. They also identified in the kpelled language expression for addition, for subtraction, for multiplication and for division. They also described the normal procedure for solving these problems to be the use of fingers or stones to represent the objects which were they counted. These procedure were used accurately only for problems involving small numbers. With large numbers the procedures became cumbersome and boring, and subjects often simply guessed a large number as the answer. This study has succeeded to identify that of kpelle, all arithmetic is tied to only in concrete situations.

Reed and Lave (1981) studied about on concrete versus abstract dichotomy that was prevalent in diverse culture. Their research consisted of a detailed analysis of arithmetic problem solving among tailors in Liberia. Participant observation and informal interviews method were selected in the tailors' shops. The field notes were used in the development of experimental task designed to sample the four arithmetic operations. Two basic strategy types, observed for solving problem deal with quantities and deal with number names. They observed that different types of errors resulted for each of these two strategies. They concluded that the evidence didn't favor a concrete versus abstract distinction. Also this research demonstrates the existence of multiple arithmetic systems in a single culture.

Curraher et. al (1987) studied the oral practices and described one general strategy used to solve addition and subtraction problems (decomposition) and one strategy for solving multiplication and division problems (repeated groupings). They analyzed that the general principles underlying the written and oral strategies seem to be the same. This study shows that written and the oral algorithms have satisfied the same properties but it does not describe the difference between written and the oral algorithm.

Measurement units are culture specific. Borda (1987) has pointed among the Brazilin tribes that the rural zone, there is a regional diversity of the measurement units, the standard measurement is not necessary yet, varying, according to the region. These are measurements such as "alqueire", "braca", "tarefa" etc.

CERID (1990) studied on "the elementary process of learning mathematical concepts and process of Rasuwa Tamangs". The purpose of the study was to study the basic mathematical concepts used by Tamang adults with no formal mathematical education, to identify traditional Tamang method of mathematics operation, and to find out the implication of Tamang processes and tone up the present learning situation. This project work has shown that Tamargs have systems of measurement counting and their own their own mathematical processes and geometrical concepts are based on the shapes and structure patterns of object existing around. This study has also showed the situation of children into the formal system, but it didn't study the effect of ethno mathematical practices in the classroom settings.

Shrestha (2003) studied the measurement system in" Newar civilization with the objective to identify the numeral systems and its trends of gradual development". His research was based on primary and secondary data, consisting of the study of profiles conducting with resource persons and the study of related journals, books microfilms etc. Secondary data were collected from several libraries, museum and personal collection. He found from data that all the numerals of Newar civilization were found as developed from the Brahmin, the ciphered numeral system was in use during the Lichchavi period, and the symbol zero was introduced during the dark age of mathematics development. This study has not showed the present mathematics practices in real life mathematics of Newar.

Ethno mathematics is a new emerging field of mathematics in this decade. There are so many investigations carried around the world in this field and many ethno mathematical practices have been conducting in various places like in Brazil, Ghana, Papua New Guinea, Spain and so on. Nepal is a multi cultural country where many cultural systems are found. But in this field, no attempts have been made as discussed on this context and the review of above literatures helped researcher to understand that there is a Gurung community whose mathematical concepts and processes haven't yet studied. Therefore, on this ground. The researcher undertook the study.

CHAPRER – III
METHODOLOGY

The design of this study is a qualitative. Qualitative research is multi method in focus, involving an interpretive, naturalistic approach to it's subject matter. This means that a qualitative researcher has to study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meaning people bring to them. Qualitative research involves the studies used and collection of a variety of empirical materials, case study, personal experience, introspective, life story, interview, observational, historical, international and visual texts that describe routine and problematic moments and meaning in individual lives (Denzing and Lineon 1994, cited in Anderson et al. 2001) are it's tool for date collection.

It was conducted on an ethnographic basis. Thus it is a descriptive type. Researcher used observation and interview as method for searching the concepts and processes of mathematics in Gurung community.

3.1 Description of study Area

Kaski district is a significant distinct in socio- cultural geographical and religious matters among the other districts of Nepal. Nepal has 75 districts, but Kaski metaphorically is a called 76th district of Nepal, for people from different districts are migrated here and mark a blend of different cultures. So here, we can observe various cultures, religions and languages. Gurung is also one of them who migrated from various Hilly regions of Lamojung , Gorkha, Tamhun, Parbat etc .

3.2 Selection of Key Respondents

Key respondents are important source of acquiring cultural data. They were those who knew their culture and a great deal about the study subject. The researcher personally visited the study area, met a social worker and explained him about the purpose of visiting of the village. By the help of the social worker, the researcher selected key respondent in two phases. The researcher had selected 21 male persons of different age groups, five persons from old age (above 60 years), eight from middle age (40-60 years) and eight from young age (20-40 years) in the first phase. The researcher selected only the male persons, for the male persons participate in every activity of their cultural role and knew a great deal which were expected under the study. The researcher did not select female persons as key respondents because of ethical consideration. After collecting responses in the first phase from the selected only six persons, two from old age, two from middle age and two from young-age. The six key respondents were selected for in-depth interview.

3.3 Date Collection Procedure

There are many approaches for the qualitative research to get the first hand information. Thus the researcher used observation and interview as the method of collecting data. The details the procedures are discussed in separate heading.

3.3.1 Observation

There are a number of techniques to gather information. Observation is one of them. According to Lokesh Koul, observation is the process in which one or more persons observe what is occupying in some real life situation, and they classify and record pertinent happenings according to some planned scheme. It is used to evaluate the overt behaviors of individuals in controlled and

uncontrolled situation. Observational methods have occupied an important place in descriptive educational research.

Researcher got information about the social worker of the study area by visiting and conversing with the people familiars with that place. Then, after walking for five hours the researcher reached at the contact of the social worker. He informed him about his objectives of going there. The researcher took some information about the environment people and their customs of that area from the social worker. The researcher spent two days for getting information about the daily activities, such as grazing goats, agriculture work, cutting grass, separating ears of corn, weaving doko, namlo, dalo of the people of study area. He observed their talk costumes and other activities. After overall observation, he identified their mathematical activities on the basis of their daily activities. He separated those mathematical activities he noted down in his note copy. Some of those activities were noted down as they were found. He utilized those field notes in his analysis and interpretation of the research work.

3.3.2 Interview

The researcher prepared interview guidelines (open – interviewed questions) on the basis of the suggestions from supervisor and the study of research book, theories, (related to the subject) research document and books related to Gurung. The interviewer (researcher) met the Gurung people individually. Moreover, he strengthened the bond of relationship with the interviewees with the help of the social worker. After informing them the objectives of taking interview, he interviewed with the selected respondents on the basis of interview guidelines. The interview guidelines were changed on the basis of the interviewee's response and the local situation (see appendix). The researcher spent four days for interviewing of the phase. The purpose of the first phase interview was to find out the actual mathematical activities done by them in real life and to select the better respondents. In depth interview was taken with

six person in the second phone. For which the researcher spent two days. The interview was quite lively (natural) because the interviewer (researcher) took their interview wherever he found them. The interview was taken in relaxing way because the interviewer initiated the talk related to the work they were doing and then only moved to the subject matter of study. The information got from the interview was written in the note copy. This research study took 15 days on the whole.

CHAPTER: I V

BRIEF INTRODUCTION OF GURUNG COMMUNITY

As declared by the Interim constitutions 2007, Nepal is multiethnic, multilingual, multi religious and multicultural country." Various Principalities of our country are declared by various ethnic groups along with their respective languages, religions and cultures. Among those groups, Gurung is also prominent caste which is believed to be migrated from Tibet (www.gurungs. org.)

The Gurung believe that Lamjung, Kaski and Gorkha are the birth place of their community. Some anthropologists revealed that the Gurung, (Tamu) (spelled Temu) are raised from the historical pre-Mongol, Hun people of central Asia, and spread and settled in Nepal they came to be known as Gurung. . According to the census of 2001 there are 543571 Gurung (Tamu) (2.39% of Nepal's total populations) of which 338925 speak Gurung language.

Other argued that they are of more recent Mongol migrants. Though it is, in view of their language which is the most closely liked to Tibetan among Tibeto- Burmese languages, their religion, Tibetan Lamaism and festival Loser / Lochhar also support this. "pye-tan-lhu-tan" is the sacred scripture of the Gurung, which contain oral accounts of their traditional history.

While seeking of history of Gurung community, Bernard pingle's document is also a notable one which is about the origin of Gurung. As revealed by a text from east of Nepal where the Rais Limbus live, goes as follows: The kirati are the oldest inhabitants of Nepal. Soyambunath eho lived in the land of Hemonta had several children. The second thoina, went off towards Japan. The third went towards Thailand. Bhutan and Cochin-China. The eldest went towards china, then Tibet, and arrived at the north frontier of India named munainua. He had ten children. It is believed that these children were the founder of

various castes, like Roktumba, Yakakowa, Lunphebe, Thangheba, Suhacepa,Gurung, Mankapa, Toklokapa and Thandwas. Among these races Gurung is believed as the founder of Gurung. (wikil Image: Nepal ethnic groups. Png selected ethnic groups of Nepal.)

About the history of Gurung a Gurung scholar, C.B.chotane writes "The origins of the Gurungs, Magars, Tamangs, Tharus, Sunwar and Danawar of central Nepal seem to be connected with the ancestors of the kirats, an ancient Indian tribal group, who occupied the northern area of the Indo-Gangetic plain and the foothills of the whole Himalayan range which extends from the Kashmir valley to Assam, Nagaland and Manipur. The earliest civilization of Kathmandu valleys was founded by Kirats. When conflict was raised to fle Kirats from valley, they were ridded in foothills as well as top of the hills. From that time 'vansavalis' was collected which revealed that the culture of different casts. The culture of Gurung was also found. (http://www.tame_pyelhu.org)

If we go in depth about the gurung community, the western Gurung are located in kaski and Syangja districts, a central strip of mountainous country in the western Gurung region of Nepal. The majority of their villages are situated on the mountain slopes at elevations between 1,000 and 2,000 meters. People live in whitewashed houses with slate roofs. The men usually wear vests and loin clothes. Women wear colorful wrap around dresses and upper garments over blouses. Nose rings or earrings are used as ornaments by female members.

Especially their hard labor, in agriculture, makes them easy to sustain enough by producing millet, maize and rice. Traditionally, Gurung society is organized in to two major class groups: the "four casts" and - "sixteen castes", lately

Differences between these groups have decreased. The western Gurungs are not isolated, but are aware of the customs of the surrounding people. They have ongoing relationships with members of the working casts who live in the

Gurung villages. In order to be considered an adult in Gurung society, marriage is essential. Marriages are arranged by both sets of parents while children are quite young. January is the preferred month for a wedding ceremony. The interesting thing is that newlyweds move in with the groom's parents and remain there until their own children have become adults. The man then builds his own house, usually near the home of his parents. The western Gurung have many interesting customs. For example, three days after the birth of an infant, the'tuno bandhne' ceremony is held. This entails wrapping the newborn baby in a long piece of cloth after washing either cow's milk or cow's urine. The young people often gather in the 'Rodighar' to sing songs that they have written.

Western Gurung is predominantly influence by Hinduism. When a Gurung dies, an astrologer consults his horoscope to determine whether the body should be buried or cremated. Then, thirteen days after the death, an image of the deceased is made and dressed in his or her cloths. The priest recites scriptures while the headman of the village and the relatives of the deceased bring offering to the image.

In Nepal, Gurung's have and continue to play significant roles in all spheres of the country's development. Outside Nepal. many Gurung's, some in their renowned role as Gorkha soldiers, have lived and been exposed to diverse ward cultures in areas as different as Bhutan, Europe, Hong kong, India, Japan, Korea and the united states of America. In Nepal two districts of them, highlanders and lowlanders have different living places. Highlanders and lowlanders living on the slopes of Himalayas still rely heavily on a post oral and agricultural way of life. They grow rice, wheat, maize, millet and potatoes, normally on terraced. They also derived substance from sheep in those days. The highlanders' way of life resembles that if Tibetan in terms of religious beliefs and culture practices. In contrast, lowlanders are more influenced by Hindu religious beliefs and practices. It is not surprising to see Gurung using a Hindu priest for birth and a Buddhist lama for last rites at someone's death.

A Gurung farmer in his orange orchard, near kalimpong. west Bengal, India, Many Gurung families, however, have another important source of income- the pensions and salaries of family members who are in the army. Among are the legendary fighters of the British Ghorkha Regiment, who were honored with victoria crosses for their bravery. Indeed Gurungs are renowned for their role as Gorkha soldiers, making unparralleled contributions for flung places such as Europe during World War I and II, Burma, Malaysia, the Falkland. Africa and India. Most Recently Gurungs have participated and continue to participate most in United Nations peacekeeping missions throughout the world.

Despite many pushes and pulls of modern day life, Gurungs are increasingly eager to leader, preserve and celebrate their districts cultural heritage and practices. This includes not only the various beliefs systems and cultural practices but also their life style.

CHAPTER: V

DATA ANALYSIS AND INTERPRETATION

Gurung is a one caste among other caste of Nepal. They have their own identity, culture, tradition, norms and values. They are varied according to the variation of geography in Nepal. Language is differed from western, Himali and eastern Gurung. Such deviation makes the effects in a society. Generally the variation of languages and the objective effects are trying to be shown and analyzed in here.

How was development of math's in Gurung society? How was it used in ancient Gurung society? How was the numeration system? How was the solution of daily mathematical problems? The above problems and their solutions are addressed by this study.

Though direct questionnaire and interview with many different group were done, it is different each other's place in their pronunciation. For example, for one, Syangjali pronounced 'kri' but kaskeli and Lamjung Gurung people said 'ghri'. Some others differently pronounced letter are shown here.

Table no. 1

Use in Lamjung and kaski	Use in Syangja	Number
Ghri	kri	One
Ngihan	Ni	Two
Shon	So	Three
Pliha	Pli	Four
Nghan	Nga	Five
Tahu	Tu	Six
Yhi	Yi	Seven
phre	Pre	Eight
ku	Ku	Nine
Chue	Chue	Ten

Though it is different in pronunciation but there is not such distinct in core.

This chapter has been divided in to three sub sections. First section deals with counting system. Second with math's process and third with measurement system.

5.1 Counting System

a) Number Concept and Counting System.

Their numeration system is based on 10 which is similar but they have their native name up to counting 10. They use 'zero' but name is like as Nepali language 'sunya'.

Table no. 2

Name of Number in Gurung.

In Gurung	In English	In Nepali
Suny (शुन्य)	Zero	sunya
Ghri (घ्रि)	One	Eka
Ngihan (ङिहँ)	Two	Due
Shon (सोँ)	Three	Teen
Pliha प्लिह)	Four	Char
Nghan (ङहँ)	Five	Panch
Tahu (टहु)	Six	Chha
Yhi (ञिं)	Seven	Saat
Phre (प्रेह)	Eight	Aath
Ku (कु)	Nine	Nau
Chue (च्यु)	Ten	Das

To count above 10, these can be found little different. While counting these numbers they count 10, 20,30,40,50,100 and 1000. But to count other number they follow same as the Hindu Arabic number. Mixing society with other groups used to count 'based-20'.

With the change of time, the numeration system is changing day by day. The effect of Hindu Arabic system is followed to adapt in Gurung language also which is a good example of modernization. Even youth and literate are not conscious to use their own language. Ghri-Ni-Ghri, Ghri-ni-Nee respectively is used for eleven and twelve. It is revealing by various organizations nowadays also.

But Gurung people who have border knowledge in language they count the number differently, for eleven, One ten and one ones, one ten two ones for twelve and so on. In their own system it is used as 'chu ghree' for 11, chu nhi for 12 and so on from table.

Table no.3

Number	In Gurung language
11	chue ghri (च्यु घ्रि)
12	chue ngihan (च्यु ङिह)
13	chue shon (च्यु सों)
14	chue plhi (च्यु प्लिह)
15	chue Nghan (च्यु ङहँ)
16	chue tahu (च्यु टहु)
17	chue yhi (च्यु ञिँ)
18	chue phre (च्यु प्रे)
19	chue ku (च्यु कु)
20	ngihan chue (ङिहँ च्यु)

Other familiar based numbers are shown in the following table.

Table no.4

Number	In Gurung language
10	Chue (च्यु)
20	Nghian chue (ङिह च्यु)
30	Shon chue(सो च्यु)
40	Plhi chue (प्लिह च्यु)
50	Nghan chue (ङह च्यु)
60	Tahu chue (टहु च्यु)
70	Yhi chue (ञिँ च्यु)
80	phre chue (प्रेच्यु)
90	ku chue (कु च्यु)
100	phra (प्रह)
200	Ngihan phra (ङि प्रह)
500	Nghan phra (ङह प्रह)
1000	Hajar ghri (हजार घ्रि)

Though regular 10 base numbers are used normally as shown in above table. Like 'Pre chue' for eighty, 'phra' for hundred and 'Nhi phra' for two hundred. But for other number they use as shown in the following table:

Table no.5

Number	In Gurung Language	In English language
37	Shon chue se yhi (सोँच्युसे ञिँ)	thirty seven
53	Nghan chue se shon (ङह्च्यु सोँ)	fifty three
71	yhi chue se ghri (ञिँच्युसे घ्रि)	seventy one
94	Ku chue se phli (कुच्युसे प्लिह)	ninety four
98	Ku chue se phre (कुच्युसे प्रे)	ninety eight
102	praha ghri ngihan (प्र घ्रि ङिहँ)	one hundred and two
717	phra yhi chue yhi (प्रञि च्युञिँ)	seven hundred and seventeen

Numeration system and pronunciation is same as their own system but little bit different than in Devnagarik system. For example, in Gurung to numeration system, seven tens and one is said to for seventy one. In Hindu Arabic numeration directly 'Sattrai' is pronounced for seventy. Although it is not exactly as Arabic system but in core, it is not far from the Hindu Arabic system. The above table is also the description of some irregular numeration system in Gurung Numeral system.

B. Grouping system

Hindu Arabic number system is a base to grouping system with decimal place value. So it has a positional grouping system it is considered to be a calculating machine because it makes column arithmetic simple through positional notation and use of zero as a place zero.

The number system of Gurung is a base 10: but they don't use zero on number. A part from the group of 10 they use other groups of numbers are 20, 30,40,50,60,70,80,90 hundred. But for thousand they use 'hajar ghree' like as Hindu Arabic system.

Mostly the old generation use base 10.on counting, grouping, interpreting any data. But the literate and younger people of Gurung didn't use grouping as used by old generation. They used only group of 10, but sometime group of 20, group of 100 and group of thousand also.

C. Recording system

Gurung has no written language and numerals. In the view at some people, Gurung had their written language, it was related to the Tibetan language, but all do not accept this saying. They used Devnagari, on writing. Now a day's some literate use Nepali and English to express their views.

All mathematical work is done orally. Thus their recording system is not the same for all, in their community because they don't have any symbol to represent particular number. Smaller amount recording memory, they use grain, stone or hand finger for resolution of the problem of memory load. These are for only short period. For long period record, they mark in stick or make knots in the rope, use grain, stone etc according to their own codes. So recording systems have no uniformity. Those recording system are used on the activities for money borrowing or lending to each other or, selling or purchasing grains. Most of the old did not know the numbers at formal system but a few literate learnt numerals of devnagari and own language to represent to record in memory.

5.2 Basic operation

The process of basic operation used by Gurung people is oral and their mental processes are discussed below.

a) Addition

Mostly Gurung did not feel necessary to count more than 10, some of them counted 20, 30, 40,…..up to 100 after 10.So they expressed any number on the group of tens and remainder. It is from that some group of 20's also. Two add two numbers together, the people of Gurung counted first number from initial level of counting to top level of that number and top level of first number made initial level for the second. Then they counted second number on the top level and made result. Some of them put sets together and counted total set. For these activities they used hand finger, grain or stone. Some calculated mentally but for greater numbers, they expressed in groups of ten's and remainder or some of them use group of 20's and remainder also, but mostly they expressed in group of ten's and remainder on their own language. To add two numbers, they

put set of groups of tens together in one side and counted and set of remainder put together in the next side and counted.

An elderly persons solved the questions of problem "what is the number at together between six tens and two (sixty two) and three tens and nine (thirty nine)? [The questions was asked by providing maize grains of the groups of 62, 39] as follows

He first expended both numbers. In the groups of Tens and remainder, the number represented as first six tens and two, second three tens and nine. Then he put together groups at twenties in one side and sets of remainder in another side. Groups at six and three tens make nine tens and two ones. So the total is 10 tens and one ones. Then the mathematical expression is.

$$62=6\times10+2$$
$$\underline{+39=3\times10+9}$$
$$= \quad 9\times10+(9+2)$$
$$= \quad 9\times10+1\times10+1$$
$$= \quad 10\times10+1$$
$$= \quad 100+1$$
$$= \quad 101$$

This is researcher's mathematical representation.

Commenting on this process, some literate persons said that the method used by illiterate Gurungs was time talking and tedious. According to them, even most of the people following that rule because of illiteracy.

Almost a sixty percentage of Gurung people in the study area were illiterate among age group of respondents. (Above 20 years) So they still use the method of ten's as mentioned above. Some of them had awareness toward formal system and had different style to add number so it indicates that the ability on skill to solve problem of addition varies in individuals with situations.

(b) Subtraction:

Subtraction was felt more difficult than addition by the people. Although people could subtract it took them more time than addition. Also a difference in the subtraction process was that they decomposed number in to different group of number (decomposing process) like 10,20,50 or 100 etc. They used decomposing process that is a sort of grouping for the solution of the problem of subtraction "if you had five 20 and seven bananas i.e.107 and two twenty and twelve ie.52, were sold then how many bananas have you now? As 107 is equal to five 20s and seven; and 52 is equal to two 20s and twelve. From five 20s, they subtracted two 20s and left three 20s. And from one 20s subtracted twelve left eight. Now two 20s, eight and seven makes two 20s and fifteen."

Three was seven ones in the first number's remainder and twelve ones in the second number. But they didn't subtract twelve from seven. On the question of why didn't they subtract from seven? They replied seven is the smaller than twelve. So seven is not sufficient to subtract from twelve. Thus it indicates that they perceive that from the smaller number, greater number can't be subtracted.

Mathematically it can be written as

$$
\begin{aligned}
107 &= 5\times20+7 \\
-52 &= \underline{(2\times20+12)} \\
&= 3\times20+ (7-12) \\
&= (2\times20) + (1\times20-12) +7 \\
&= 2\times20+ (8+7) \\
&= 2\times20+15 \\
&= 55
\end{aligned}
$$

Note: For smaller number (less than 20) they computed mentally without difficulty.

Alternatively by the literate person solved above problem as:

"107 is the same as two 503 and seven; and 52 is the same as one 50 and two. From two 505 subtract one 50 leaves one 50 and from seven subtract two leaves five. Thus one 50 and five makes 55."

107 =50×2+7
-52 =50×1+2
55 =50×1++ (7-2)
= 50×1+5
= 55

It showed that before subtraction between any two numbers they expressed the number in the form of 20's, 50's00 100's. Most of them expressed in to the form of 20's. At first they subtracted between the group of twenties and then remainders.

Thus decomposition rules were different in the old age and young- age group people. Young age group had seen somehow, the effectiveness of formal rule, old age group remained totally on traditional way. So, method of subtraction seems changeable because of their contact with other community which was shown in some young age group and literate person in the study area.

(c) Multiplication

It is the short form of addition. If has repeated grouping process. Gurung computed the multiplication problem as addition. They put together the same types of groups in one place and counted.

It just took more time compared with addition in the Question of 'if there are 35/35goats in four places, how many goats would there have in total? Solved as'35 means one twenty and fifteen. Four place one twenty makes four twenties. From one pair of 15s also makes one 20 and ten. Now here all are six 20s. And from ten and ten makes one 20. In total seven 20s.

Mathematically if can be represented like.

$$
\begin{aligned}
35\times4 &= (1\times20+15)\times4 \\
&= (20\times4)+15\times4 \\
&= 20\times4+(15+15)+(15+15) \\
&= 20\times4+20+20+10+10 \\
&= 20\times6+10+10 \\
&= 20\times6+20 \\
&= 20\times7 \\
&= 140
\end{aligned}
$$

Without feeling any difficulty, they solved problems like 5×2. It is quite different by solving literate people. They solved it orally as 'twos 35 equals 70 and another twos 35 equals 70. Now two 70s which equals 140.

Thus it indicated that ability and skill to solve the problem of multiplication was different according to individual's mathematical ideas and knowledge. Base 20 multiplicative grouping system was the easy expression for multiplication.

d) Division system

Basically base 20 is based to divide any numbers. They express dividend number in the form of 20s. If the expression of 20s couldn't be divided in groups of twenty, they again decomposed in the groups of 10s. After following this process, they divided the remainders and made result. For smaller number people divided number making of 2's or 5's groups of 2's or 5's of number are calculated mentally. For greater number, they used group of 100 and group of 500. They had never made greater number practices except the money problem. Sometimes they made mistakes while in division. It is quite difficult task.

While to solve the problem 64 is equally divided for four persons, how will each get? 64 equal three 20s and four, three 20s is equal to six 10s, each gets

10/10and leave 10s. From two 10s, each gets 5/5. From four each gets 1/1. Thus one 10, five ones and one makes sixteen.

Mathematically:

$$64 \div 4 = (3\times20+4) \div 4$$
$$= (3\times20) \div 4 + 4 \div 4$$
$$= (6\times10) \div 4 + 4 \div 4$$
$$= [4\times10 \div 4] + [(2\times10) \div 4)] + 4 \div 4$$
$$= 10 + [1\times20 \div 4] + 4 \div 4$$
$$= 10+5+ (4 \div 4)$$
$$= 10+5+1$$
$$= 16$$

Note: Base 100; 200; 500 and 1000 are used to solve the problems based on division.

5.3 Measurement system

(a) Measurement of length and Distance.

Traditional way of measurement is used till the data. There are natural objects as standards. For short measurement the standard is the distance between the elbow and the tip of their middle finger. The length is measured as in Nepali 'Heat'. The shorter length called 'amla' in Nepali and Gurung both. Moreover, shorter length is measured in 'bitta' length of stretched palm or in 'kurut'.

The way of length conversions is presented below:

9 Amla = 1 kurut

10 Amla = 1 Bitta

2 Bitta = 1 haat ' Ghree yho '

In the time of construction, breadth and height were measured in haat 'yho'. More than seventy percent of them knew about 'inch' and 'foot'. Only a few

younger and literate persons knew about centimeter and meter. But these units were not used. Thus, many people were aware of new units of length measurement in foot and inch.

In case of measuring distance, half of the Gurung people in the study didn't know how far it is only literate person knew it. Even they used to indicate distance by comparing the distance up to other known place.

(b) Area Measurement

Though direct measuring rods were not used by Gurung traditionally. But in case of construction of buildings, they estimate area of land by stretching the rope to the required shape. Ropes of fixed measurement of length and breaths with hand are made which are used to measure required length of the ground.

When to measure farmland, it is measured in terms of the quantity of the seed of corn required to sow Seed quantity is measured in Mana or kuruwa. A 'Mana' is the unit of farm land measurement. kuruwa is the bigger unit of farmland measurement. In measuring large quantity 'pathi' is used. Appromately one mana of seed is used to grow for 134 sq. meters.

Another traditional way for measuring area is 'ploughing'. It is carried by using oxen. Size of their land area is measured with ploughing in a day as the measurement unit. The size of land that could be ploughed in one day varies because of season and capacity of ploughing by ploughman and two oxen. It is estimated mainly in time of planting corn. It average one ploughing measurement unit 'one hal' or 'Ghree hal' which equals to 2.5sq km ie.806 square meters.

For the official use of measuring area in Gurung bigha, katta ropani and dhur are used. But it is found only in less number.

(c) Volume Measurement

In a survey, it is found that 'Muthi', 'Mana', kuruwa', 'pathi', 'muri' are dominant measures for measuring volume. The familiar units' conversions are presented below.

2 Dhewa - 1 Mung (panch muthi)

2 Mungs - 1 Mana

8 Manas - 1 Pathi

20 Pathis - 1 Muri

Mana and kuruwa are the measurement of volume held on the basis daily use of pots. Pathis are measured in dakar (a bamboo basket) and muris are measured in bhakari.The less amount than 'dhewa' is measured as 'chimti'.

Grains of corn; bean, rice, millet, wheat etc. are measured in 'mana' or 'kuruwa'. For the purpose of measuring such quantity, they make measuring pots. Out to form cylindrical containers. Water is measured in the 'lota' or gagri.

(d) Weight measurement

In Gurung groups/tribes weight is mainly limited to trading of ghee, milk and meat. Sometimes food grains is weighted. The weight device used in this task is 'tulo' which is made of iron bar and has fixed blob of mass on one side. The other side's carry a *nanglo* (a bamboo plate) tighted by rapes. The suspension could be shifted at different measure marks on the iron bar to balance the weight. It is considered that 'phulis' which is shown by iron bar determines weight. 'Dharni' and 'Bisauli' are the expression by which higher weight is measured.

General conversion of weight

1 dharni - 2 bisauli, (2.5 kg approx).

1 bisauli - 2 barha pal

1 barhapal - 2 bodi

The other units of weight measurement are Thurmi (made up of wood of jackfruit or Daar) chauthai etc. Nowadays by younger and educated ones used litre\kg as the standard measure of Wight.

CHAPTER: VI

SUMMARY, FINDINGS, CONCLUSION AND RECOMMENDATION

6.1 Summary

In the time of globalization in 21st century that narrower the world distance. The daily communication involves the frequent use of mathematical concept and people use mathematical concept, thus environment or the culture of the people determines their mathematical ideas. Keeping this important fact in mind, the present study was carried upon an ethnic group (Gurung) community. The study was concerned with exploring the existence of mathematical concepts and processes used by Gurung people in Ghadruk.The main purpose of the study were to explore the counting system to find out the way of doing four fundamental operations in mathematics moreover uses of such operations in Gurung community.

This study is descriptive in nature because of its survey in ethnographic basic. The researcher had selected the study area in Ghadruk in kaski district which is considered as the originality of Gurung cast. It is found that various types of customs. Language and believes are prevalent about the Gurung community in Ghandruk. Though land structure is almost sloppy, land is fertile. Questionnaire was designed by based on the Gurung's activities and series of inter connections which were carried to fulfill the purpose of study. With the help of the social worker, 21 persons as respondents from different age group in the first phase. Two methods were carried out to collect data i.e. interview and observation. Answers given by respondents were recorded on note copy and analyzed in a descriptive way.

6.2 Findings of the Study

The following result has been depicted after the analysis of collected data.

- The numeration system of Gurung is base 10 and 20 both. They have only ten number name in their native language. For the greater numbers above ten they have followed as Nepali 'Devnagarik' system.
- Except the groups of base 10 and 20, they used other groupings as 50,100,200,500 and 1000.But individually it is varied also.
- In the Gurungs groups in Ghandruk have their own system of counting and measurement system. Most of their calculations are based on the traditional practices.
- Though the written documents about the numeration based on Gurung language is not found easily but somewhere else it is found.
- In case of operation of mathematical process, addition and multiplication are easier than subtraction and division.
- For the addition of two numbers or quantities. They make groups of 20s and then counting by cummulation process. For this they use grain, stone or finger. They used to use this process when there will be complication.
- While doing subtraction. Gurungs decompose groups of the number like 10, 20,100,500 etc. But widely used system is decomposing group of 20s. But greater number is not subtracted from smaller in their own system.
- Problems of multiplication are done as repetitive addition technique. But they add only two numbers at a time.
- They follow the subtraction method for division process or decompose process is used for division.
- Traditionally lengths are measured with 'hand' and finger' width but 'meter' and 'kilometer' in modern time.
- Area of field is measured in terms of ploughing time.

- Volume is calculated according to the production of grains. But nowadays standard means are also adopted.
- Weight is measured with the help of 'Tulo' which is a local measurement device. General units of this measure are 'dharni' 'bisauli', etc.
- Nowadays younger and literate people are becoming aware of formal system of mathematical concept and processes.

6.3 Conclusion

The concept of using mathematical knowledge in real application is varied among the castes or different tribes. Among them, in Gurung they have also different way of using mathematical knowledge. The systems were locally developed in the past. Even these systems are very simple and not abstract in nature. So they use their own systems of counting and measurement and math's processes for their normal day-to-day activities. Thus, these systems seem to be of practical utility in their life.

Raising rapid development of technology has made people learn modern math's concept and processes. So noone should be left behind of progress and advancement. Thus, Gurung people need to learn formal school math's. It is better to introduce ethno mathematics of Gurung in the school levels curriculum. Even though this study has not covered all the aspects of basis mathematical concepts of Gurungs like geometrical concepts. It can contribute towards local school math's curriculum of Gurung.

6.4 Recommendation for Further Study

Though the study was limited in several aspects. The finding of this study has covered in limited area. So, considering these limitations. The following recommendations have been made.

- Nepal is a diverse multicultural country. So, there are many different ethnic groups which have their own types of culture. Thus, similar study can be extended in other ethnic groups.
- This study is limited to counting system, measurement system and math's process. Similar study can be done which have not covered it like geometrical concepts, inference making about units, ethnic mathematical practices in classroom.
- The intensive study is carried out because of the bound of time limitation.
- The similar study can be extended in other subjects as well.
- It is further recommended that such study should be done to preserve the culture and customs of various ethnic groups which keep blooming the diversity of our Nation.

BIBLIOGRAPHY

A guide to the Gurung: A lan in mcfarlane and indra bahadur Gurung (PDF).

Bastola, P. (1996), An' Ethnographic study of Chepang in Sharki khor VDC Clutwan, Unpublished Master's Thesis, T.U.

Best, J.W. and Kahn, V (1995), Research in Education, Prentice Hall of India, Private Limited, and New Delhi.

Bista,D. B. (2000),People of Nepal, Ratna Pustak Bhandar, kathmandu.

Chaudhary, R.N.(2000). A Comparative Study of Achivement in mathematics of Primary level Students Related to parents' Educational Status. Master's Thesis, Department of Mathematics Education, T.U.

CERID (1995), Non Formal Education and Rural Income for Chepang Woman and Youth.

CERID (2033), Use of Devnagari and Hindu Arabic Numeral at Lower Secondary Schools, A Research, Report, National Education Committee, Kathmandu.

D' Ambrosio, U. (1985), Socio-Culture Bases for Mathematics Education, UNICAMP.

Danal D. messor (1990) Gurung of Nepal.

Eves, H. (1983), an Introduction to the History of Mathematics, The Sounder Series, Fifth Education.

Gautam,R.and Thapa Magar,A.K.(1994). Tribal ethnography of Nepal (Vol-I). New Delhi: Published by Book Faith India.

Handbook of Research on Mathematics Teaching and Learning Mac Millan Publishing Company (1989).

James, W.H. (1964), Today's Mathematics, California Science and Research Associates Inc. Second Edition.

Kerlinger, P.N. (1995). Foundations of Behavioural Research, New York Holit and Winston.Inc.

Koirala er.al (199),Elementary Process of learning Mathematical Concepts in Nepal A study on Maths Concepts and Process of Rasuwa Tamanga CEROD, kathmandu.

Koul, L. (1997), Meth logy of education al Research, New Delhi; Vikash publishing; house pv.Ltd.

Kumar, R. (1996), Research Methology, SAGE publications Ltd.London.

Katiwada, P.K.(1974).A Study to Compare Activity Ratio and Their Achievement in the Third Grade Mathematics conducted by Train and Untrained Teachers in the School in the Town of Birgunj. Master's Thesis, Department of Mathematics Education. T.U.

Mahoto, K.(1985). A Comparative Study of Achievement in Mathematics. Master's Thesis, Department of mathematics Education, T.U.

Maskey,S.M. (1975). A Comparative Study of Mathmatics Achievement of Primary Level Students Under Different Class Sizes. Master's Thesis, Department of Mathematics Education. T.U.

Mauri regmi, 1990, The Gurung, the thunder of Himalayas.

Neupane, S.R. (2001 Ph.D.). In H.P Upadhyay (2003). Thesis Abstract(In Mathematics Education, T.U.). Kathmandu: Kshitij Prakashan.

NCTM (1997), Multicultural and Gender Equity in the Mathematics classroom Yearbook.

Orey, D,k.(2003), pop. A study of the ethnomathematics of Globalization using the secred Mayan mat Pattern, California State University.

Pande,R.N.(2002), The Ecological Influence on Socio Economy and Culture of the Chepangs, Unpublished Master's thesis, T.U.

Pandit, R.P.(1980).Attitude of Secondary School Students and their parents towards Mathematics and Other Subjects. Master Thesis, Department of Mathematics Education, T.U.

Pokharel, k (2002),Socio-Economic condition of Chepang in Shaktikhor VDC, Chitwan, Unpublished Master's Thesis, T.U.

Rao, D.B. and Latha. D.P. (1995). Achievement in Mathematics. New Delhi: Discovery Publishing House India.

Research Centre for Educational Innovation and Development (1992). Teaching Through Mother Tongue in Primary Schools of Nepal. Tripureshwar, Kathmandu, CERID, T.D.

Sah, B.L. (2000). A Comparative study of Mathematics Achievement of Different Ethnic Groups. Master's Thesis, Department of Mathematics Education, T.U.

Shrestha, C.B.et.al.(2002). Theory and practice of Measurement and Evaluation in Education. Bhotahity, Kathmandu: Study Book Bhandar.

Shrestha, M.B. (1991). A Study of sex Different in Achievement in Mathematics of Nine Grade Students. Master's Thesis, Department of Mathematics Education, T.U.

Shrestha, D.B. (2003), The Measurement system in Newar Civilization, Unpublished Master's Degree Thesis, T.U.

Sing,A.K.(1997), Measurement and Research in Behavioral Science, MC Graw Tata.

Spence, P.L.et.al.(1976(, Building mathematical Competence in the Elementary School.

Subedi, D.B. (2000). A Comparative Study of Achievement in Mathematics of primary Level Students Due to Teachers' Gender in Teaching. Master's Thesis, Department of Mathematics Education, T.U.

Tamu. Dillijang, 2054, "Tamu jati ko parichaya".

Tiwari, S.D. (1984). A Comparative Study of Boys and Girls Attitude towards Mathematics. Master's Thesis, Department of Mathematics Education, T.U.

UNESCO (1986), Studies in Mathematics Education, Vol.5.

UNESCO (1989), Mathematics, Education and Society.

Wagle, A. (2001), Social. Culture and Economic States of Chepang, Unpublished Master's Degree thesis, T.U.

Internet sites.

- Ethnoligne prodile: Eastern Gurung Western Gurung
- www.Gurung .org.
- http//www.harkgurung.org
- http//www.tamu_pyelhu.org
- http:/en.wikipedia.org/wiki/Gurung." mumford, Stanley Royal 1989 "Himalayan dialogue. Tibetan lamas and gurung shaman in Nepal,
- http:/www.cs.uidaho.edu/the role of ethno mathematics in mathematics education.
- http://www.enthnimathematics.org/ernthnomatics and philosophy.
- http://www.ethnomath. ethnomath.org./ethnomathmatics and philosophy
- http//www.google.com/ethnomatics and its place in the history and pedagogy of mathematics
- http: //www.cs.uidaho.edu./the role of ethnomathematics in mathematics education.
- http://www.prel. org./connecting the ethnomathematics of carpet layers with school learning.

Appendix

Questionnaire

Questionnaire guidelines

- How many numbers can you count in your language?
- How do you count if you need to count more than that number?
- How do you remember money given to somebody or taken from somebody?
- How can you add two numbers like 52+29?
- What is remaining amount if you give Rs.250 from your Rs.370?
- If 27/27 sheep are kept in four places, how many sheep would have there in total?
- What would be in each share if 4165 is equally distributed among 5 persons?
- What is the way to calculate mathematical operations by literate?
- How is the length and breadth fixed while constructing house?
- What measure is used to estimate short length?
- How do you express long distance between two places?
- How much land do you have? How can you measure its production?
- How can you weigh cereals?
- Do you know any other method of measurement used by literate?