BASIC MATHEMATICAL CONCEPT AND NUMERATION SYSTEM USED BY MEWAHANG RAI COMMUNITY

A

THESIS

BY

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CHAPTER I

INTRODUCTION

Background of the Study

The concept of number and the process of counting developed, as so long before the time of recorded history, that the manner of this development is largely conjectural. It seems fair to argue that humans even in the most primitive time had some number sense. At least to the extent of recognizing some objects that were added to or taken from a small group. With the gradual evolution of society the simple counting system becomes imperative. A tribe has to know if his flock of sheep was decreasing in size. Probably the earliest way of keeping a count was by some simple tally method, employing the principle of one to one correspondence. In keeping a count could also be maintained by making a collection of pebbles or sticks, by making scratches in the dirt or on a stone, by cutting notches in a piece of wood, or by tying knots in a string. Then perhaps later, an assortment of vocal sounds was developed as a world tally against the number of objects in a small group. Still later, with the refinement of writing an assortment of symbols were devised to stand for these numbers. Such an imagined development is supported by reports of anthropologists in their studies of present-day primitive people (Eves, 1981).

Mathematics is the study of quantity, structure, space, numbers and the development of science and technology with abstraction and logical reasoning from counting, calculation, measurement and from the study of shapes and motions of physical objectives. Mathematics begins with human civilization and practice. In ancient times mathematics originated from counting by using pieces of stones and by

cutting notches in a piece of sticks or by tying with gradual evolution of society (Eves, 1881).

Mathematics is the subject that has significant impacts on person and activities. Every people needs mathematics to solve the problems in their daily activities. The development of mathematics has its far history with the development of human civilization. "Mathematics is used throughout the whole world as an essential tool in many fields, including natural science, engineering, medicine and the social science" (Bell,2008).

The development of both number counting and math processes were based on simple interactions between people with regard to physical objects in their own environment. Number recording needs a counter, fingers and toes are clearly the handiest of all counters therefore, a counting system based on fingers (10), fingers, and toes (10+10) were developed in many parts of the world. The invention of symbols helped to develop mathematical processes, which utilizes positional representation of numbers and operation of numbers. This made math a process: addition, subtraction, multiplication and division. Today people have developed several forms of number counting: some of base2, some of base 5, sum of base 10, sum of base 20 and so on. Some ancient counting systems have already become absolute and some others that have survived gradually being replaced by new systems. For example, in France, quainter vignette dig means four twenties and ten. The previous British monetary system of 20 shillings = 1pound was based on 20 (CERID, 1990).

A community is a small or large social unit who has something in common, such as norms, religion, values, or identity. Most of the countries in the world are multicultural, multilingual and multi –religious. Mathematics is now considered as

social creation. Culture is the contributing factor for the development of mathematics.

Mathematics plays a vital role in the development of culture and civilization. Since

ethno, mathematics refers to the mathematics practiced in cultural groups. It is

different from one culture group to another culture group. Ethno-mathematics is

recognized as a set of mathematical practice, which is known in culturally different

groups. Although mathematics is considered as a universal language, the way of

teaching and learning mathematics such as simple operations, counting, estimating,

calculation, measuring etc. are culturally dependent and therefore different (Acharya,

2017).

Introduction of Mewahang Rai Community

Nepal is a multi-culture, multi-religion, multi-ethnic country. Nepal is a

landlocked country in Asia, which is sandwiched between two very large countries,

China and India. The total area is 147,181 square km and it has around 3 million

population in number. Even Nepal is small in size and it is rich in cultural diversity.

So, in this sense we can say that Nepal is a multicultural, multi diversity country.

More than 123 languages are spoken as mother tongue in Nepal. Similarly, fifty five

ethnic groups who live in a variety of geographical diverse regions that stretches from

just a few meters of sea level to the tallest point (the Mount Everest) in the world.

The Mewahang Rai origin place is near to Sankhuwa khola. It is situated in

Koshi zone, which is situated in eastern hill side of Sankhuwasava district. Mewahang

Rai mainly live in Shilichong Municipality Bala, Sisuwa, Tamku, and Yaphu. Now,

some of the people have also migrated to Bhojpur, Illam, Morang, Sunsari,

Kathmandu, Darjeeling and UK. Mewahang is a language spoken by Mewahang rai

people. The Mewahang Rai language is related to Sino-Tibetan family. It is ground

under the East Himalayish or Kirati languages of the Himalayaish subsection of the

Bodic section of the Tibeto-Burman branch of Sino-Tibetan family. The Yamphu and Lohorung languages are close to Mewahang Rai genetically and Kulung Rai geographically.

According to the population Census, 2001 the total population of Mewahang mother tongue speakers in Nepal is 904 which is less than 0.01% of the total population. Their largest number of speakers is found in Sankhuwasava district. The Nepali language being an official language and so- called educated people's interest to educate their children through the medium of English, Mewahang speakers are decreasing day by day. According to the population, Census, 2068 the Mewahang Rai have a total 3700. The Mewahang Rai are divided into 46 clans or steps: Langchhawa, Temmora, Ketra, Lumluwa etc.

Statement of the Problem

Nepal is a multi-ethnic, multi-cultural and multi-lingual country with 3 million population of 125 ethnic groups and 123 mother languages (National Population Census, 2011). There are many ethnic groups in Nepal and every group has its own religious, social, professional and cultural belief. Most of the ethnic group have their own mathematical knowledge, counting system, concepts and problem solving methods, which are almost undiscovered. They occupy the traditional occupation from generation to generation. The mathematical concepts and processes are transmitted from generation to generation. The Mewahang Rai provides a clear example of such a group.

Every cast has its own cultural heritage and way of living. Mathematics is now considered as social creation. Culture is the contributing factor for the development of mathematics. Mathematics plays a vital role in the development of culture and

civilization and vice versa. Every culture has its own way of defining and understanding towards the phenomena. Therefore, every culture has its own way of measuring, calculating and doing mathematical processes. Hence, the cultural diversity and the equality of learning opportunities have been considered as one of the problems of mathematics. So ethno-mathematics has emerged as one issue in mathematics. Mewahang Rai is one marginalized caste. Their cultural activities are different from other cultures but studies have been conducted dealing with ethno-mathematics of Mewahang Rai community in Nepal. Therefore, I intended to study the elementary arithmetical concept, process, and social culture practice in the Mewahang Rai community. I also belong to the Mewahang Rai community and well know about the culture, lifestyle and practices of mathematics in this community. Mewahang Rai is one of the disadvantaged and backward groups. Their mathematical concepts and processes are different from the modern formal mathematical concepts. So, I selected this topic to study the basic mathematical concept and numeration system that is practices in the Mewahang Rai community.

Objectives of the Study

The major objectives of this study were to explore the ethno-mathematics practices in the Mewahang Rai community at SankhuwaSava District. The main objective of the study are as follows:

1. To the counting numerations system used in the Mewahang Rai community.
2. To explore the measurement system used in the Mewahang Rai community.
3. To find out the basic geometrical practices in the Mewahang Rai community.

Research Questions

The following questions were used in this study to fulfill the objectives of this study:

1. What is the nature of the counting and numeration system that is practiced by the Mewahang Rai community?

2. What is the measurement system practiced by the Mewahang Rai community?

3. What kinds of geometrical concepts were practice by the Mewahang Rai community?

Justification of the Study

This study reflects and represents the indigenous mathematical knowledge practice in the Mewahang Rai community. This study will be helpful for mathematics teachers, researcher educators' students, and mathematicians as well as other people who are interested in understanding the artifact of culture Meawhang Rai and its relations to basic mathematical concepts. The degree of the development in basic Mathematical concepts depends upon the opportunity to handle different objectives in the environment. Every ethnic group has their own occupation and lifestyle. During the occupation and activities, people use mathematical ideas to solve their occupational problems. The rationale of this study was to know what the Mewahang Rai know and how they learn mathematical knowledge in their everyday activities. This study focused on the mathematical ideas, traditional knowledge and notations practiced by different cultural and occupation groups of Mewahang Rai. This study has both theoretical and practical values and this study would have a greater significance for development of the curriculum of primary school.

The justification of this study were as follows:

- This study is adding a new dimension in the field of Ethno-mathematics.

- This study would be helpful to identify the counting system, measurement system and algorithm of basic mathematical operation practiced by Mewahang Rai.

- This study helps to make the content of mathematics in primary level, if primary education is given the mother tongue.

- This study may help to promote mathematical knowledge and skill of the Mewahang Rai community.

- This study would be helpful to the curriculum designer, educational planner, politicians and parents would also be obligated to think about the ethno-mathematics and it is incorporated in the school curriculum.

- The study helps to remove mathematical anxiety, practicing multicultural curriculum. As well as it helps to develop the students research habit on mathematical content. Similarly, the students will apply the mathematical knowledge in their daily life activities.

Delimitation of the Study

There are many ethnic groups in Nepal with their own culture, customs, language, lifestyle, dressing, tradition and mathematical system and the study can be done in many aspects of the community. This study had been carried out only about mathematical ideas and measurement in the Mewahang Rai community. This study has been executed in a disadvantaged and backward community with a small number of respondents.

This study has the following limitations:

- This study was based on ethno-mathematical concepts that were practiced in the Mewahang Rai community of Shilichong Municipality, Sankhuwa Sava district.

- This study was concerned with the measurement system, counting system, basic mathematical concept and numeration system that was practiced by the Mewahang Rai community.

- The sample of the study was indigenous people of ten Meawhang Rai.

- This study was based on qualitative design.

- This study was based on only the Mewahang Rai ethnic group.

Definition of Key Terms

Basic Mathematical Concept. Mathematical concept refers to the abstract idea that is concept of numbers, counting, calculating, measuring etc. in the Mewahang Rai

Mathematical process. The computation with numbers makes rules to compute in Mewahang Rai community.

Numeration system. A numeral system is a writing system for expressing numbers; that is, a mathematical notation for representing numbers of a given set, using digits or others symbols in a consistent manner in Mewahang Rai community.

Measurement system. In this system, it refers to the technique of measurement, which includes length/ distance, area, volume and weight.

Mewahang Rai. Mewahang Rai refers to an indigenous ethnic group of Nepal. Mewahang Rais are member of Kirat.

Ethno-mathematics. The study of mathematics techniques used by Mewahang Rai community identifies cultural groups in understanding, explaining and managing problems and activities in their environment.

Community. Community is everybody, adults and children, social and non-social persons, living in a certain territory where all share a mode of life, but not all are conscious of its organization or purpose. Community is the smallest territorial group that can embrace all aspects of social life.

Ethnic Group. A type of group contained within the national boundaries defined by race, religious or national origin. In Nepal, there are many kinds of people with their culture, norms and values. A category of people who identify with each other based on common ancestral, society, culture or notion who share a common cultural background, which is Mewahang Rai caste.

Culture. In my study culture, means a limited area where there are many people living who have their own languages, rules, norms, values who share common things.

Practices. Systematic use by repetition in behavior. In this study practices means what types of activities do in their everyday activities. Specially in counting system, measurement system

CHAPTER II

LITERATURE REVIEW

This chapter is related with empirical literature, theoretical and conceptual framework of the study. A collective body of work done by scientists is technically called the literature. Review of related literature is an important part of the research because it supports to identifying variables relevant to research, to avoid the repetition and synthesis of prior works. It also determines the meanings and relationship among the variables (Sing, 2008). This chapter includes the different features of articles, journals and findings of different researches in the field of basic mathematical concept and numeration system used by the Mewahang Rai community. The main purposes of related literature is to identify the basic mathematical concept and numeration system used by Mewahang Rai community. This chapter deals with the work carried out in the area of this research project, theories and interpretation ever found the literature reviewed were previous theories, books, journals, articles and internet resources.

There are two types of literature review named: empirical literature and theoretical literature. The empirical literature includes the different research in the area of basic mathematical concept and numeration system used by the Mewahang Rai community and theoretical literature for linking different theories.

Review of related literature is an essential part of the research for the researcher. A brief summary of previous research and the writing of recognized experts provide evidence that the researcher is familiar with what is already known, and with what is still unknown and untested. By understanding a literature review we are able to critically summarize the current knowledge in the area under investigation. By reading many different studies. We would begin to gain an impression about the

important aspects of the topic, identify data source that other researcher has used, identify and become familiar with style of writing that is used- particularly within the ethos of the area that we are researching , identify ideas for further consideration and create our own reading critiquing strategy.

Mathematics is the cultural aspect of society. ''Mathematics is identified in cultural activities in traditional and non-traditional societies" (Orey & Rosa, 2007). So I have collected some books, journals, articles, researches which are related to Mathematical concepts and processes which are used in different Ethnic groups. This means that ethno-mathematics refers to mathematical concepts embedded in cultural practices. Many reviews highlighted the benefits of culturally relevant education for supporting student learning. In this part, I reviewed some documents related to my study. I am going to review the related literature by organizing as; empirical review and theoretical review are as follows:

Empirical Review

Thapa (2011) had conducted the research on the basic mathematical concept and process used by the Magar community in Sindhuli district. This study had selected Dadiguranse VDC of Sindhuli District for the study area and only seven respondents were taken for interview. Interview and observation were adopted as data collection methods. Shorting and making interpretation techniques were used for analysis and interpretation of data. He concluded that:

Base 10 and base 20-numeration system has been practiced in the Magar community for counting purposes. Magar had no own separate script. So there was no specific symbol to represent the particular numbers. Simple mathematical operations were applied orally but not any written documents were found. The Magar people of

Sindhuli had their own system of counting and measurement and their own mathematical processes. All these processes were based on traditional practice. To solve the additional and subtraction problems, they express the number of groups of 5,10,20,50 and 100 etc. According to the nature of numbers .Then, they first add or subtract based on grouping and express their answer in a grouping system as far as possible. Magar people solve the problem of multiplication as repeated addition. So they took a long time to solve the multiplication problem. To solve the division they first expressed divided in different forms of groups and remainders. They generally form the groups of 5, 10, 20, 50, 100etc.According to the nature of division. In this community, length was measured with hand and figure, volume was measured with different types of pots. Weight is measured with 'Tulo'. Old people used their own shadow to calculate the time. Young and literate also used to the counting system and they also wanted to use formal and short cut methods to solve mathematical problems.

Rai (2011) had studied Mathematical Concept and process practiced by Dumi Rai at Khotang District. He used qualitative research design. He selected Jalapa VDC of Khotang district for the study area and only 25 respondents were taken for interview. For data collection methods interview, observation and related published and unpublished documents were used. He found that Dumi Rai people have two types of numeration systems. They use their own counting number in Dumi language as well as place value system. They have a mathematical process that is a simple commutative process. Addition and multiplication are done by grouping and addition process. Numbers are decomposed in different groups of the numbers for division. They have their own traditional system of measurement. Length is measured with hand fingers, and hand. Area of land is measured according to seeding and plugging time. Volume is measured by 'muthi', 'mana', 'pathi' and 'muri'.

Gurung (2014) has researched on topic, "Mathematics in the Gurung community". She used an ethnography approach in her research. She found that Gurung communities have their own mathematical practices such as counting number, number system, measuring system, addition, subtraction, multiplication, division and properties of rectangle. Those were possible to incorporate in the school mathematical curriculum. In empirical research in a divergent community, the researchers found that there are several ethno- mathematical practices and are able to incorporate in school mathematics curriculum.

CREID (1990) conducted a research on title "Elementary process of Learning Mathematical Concepts of Process of Rasuwa Tamangs".The purpose of that study was to identify the basic mathematical concepts used by Tamang adult with no formal mathematical education, to identify traditional Tamang method of mathematical operation and to find out the implication of Tamang have their own system of measurement counting and their own mathematical processes and geometrical concepts. The study has also shown the situation of children into the formal system. However, it did not study the effect of ethnic mathematics practice in the classroom. The study concluded that Tamang numeration system is base twenty and Tamang have their traditional distinct concept for calculation, measurement and mathematical work.

Dhakal (2009) carried out the study entitled "A carpenter developing mathematical concepts in this surroundings." The study seeks to identify what types of mathematical concepts the carpenter needs. To investigate the effect of social cultural effect mathematical thinking. His research tools were participant observation, interview and photographs. The result shows that the carpenter applied mathematical concepts knowingly or unknowingly to make a cupboard, table, bed, seat, rack, door

etc. To make above lists of materials he uses different mathematical concepts like; plan, perpendicular, parallel, congruence, triangle, center etc. A carpenter acquired some knowledge by seeing others, doing the work, practicing and by feelings.

UNESCO (2008) has carried out the study on "Developing Culturally Contextualized Mathematics Resource Materials: Capturing Logical Practices of Tamang and Gopali Dhakal Communities". In this study, it found that they have prepared five sets of curriculum resource materials for mathematics teaching and teaching as well encouraging parents to help their children for understanding of the mathematical concept from their household activities. In third position, they have also prepared materials for geometry named as 'Grand Tour of Geometry' where they explored the geometrical concepts dealing with various artifacts such as Doko (wicker basket), Ghum (locally prepared rain shield cover), structure of house and temple. Through this study, they found that parents, teachers and students were very positive towards culturally responsive teaching learning and curriculum materials.

Dhakal (2008) has studied the "Basic mathematical concept and process of the Raji Ethnic Group". The purpose of the study was to study the counting system of the Raji ethnic group, to find the way of the four basic mathematical operations practiced by the Raji ethnic group. She concluded that ethnic group has been 10 (young /literate people) and base 20 (traditional people) practiced in their community. They do not have their own symbol for native name of numbers. Their counting system, measurement system and operation system are also the same general but language is different. Nowadays, literate and younger people also use Hindu-Arabic counting system and they use short cut methods to solve mathematical problems.

Chemjong (2013) studied on "Basic Mathematical Concept that Practiced by Limbu Community" and concluded that Limbu community have their own script

numbers of notation which were developed by the king Sirijanagha and rediscovered by the second Sirijuga which is called Kiranti script. The numeration system of the Limbu community is base 10. Limbu scripts have also been identified as the natural cardinal numbers which are hope = zero, lacha =aak, fangshi=nau. They mostly prefer to construct geometrical objects, which are triangles, spheres, circles and rectangles and use parallel axioms. They have concepts of x-axis and y-axis.

Erdogan & Sengul (2014) did research on "A study on the elementary school student's mathematics self-concept". The purpose of this study was to investigate the elementary school students, mathematics self- concept level regarding their grade level and gender. Relational survey method was used in this study. The research sample was composed of 281 students, determined randomly from primary and secondary school in Istanbul in the spring term of 2013-2014 academic years. Data collected using the self -description questionnaire. The results of the analyses indicate that there is a statically difference between elementary school students' mathematics self-concept levels based on their grade levels. Furthermore there was a significant difference in elementary school students' mathematics self- concept levels point of view gender.

Research Gap

From the above discussion of related literature, very few studies have been carried out around the field of ethno-mathematics with respect to the Mewahang Rai community. Among these practices, some were directly related to learning strategies of mathematical concepts of different ethnic groups. But this study tried to find indigenous mathematical knowledge used by Mewahang Rai people. These cultural groups perform their mathematical problems by their own style. The review of above literature motivated me to study the mathematical knowledge practice in cultural

activities of the Mewahang Rai community. Therefore, on this ground, I am motivated to carry out this study entitled Basic mathematical concept and numeration system used by the Mewahang Rai community.

Theoretical Literature

In this chapter, I reviewed some theories related to my study. There are various theories about learning mathematics, ethno-mathematics, constructivism and ethnography. There are many social as well as learning theories, for the study, the researcher introduces the theoretical discussion in this chapter. The constructivism theory and Vygotsky theory of social constructivism have been used for the interpretation of the findings of the study. Some reviews, which are presented below:

Constructivism

In general, constructivism means kind of consideration about in general, constructivism means kind of consideration about themes and builds up the strong mental plan, so different individuals have their own construction about existing constructivist theory posits that student make sense of the word by synthesizing new experience into what they have previously understood. They form rules through reflection on their interaction with objects and ideas, when they encounter an object, idea and relationship that do not make sense to them .They either interpret what they see to conform their rules or they adjust their rules to better account for the new information (Brook and Brook, 1993).

Constructivism stands on its three axioms that are as follows:

1. Learners learn knowledge from their active participation.
2. Learners gain knowledge while reflecting on their own action.
3. Learners gain knowledge when they try to convey their solution to others.

Social Constructivism

Social constructivism is the trend within the modern field of sociology of knowledge. Sociological knowledge is an epistemological discussion of knowledge that is created and acquired. Social construction has been used for the interpretation of the finding study. Social constructivism emphasizes the importance of culture and context in understanding what occurs in society and constructing knowledge based on this understanding (Derry, 1999 ; McMohan,1997).Similarly according to social constructivism, knowledge is the best constructed when learners collaborate together (Lama,2016). This shows that social construction believes the multiple constructions of the word.

According to social constructivist Vygotsky, knowledge is constructed in two ways in the social context. Firstly social interactions influence the nature of knowledge that is constructed and processes of individual use to construct that knowledge. Thus the constructions are socially centered in value, process of knowledge on children to children to gain knowledge is a process of observing, reflection, thinking, performing, practiced and creation to fulfil each and every mathematical need applied mathematical concepts knowingly or unknowingly.

Mewahang Rai has lived with their culture, environment and society. As a rule, naturally there is an intersection between society, culture and environment. According to social constructivism people gained knowledge from intersection among culture Society and Environment. They have to fulfil their needs to solve problems, which they face during life. They get knowledge and concept from experience. Their knowledge and concepts are transformed into junior persons. These processes of learning of mathematical concepts become a system after a period so that this theory is applied in my study (Pandit, 2014).

Cognitive Constructivism

Cognitive constructivism is based on the work of Swiss developmental psychologist Jean Piaget. Piaget's theory has two major parts. "Ages and Stages" which predicts what children can and can't understand at different age and a theory of development that describes how children develop cognitive constructivism approaches to learning Piaget's theory of cognitive development suggest that human can't be given information which he/she automatically understand and use they must "construct" their own knowledge. They have built their knowledge through experience, which allows them to create mental images in their head. Cognitive prospect theories focus on both what people learn and the process by which they do so.

Piaget's theory of development proposes that humans cannot "be given" information which they immediately understand and use. Instead, humans must "construct" his or her own knowledge. They build their knowledge through experience. Experience enables them to create models in their heads. The cognitive constructivism holds that preparation or cognition is largely influenced by culture, environment, social activities, language and the form that takes shared interpretive schemes and organizational strategies. It talks about human action. How we act in the word guided by relevant interaction and belief, produced by our schemas of interpretation, the interpretive schemas suggest alternative lines of action; we then apply action schemas or strategies (Pandit,2014).

Constructivism in the Learning Mathematics

Constructivism holds that there is no knowledge that exists outside of the person, there is no objective reality. Constructivism claims that knowledge must be

activity constructed by learners as they are already "knowing beings" who bring previous knowledge and experience to any learning events (Acharya, 2015).

Constructivist teaching is based on the belief that learning occurs, as learners are actively involved in a process of meeting and knowledge construction as opposed to passively receiving information. Learners are made of meaning and knowledge. Constructivist teaching fosters critical thinking and creates motivational and independent learners. This theoretical framework holds that learning always builds on knowledge that a student already knows; this prior knowledge is called a schemes. Because all learning is filtered through pre-existing scheme, constructivists suggest that learning is more effective when a student is actively engaged in the learning process rather than attempting to receive knowledge passively. A wide variety of methods claim to be based on constructivist learning theory. Most of these methods rely on some form of guided discovery where the teacher avoids most direct instruction and attempts to lead the student through questions and activities to discover, discuss, appreciate, and verbalize the new knowledge. There are number of different forms of constructivism, but underpinning all versions are three premises;

- Rather than being passively received, knowledge is actively constructed by learners.
- Mathematical knowledge is created by students as they reflect on their physical and mental actions.

By observing relationships, identifying the patterns and making abstractions and generalizations, students come to integrate new knowledge into their existing mathematical schemas. Learning mathematics is a social process where, through dialogue and interaction, students come to construct more refined mathematical knowledge. Through engaging in the physical and social aspect of mathematics,

students come to construct more robust understanding of mathematical concepts and process through process of negotiation, explanation and justification.

Constructivism recognizes that mathematics must make sense to students if they are to retain and learn mathematics. For students to develop appropriate knowledge, they must be provided with rich learning experiences so that their constructed meaning and understanding are in keeping with the discipline of mathematics (Ernest 1991, cited in Acharya, 2015).

Lev Vygotsky

Vygotsky was a famous scholar who emphasized social constructivism. Social constructivism is a theory among several theories on constructivism. Every knowledge is socially constructed and children learn when they contract with the outer environment either verbally or observantly, Vygotsky theory is one of them that regards social interaction between peers and adults as important aspects in creation meaning making sense and conveying culture within a hard context. Knowledge is constructed in the social situation of negotiation, rather than bringing the reflection of the objective reality, which is termed as social constructivism. Social construction believes in the multiple construction of the world. In social constructivist theory, each human being makes sense of the world in a unique way. Vygotsky argue that child development cannot be understood by studying the individual that needs to examine the external world (Acharya, 2017).

Constructivism holds that there is no knowledge that exists outside of the person, there is no objective reality. Constructivism claims that knowledge must be actively constructed by learners as they are already "knowing beings" who bring previous knowledge and experience to any learning events (Acharya, 2015).

"Sociogenesis", Vygotsky affirmed, "is the key to higher behavior" (1929/1989, p.63). All that is internal in the higher functions was of necessity external at some point; it was social, a relation that was between two people, before it became an individual function. This idea achieved its fullest expression in Vygotsky's general genetic law of cultural development. Vygotsky (1934/1963) expressed the law as follows: All higher mental functions make their appearance in the course of child development twice: first, in collective activity, social activity, i.e. as intrapsychic functions , second in individual activity, as internal properties of the child's thinking, i.e. as intrapsychic functions. In social constructivism, the main three which are presented below.

Meaning Making. Learners make processes, understand or make sense of life events, relationships, and the self. Learners build up any things meaningful from society, which is the important role of society in learning.

Tools for Cognitive Development. In society there are so many tools for the learners that are culture, ancestors, senior parents, Language are the tools of knowledge from them a learner can get a lot of knowledge in learning their mobilization and their nature towards education effects the learning.

The Zone of Proximal Development (ZPD). ZPD means difference between the actual development levels as determined by the independent problem solving and level of potential development as determined through problem solving under MKO (More Knowledge Other) and solving problems from the supporters of others. In ZPD provide scaffolding- masters task remove (fading). Social interaction leads to increased knowledge. The development of ZPD with the relevance of social guidance, collaboration, and social interaction.

Conceptual Framework

A conceptual framework is used in research to outline possible courses of action or to present a preferred approach to an idea or thought. This section deals about the conceptual framework for the research. This conceptual framework was established based on research topic areas to fulfill the objectives of the theoretical framework for the study of basic mathematical concepts and numeration systems used in the Mewahang Rai community. It is related on the learning theory of constructivism. The research would conduct on the basis of the following theoretical framework**.**

Conceptual Framework for the Study
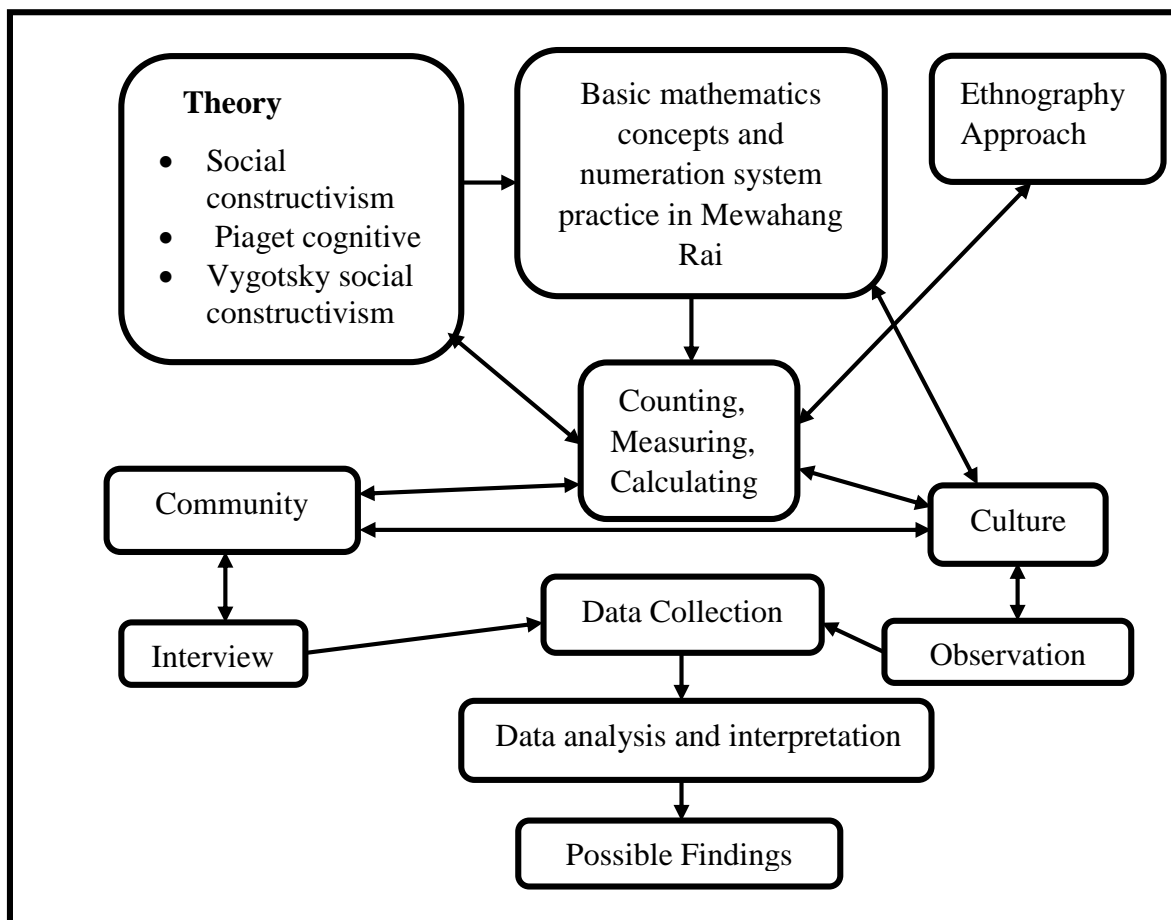
Figure No.1

Conceptual framework devised through the literature studies facilitated to attain research objectives, get the answer of the research questions and carry out the research work as a whole smoothly (Acharya, 2015). Mathematics originated along with the human civilization. Human beings themselves created mathematics in the field for application for counting and measuring in relations to both quantities as well as special objectives. Mathematics, culture and community are interrelated; mathematics is developed in the culture. People and culture form the community. There can be found counting, measuring and calculating which the parts of mathematics are. These activities can be found by observation and interview. In the above figure Mewahang Rai mathematical practices and uses is the main issue in this study depicted. Then it shows what my research design, tools for data collection is, theory which is blended in the study has shown clearly in the above framework.

CHAPTER III

METHODS AND PROCEDURE

This chapter describes the design of the plan and procedure of the study. It provides a way to research about how to conduct the research. It helps the researcher to achieve the goal or objectives of the research. It determines how the research becomes complete systematically. The method applied in this study was discussed in the following section: Research design, site selection, and sample, tools, method for data collection and analysis.

Design of the Study

This qualitative research design is a research method that is used extensively by scientists and researchers studying human behavior, opinions, themes and motivations. According to (Creswell, 2004), there are five different types of qualitative research, which are phenomenology, grounded theory, ethnography, narrative inquiry, action research and case study. My research design was ethnography in nature because it helped for systematic and scientific study of socio-culture of the Mewahang Rai community. So, qualitative research methodology guided click and every moment of study. "Qualitative research is a multi-method in focus, involving an interpretative, naturalistic approach to its subject matter" (Creswell, 2004). This means it helped the researcher to reach natural socio-cultural methods where it was concerned with people's belief, live experience and context of particular time.

Site Selection

This study was conducted at Sankhuwasava district. It was done only in Mewahang Rai community. Mewahang Rai have been living in many district and out

of country like Darjiling, Barma, Uk, Singapore. Among them, only shilichong Municipality was selected as study area. Therefore, my research was conducted Shilichong municipality of Sankhuwa Sava district.

Selection of Respondents

This study was conducted at the municipality of Shilichong in Sankhuwa Sava. It was done only by the Mewahang Rai community .This study is qualitative research. So, I used "purposive sampling" to meet relevant information that could be done with a specific purpose in mind. Ten people of Mewahang Rai community in which one teacher/Senior (Ganesh Kumar Mewahang Rai), two students, four male and three female. I had selected such personalities who were very close and familiar with their culture, language.

Population of the Study

The population of this study consisted of ten Mewahng Rai people from the Shilichong municipali of Sankhuwa Sava district who represented the Mewahang community of Neapal. And who had studied a lot of Mewahang culture and history. Who had helped to study smoothly and complete as per plan.

Tools for Data Collection

Tools are very important for the research. The tools of data collection were observation, interview and photographs. For the collection of the valid information to conduct this study, I used the following tools, the shorts descriptions of the tools as follows:

Observation

I collected information about the study area by visiting and conserving with the people, familiar with that place. I watched, asked and interacted with their daily

activities such as customs, game, working, house making, construction of any tools, counting system, measuring system, and other mathematical activities. Observation is one of the most important techniques in qualitative research. This is why; I observed the work place of the Mewahang Rai community individually and collectively during their working time. This activity helped me to identify Mewahang Rai mathematical concepts and processes. Then I observed their artifacts and the processes of how they were made. The information supplemented by the use of cameras, to take photographs. I used both the participant and non-participant observation for the study. This observation helped me to get information, which was not obtained from interviews. Observation further helped in finding the answer of different questions like, how do they work? What do they think? What type of mathematical concepts do they use in their occupation? What do they think about mathematics? Therefore, I used the observation tools. This tool helps for search the basic mathematical concept and numeration system used in the Mewahang Rai community.

In –depth Interview

Interview is a process of data collection from face to face interaction. Interview is an oral questionnaire. Most of that discussion focuses on needing the information for qualitative research. Interview helps to get the information, which could not be obtained from observation. The advantage of interviewing was that the interview explained more explicitly. The interview's purpose will get the actual information that the researcher wants. From the interview schedule, the researcher can collect primary data like how people learn mathematical concepts that they are using in their daily life whether they have learned from formal education or from daily need. (Sherpa, 2018)

For my study, at first I prepared interview guidelines including open-ended topics based on research documents, objectives of the study, suggestions from my supervisor and according to the situation of the environment. Then, I went to my own village and met the Mewahang Rai people individually. I made clear about my research proposal of research and the importance of their help. I carried out the open-ended interview along with unstructured and structured questions as well as observation.

I took the in-depth interview of the Mewahang Rai community; Mewahang Rai farmers, Senior of Mewahang Rai people, Teacher, Mewahang Rai house makers, Mewahang Rai homemaker, Mewahang Rai ancestral to collect primary data. The main objectives of the in-depth interview was to identify the basic mathematical concept and numeration system used by Mewahang Rai community and its pedagogical implication. I took an interview about cultural artifacts used in the field and its construction process, cultural objects, cultural activities. At that time, I also took photos, videos, videos recorder, and audio records and made filed notes. The data from interviews consisted of direct questions to people about their skill, experiences, ideas, knowledge of basic mathematical concept and numeration system.

Quality Standard

Lincoln and Guba (1985) propose four criteria for 'naturalistic' research. As their work to 'formalize rigor' has been particularly influential in social science generally, and in the occupational therapy field specifically, it is worth focusing on their categories in depth. Interestingly, they link (or pair) their criteria with four used conventional quantitative inquiries: those of internal validity, external validity, reliability and objectivity.

Credibility. Credibility is achieved by addressing such aspects as immersion in the environment, accurate interpretation of the data, triangulation and member checking (Lincoln & Guba, 1985 as cited in Smyth, 2006). To maintain credibility of my research, I tried to spend more time with participants for the research. The data were collected from multiple sources such as observations and interviews and got several information related to research problems. After getting information, again I met participants to make results realistic in the perspective of participants about their culture when I got that participants were eager to hear their culture activities and experience in the form of research.

Transferability. Transferability refers to findings of the research that are applicable and similar to other educational settings. In the field of research, the data generating process can be useful and similar to other researchers in the similar area. To maintain transferability of the research, I captured the daily life activities, culture, profession, and social activities of the Mewahang Rai community by observation, interview and included photos in this research. Also this study encouraged linking reader's culture and geometrical knowledge of socially available and made the education process effective and object oriented through ethno mathematics.

Dependability. To maintain dependability, I had observed and taken interview with the participants and included myself in this study. If repeated the study, the result of research would be the same from the involvement in the same place, same participants and same methodologies, when social environment is changing due to modernism.

Conformability. For Conformability, it is also important to ensure that the findings of the investigation are the result of the experiences and ideas of the participants and not the preference and characteristics of the researcher (Shenton,

2004 as cited in Vandeleur, 2010, p.127). So to the quality of the results produced by an inquiry in terms of how well they are supported by the informants (members) who are involved in the study and by the events that are independent of the inquirer. So all collected information was based on participant's views, ideas, experience and interpretation. Thus, this helps to make the research findings are true and exact on participant's practices. In this study, I had presented ideas, Views and a practice the participant has found to be the same in their daily life activities.

Data Collection in Procedure

At first, I went to the village with tools (interview guideline, observation guideline etc.) so that it made me easy as it was my own village. I discussed with Mewahang Rai farmers, leaders, senior adults, teachers and educated people. I directly told them the purpose of my research. First, I had an interview with a senior educated person. After that, I interviewed a framer, housewife. Similarly, I visited five villages (Sisuwa, Bala, Tamku, Mangatewa and Yaphu) of Sankhuwa Sava district in Shilichong municipality. At that time, I also took photos and filed notes. I took one month to collect the data in Shilichong municipality. The study emphasized practical and local traditional concepts and ideas of math practiced by them rather than abstract math. Especially I collected data in naturalistic a situation.

Data Analysis Procedure

Analysis of data means studying the organized materials in order to discover the inherent facts. The data and information gathered from the field study was analyzed and interpreted in a descriptive way. At first, I visited my village area and I measured tools of data collection needed for my research study. I used an unstructured interview and observation form. Then collected information at first was categorized

according to the basic mathematical concept and numeration system used by the Mewahang Rai community. At the time for the identification of basic mathematical concepts and pedagogical implication, I asked a research question to Mewahang Rai framer, students, teacher and senior Mewahang Rai. I took the interview according to the objectives of the study and at that time I did audio and video recording along with photos then I collected the necessary information. I coded, categorized and organized the collected data according to the objectives of the study. After finishing this task, I categorized and kept the information under the different headings.

Then I moved for my first objective to uncover the numerations system used in the Mewahang Rai community. Second objective is to explore the measurement system used in the Mewahang Rai community to find mathematics of Mewahang Rai culture. Lastly, I worked over the last objective to find out the basic geometrical practices in the Mewahang Rai community. Also, to suggest the pedagogical implication of mathematical practice Mewahang Rai culture.

Ethical Consideration

Ethical consideration can be specified as one of the most important parts of the research. Research participants should not be subjected to harm in any ways whatever. Respect for the dignity of researcher participants should be prioritized. Full constant should be obtained from the participant prior to the study.

I had many ethnic considerations to conduct the research as given below.

- I equally respect all respondents.

- I spoke politely with respondents.

- I took permission before entering the field site.

- I respected the people's rights, thought and diversity.

- I did not keep the information in control and pressure as well.

- I did not discrimination the basic respondent cast, culture, language and gender.

- I took the permission of the respondents before taking their photos, audio, video and interviews.

CHAPTER IV

ANALYSIS AND INTERPRETATION OF DATA

This is an ethnography study related to finding the basic mathematical concept and numeration system used by the Mewahang Rai community. This chapter is devoted to analyzing and interpreting the data. The data were collected from field observation, interviews and photographs. Mainly, this chapter is divided into three parts. First part was to uncover the numerations system used in the Mewahang Rai community in their daily activities. The second part includes the traditional ways of measurement of weight, measurement system, length/distance and its units. Last or third part was to find out the basic geometrical practices in Mewahang Rai community. The main idea of the research was to study the use of mathematical knowledge in traditional ways by Mewahang people without getting its formal education. In the present day all human beings feel the need for mathematical concepts as well as they use mathematical concepts in their daily life knowingly or unknowingly. Likewise, this study was entitled "Basic Mathematical concept and numeration system used by the Mewahang Rai community", which was based on ethnography methodology.

The data were collected from Silichong municipality of Sankhuwasava district, where I spent 30 days to collect required data. In these days, I observed the activities of the Mewahang Rai people (farmer, artifact and housewife) and I discussed with the farmer, artifact, housewife, senior of Mewahang Rai people and teacher. The data collected through the non-participant observation, interview and photograph. The data were analyzed and interpreted using different sub headings:

Number Concepts and Counting System

The concept of mathematics begins with the concept of counting in the ancient period. The people at that time might have used to count their family members and cattle by different things like sticks, tally marks, stone using one to one correspondence method, number ideas and special language for their expression are important mathematical development. Mathematics is an important discipline to all humans as they use it to solve their daily life problems. People in different communities use mathematics differently. One of the most influencing factors to use mathematics is community where each person starts to learn. Most of the Mewahang people live in Shilichong Municipality. Some children go to school, but they do not complete school education due to family problem and obliged to the victim of child labor.

Mathematics is an important discipline to all humans as they use it to solve their daily life problems. I asked one of the Mewahang Rai people Gaanesh Mewahang Rai about idea of numerals and counting system of Mewahang Rai,

He replied that Mewahang Rai people mostly use their native counting system (which is in practice from a long period of time). But the young children who are educated, can count the formal system. Usually, I counted numerical system in own native language such as; Ibom for 1, Hikbom for 2, Sunbom for 3, Likbom for 4, Nakbom for 5, Tukbom for 6, Rekbom for 7, Bakbom for 8, Nukbom for 9, Ipon for 10. Similarly, to see the other counting systems of Mewahang people, we can see appendix (III). From the above interview I claimed that they have their own counting system of number. I did not find their own script to record their numbers. But Mewahang Rai also used the Kirat script.

The field note of observation and interview that many kinds of mathematical knowledge were created through their experience and practice. Observation and interview showed that mathematics is socially constructed in the course of socialization, daily activities and cultural transformation through the means of communication. So Vygotsky's theory of social constructivism supports the above mentioned way of learning.

The Mewahang Rai acquired mathematical concepts from his elder father, mother, uncle and educated people. Mewahang acquired mathematical knowledge through his experience and practice. Some knowledge and mathematical concepts are obtained from observation, exploration and through the medium of mathematical communication. Creativity also helped to construct knowledge. Constructivism assumes that the learners construct their own knowledge on the basis of interaction with their environment.

Own Calendar in Mewahang Community

The Kirati's have many descendants. Mewahng Rai is one of them. And Mewahang Rai used kirat script and Kirat have their own year, which is far earlier than B.S and A.D. Recently when it is 2020 AD according to English calendar and 2077 B.S according to Nepali calendar. According to their calendar Yale Sambat (5080) belongs to Mewahangs Rai. In their native language, the year called as "Dong". Their New Year begins on the 15th Paush according to the Nepali calendar.

Mewahang Rai's holy book is Mundhum. A year is divided into two phases: Ubhauli (going up) and Udhauli (going down). This day is very important for them. They celebrate this day, they dance, and this dance name is called Sakela. On this day, they worship god Sumnima and Paruhang. They celebrate the day by having delicious foods. They have their own name for the twelve "12" months according to

their calendar. Mewahang Rai calls a month as "laa" in their native language and they have their own native language for 12 months. According to native language of Mewahang Rai calendar are as follows:

Name of 12 months in Mewahang Rai Language

S.N.	Months In AD.	Months in BS.	Months in mewahang
1	Jan/Feb	Magh	Nangwal
2	Feb/March	Falgun	Nanwala
3	March/April	Chaitra	Chewela
4	April/May	Baisakh	Yaawala
5	May/June	Jestha	Cholepla
6	June/July	Ashar	Bangmaala
7	July/Aug	Srawan	Remaala
8	Aug/Sept	Bhadau	Yakshala
9	Sept/Oct	Ashoj	Chukmila
10	Oct/Nov	Kartik	Paamlaa
11	Nov/Dec	Mangsir	Paktula
12	Dec/Jan	Push	Chewala

Also, Mewahang Rai have their own native name for a week. They use the word ' Lyen' for a week. According to the Mewahang Rai, the name of week are as follows;

Name of 7 days in Mewahang Rai Language

S.N.	English Calendar	Nepali Calendar	Mewahang Rai Calendar
1	Sunday	Aaitabaar	Ilyan
2	Monday	Somabaar	Huklyan

3	Tuesday	Mangalbaar	Sungkulyan
4	Wednesday	Budhabaar	Lillyan
5	Thursday	Bihibaar	Nanklyan
6	Friday	Sukrabaar	Bangkulyan
7	Saturday	Sanibaar	Reykulyan

Mathematical Symbol in Mewahang Rai Community

Mewahang Rai have their own native numbers' name, months' name, days 'name and they have their own native language for the basic mathematical symbols. Which are as follows:

Basic operational symbols

Mathematical sign	English name	Name of sign in Mewahang Rai
+	Addition	Khommawa
-	Subtraction	Naahwa
×	Multiplication	Dhidiahwa
÷	Divided	Haamwa
=	Equal	Aytchoahwa

Weight Measurement

In the research area, I observed that the weight measurement system was limited for trading of meat only but also nowadays, they were not using their traditional measurement system. The Mewahang measurement weight system is much influenced by the modern measurement system. The most important tools used in Mewahang Rai Community for measuring weight were a Tulo Sample person who has a grocery but he has not used Tulo.

Made by Bamboo (Bamboo Tulo)

Made by Iron (Iron Tulo)

Weighting meat by using Tulo

Figure No.2: Tulo

I asked Tulo what *he said our father and grandfather used but at present we use Taraju (balance). More specifically, Tulo is made of iron bar (stick) and has a fixed blob of mass on one side of that bar and other side carries a small nigalo or bamboo or plate thin iron, suspended by strings. The suspension could be shifted at different measure marks on the iron bar to balance the weight. The blob iron mass is working as a counter weight. Different measures are marked in the iron bar called phulos. If there are no phulos at the iron bar, they measure the weight using different measured sizes of stones. The units of weight measurement are Pasari, Dharni, Phulo, Sher, Aathpol, Hamali, Bodi. But young and educated Mewahang Rai people are slowly changing their measurement units and they have started to use modern measurement units: like Kilogram, Gram , to measure the weight of any types of objects, when they have to borrow some goods from others places and cut meat of pig, goat, chicken and fish then use their measurement units. They used the following measurement system*;

1Dharni   =   2 Bisauli

1Bisauli   =   2 Sher i.e. 1Sher   =   ½Bisauli

1Sher   =   2 Bodi i.e. 1Bodi   =   ½Sher

1Bodi   =   2 Athpol i.e. 1Athpol   =   ½Bodi

Comparison with the above measurement system with global math is,

1Dharni   = 2.5kg, this shows

1Bisauli   =1.25kg. 1 kg 250gram is the modern measurement of Bisauli.

 Sher   =½kg 125gram

Volume Measurement

In the Mewahang Rai community, measurement is mainly used to measure Hengmawa (Raksi), oil, hunney, milk etc. The volume of grain or water is usually

required while having and asking for a family and for trading of cereal and liquid materials. Sample person said that units of volume measurement widely used are chimti, muthi, pasar, mana, kuruwa, pathi, muri etc. The measurement of volume is used in daily life. Pots are such as dalo, thunche,bottle, Glass etc. They use muthi, mana, kuruwa,pathi, muri measure rice, paddy, corn, wheat, lentils etc. They measure the volume of liquid materials to measure by Kathuwa, Bottle, and Glass etc. They use Kuruwa, Dhawang pathi, different sizes can be seen in the following.

Conversion of Volume

10chimti = 1 muthi

10muthi = 1mana

8mana =1pathi

20pathi=1muri

Mana & Pathi

Muri (1muri Jane Thunche)

Length / Distance Measurement

Mewahang Rai has their own measurement system in Shilichong, Sankhuwasava. Almost every Mewahang Rai people had been adopting the traditional system of measurement through the transmission of culture; they also use the standard way and unit of measurement. The unit of measurement of long and short things are different, the short things are measured in terms of width of finger but it is not necessary to measure the two short things that are less than one inch and they cannot measure such things.

Generally, the measurement units to measure the long things are feet but these are quite different from the standard unit because they form the unit in terms of hand "Kuri" "Bitta" and "haat". If they have to measure their very short length of anything they use fingers.

Similarly, they use Kuri to measure, which is distance between tip of the thumb to tip of the pointer figure, and it is called Kuri, which is shown in following figure:

Figure No.3: 1Kuri (Kure)

They use Bitta to measure short distance, which is the distance between the tips of the thumb to the tip of the middle finger, which is shown in the figure.

Figure No.4:1Bitta

Moreover, another measurement unit is Haat and it is measured by the distance between elbows, the tip of the thumb to the middle figure, which has shown in the figure.

Figure No.5:1 Haat

Area Measurement

Measurement of an area is mostly reflection in estimating farmland and building House, Goath and Khor, trap etc. also need to be measure.

Area Estimation for House Plan

Measurement of area is used by Mewahang Rai people in their daily life to measure the area of their house, the simplest method use by the Mewahang for measurement of area one to one correspondence that has verification. When they start building houses, they measure by a rope in which different symbols are marked on the basis of the length measure in haat which is used to measure required length of the ground. I asked a house builder sample person, how to make a house? He said, if we want to build a small house then we need 9 haat breadth and 13 haat length, if we build medium size of house then we need to need 9 haat breadths and 15 haat length. The house 9-15has 3medium sized rooms. They have used haat to measure medium size of rope. We have to draw on the right side by stretching-bending a rope to the required shape of the new house. Nowadays, the Mewahang people use phitta, Ruler etc.
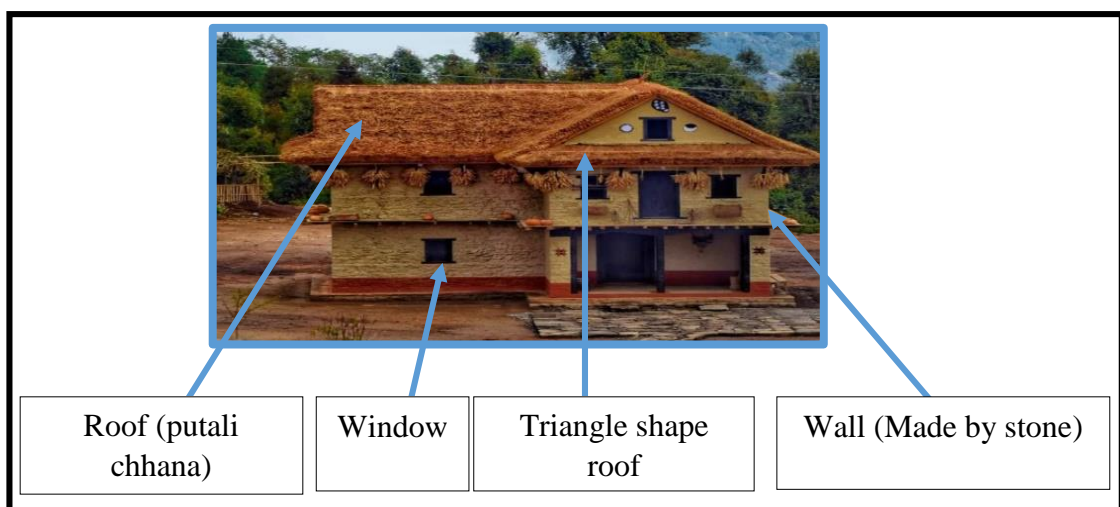

| Roof (putali chhana) | Window | Triangle shape roof | Wall (Made by stone) |

Figure No.6

Geometrical Knowledge Used by Mewahang Rai People

Okhal. Okhal is the most important objects in the Mewahang Rai community. It is made of wood. It is in cylinders shape.

According to the respondent (Dhanpal Mewahang Rai)

"*It is constructed by wood .The basic concepts of cylinder. Its height is 4-5 fit and thickness is 2-3 fit. Old men or farmers make it. Earlier this threshing was used to thresh paddy but now there is a threshing mill"*
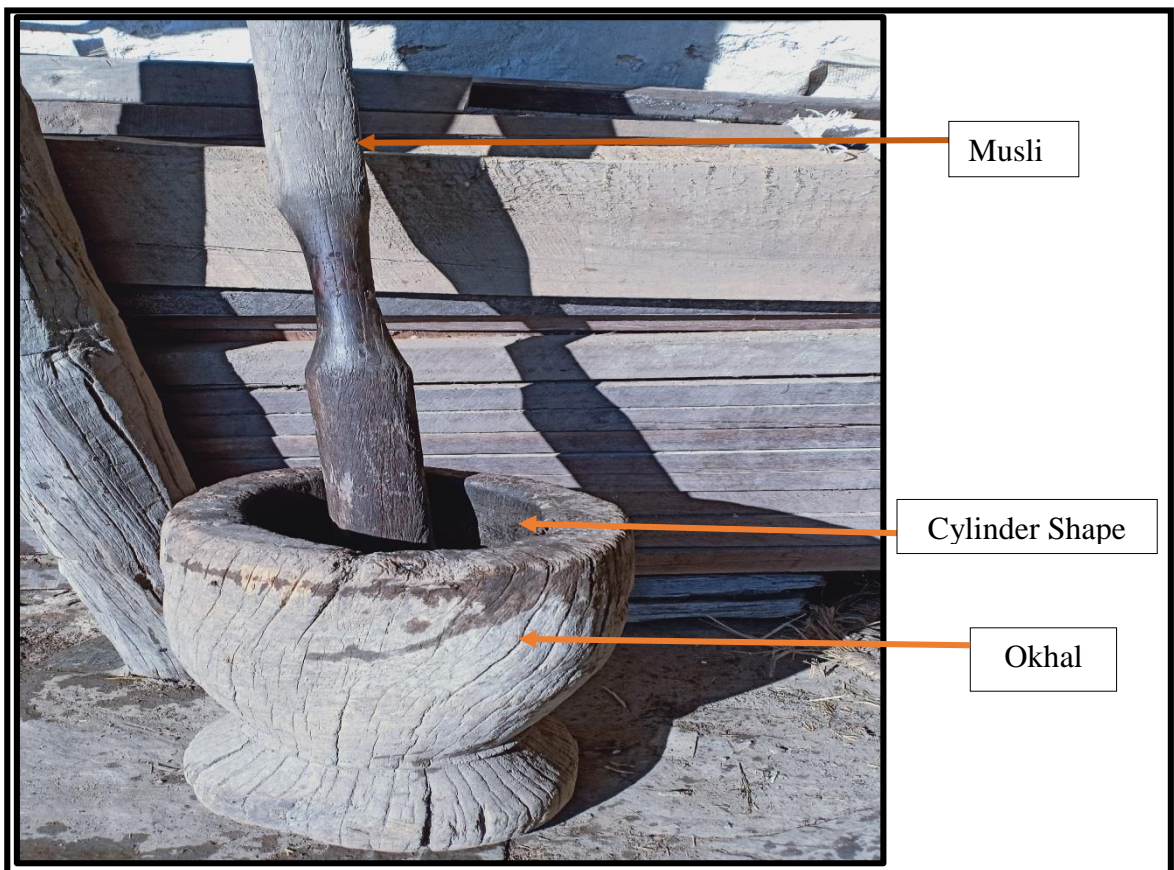

Cylinder Shape Okhali, Made by wood. We can teach Okhal to give examples for cylinders while teaching in the classroom.

Chhapani. Chhapani is another most important object in the Mewahang Rai community. They are 3-diemensional geometrical shapes .It is cone shape.

According to the respondent (Bhakta B.Mewahang Rai)

"It is made by an old man or farmer who knows how to weave doko, dali, vakari, chitra. It is constructed by small pieces found in bamboo. Its thickness is 1.5fit and its height is 2.5fit. It used to make a jaad(Chheng) and sometimes use catch a small fish from water, it happens in everyone's Mewahang Rai's home"

Chhapani

| Straight Lines | Perpendicular Lines | Cone |
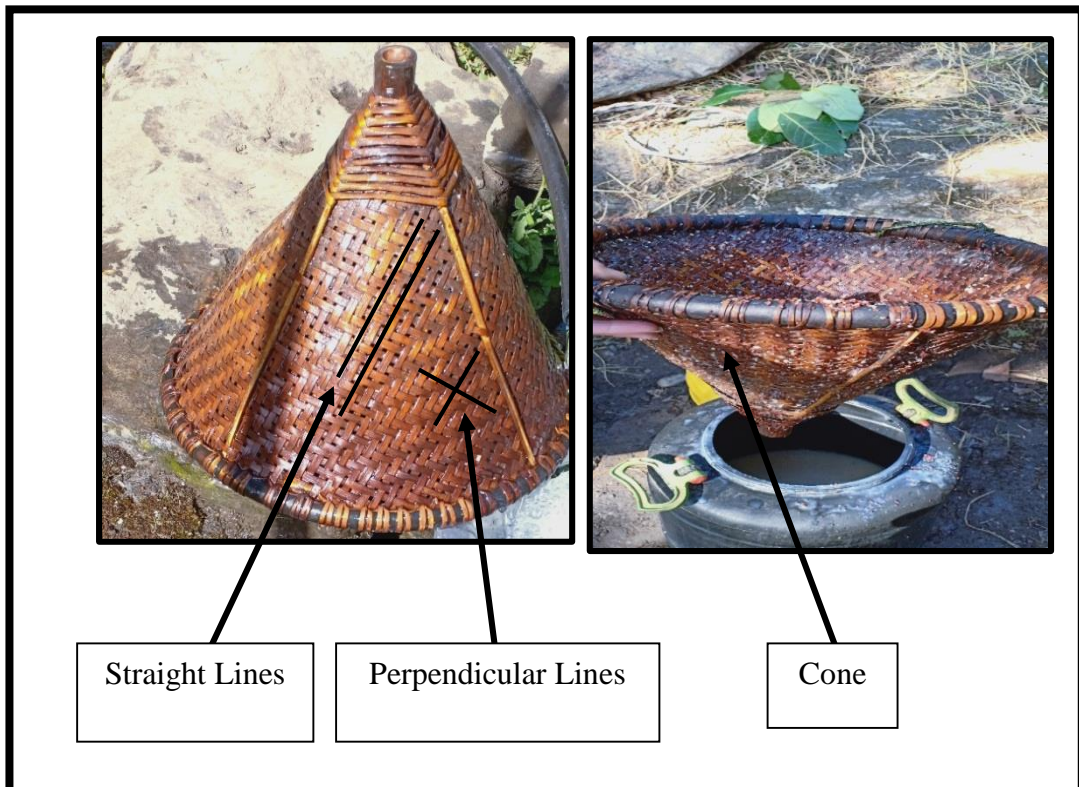
There are geometrical concepts in Chhapani. It is cone in shape as well as there are many perpendicular lines. We can give Chhapani to give examples for geometrical figure solid, cone, straight lines, and perpendicular lines while teaching in the classroom. So that, by the help of these materials we can teach the basic concept of cones, solid clearly at the school geometry.

Nanglo. Nanglo is the most useful and important object in the Mewahang Rai community.

According to the respondent (Hariprasad Mewahang Rai)

"Nangla is constructed by small pieces of bamboo in the shape of circular. It is used for making flour pure from the mixture of any other unwanted thing. It is use; pick paddy, cones, millet, rice etc. from the waste of stones. First, choya is made from bamboo and the Nanglo is made. Its Bit is a perfect example of a circle. Also, we see that the combinations of square are again a square .So, these materials help us to teach the basic concept of circle, square, and combinations of square are again a square, parallel line, perpendicular line and then circular to construct it. Nanglo itself is in circle shape".

Circle   Perpendicular   Parallel
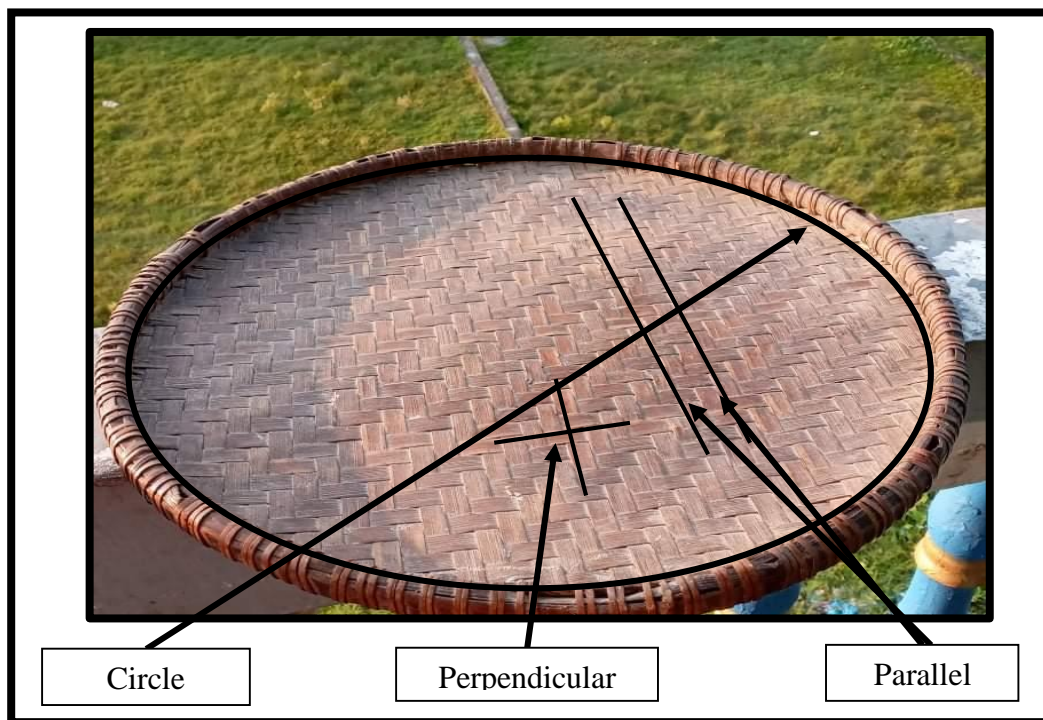
In the Nanglo there are different types of geometrical concepts. The small pieces of bamboo are parallel, vertical pieces and horizontal pieces of bamboo are perpendicular lines in each other's. Some pieces make a parallelogram and the whole Nanglo is Circular in shape. Therefore, these objects help us to the basic concepts of circle, parallel line, perpendicular line, parallelogram at the school level in geometry class.

Hand Knitted Bag (Jhola). Jhola is one of the most important objects in the Mewahang Rai community.

According to respondent (Sita Maya Mewahang Rai)

"Bag; weaving is done from yarn. In our Mewahang community, mothers and sisters weave. Who have knitting skills related to yarn, bags are used to carry a variety of materials, especially for school going students who carry books, copies, pens. They express the object which is triangular in shape as tinkune".

Triangle   Lines
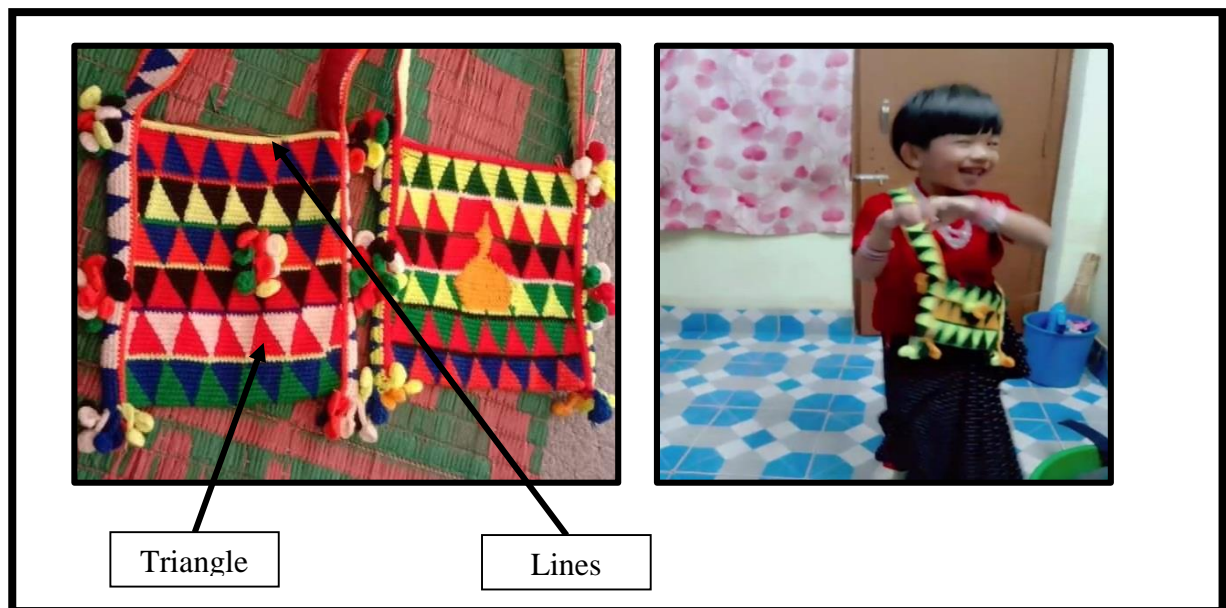
The clear concept of a triangle was found in a knitting bag. Different colored threads are used to denote different triangles as shown in the figure.

Making Alcohal (Hengmawa). At the time of field study, I asked my research questions to my mother Devi Kumari Mewaahang Rai about her ideas to make alcohol by the help interview guidelines.

Then she replied that

"First she told me about the process of making ale (Jaad). Jaad is very famous for drink in Rai culture, especially Mewahang Rai community every Festival,

Occasion, Marriage ceremony; adore (dewa, chinta, nuwagi) to need ale (jaad). At first, to make alcohol she must have marcha, which was sphere in shape and constructed by flour, rice and leaf of Kongla. While making ale, which means jaad. Then, 1/2 water needs to be boiled and 2/3 part of corn or millet or rice are cooked. After cooking this, we dried for half an hour and mixed Marcha 150gm. Then after 2 / 3 hours, she kept the ale (jaad) in the Drum and after around 3/4 days, it was ready to make ale. Which was ready to make alcohol (Raksi or Hengmawa) after around 20 /30 days. Then found that she arranged the t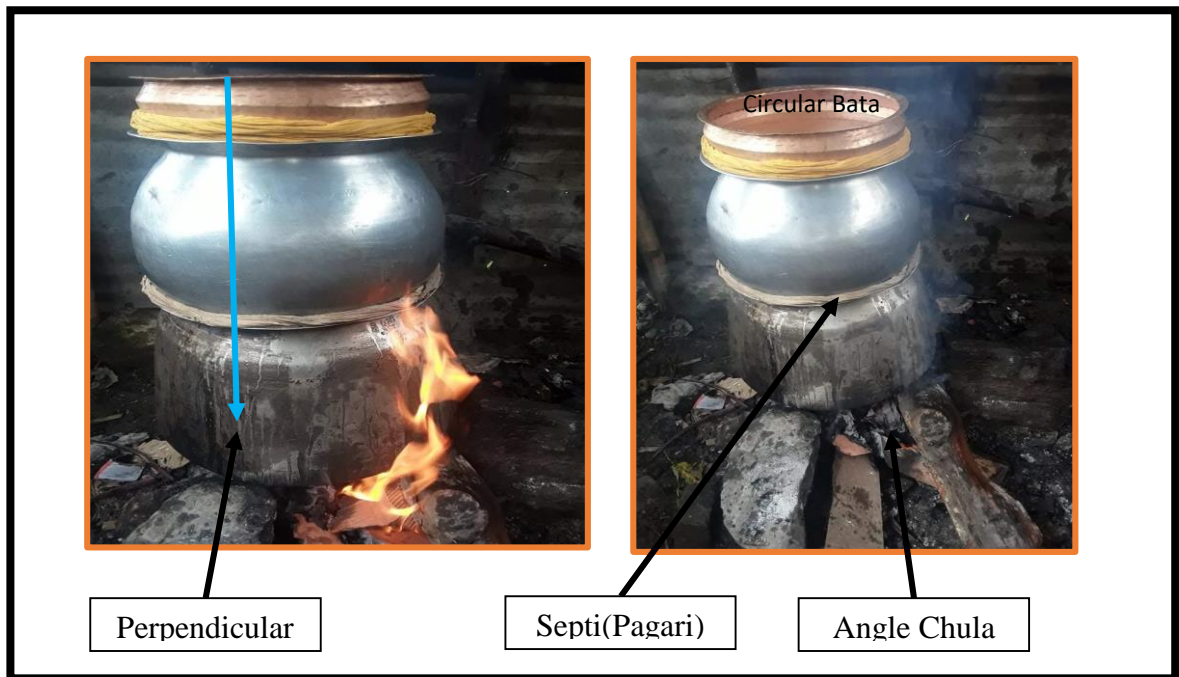hree stone in circular shape at every 120°angle to firing, locally called Chula. Then she placed Phosi on that Chula with keeping water and ale which was perpendicular to the land, then she placed the Jhajari (Manchhi) on the top of Phosi and put a small pot into Jhajari (Manchi) which called Naani Hadi. Then they placed Bata on Jhajari and put water into it. She places the Septi between phosi and jhajari, jhajari between Bata. She notified Tinpane for very hard alcohol, Satpane for good alcohol. She used this process to make alcohol because she must change the steam of water and ale in water again and again which is called alcohol.”

| Circle | Phoshi | Manchhi(Jhajari) | Nani(Had | Pani Bata |

| Perpendicular | Septi(Pagari) | Angle Chula |
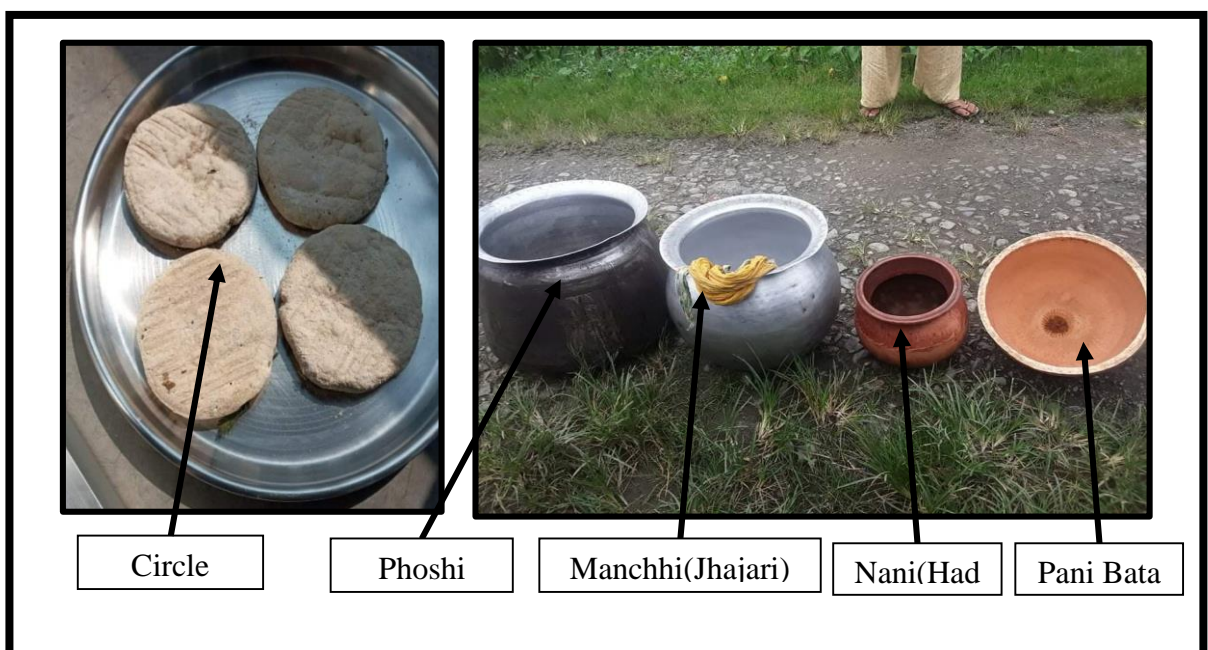
In this process of making alcohol, different types of geometrical concepts are found. We can see that the shape of Marcha is a perfect example of a sphere. In the process of making alcohol stones of Chula are circular shaped at every 120° angle to each other and all pots are perpendicular to the land. So by the observation of this process of making alcohol we can teach the basic concepts of sphere, circle, angle, perpendicularity, ratio and proportion at the school geometry.

Juwa. The Juwa is the tool of farmers and one of the important objects used in the Mewahang Rai community. Generally, farmers themselves make it.

According to respondent (Narhang Mewahang Rai)

"It is used to control two oxen while plaguing the field. It is to keep the relationship with Halo. These were a kind of object made from wood and bamboo. This object is constructed by using a process of perpendicular lines, midpoint, curve, angle, slope and distance between two points."

| Parallel | Midpoint | Curves | Distance between two points |
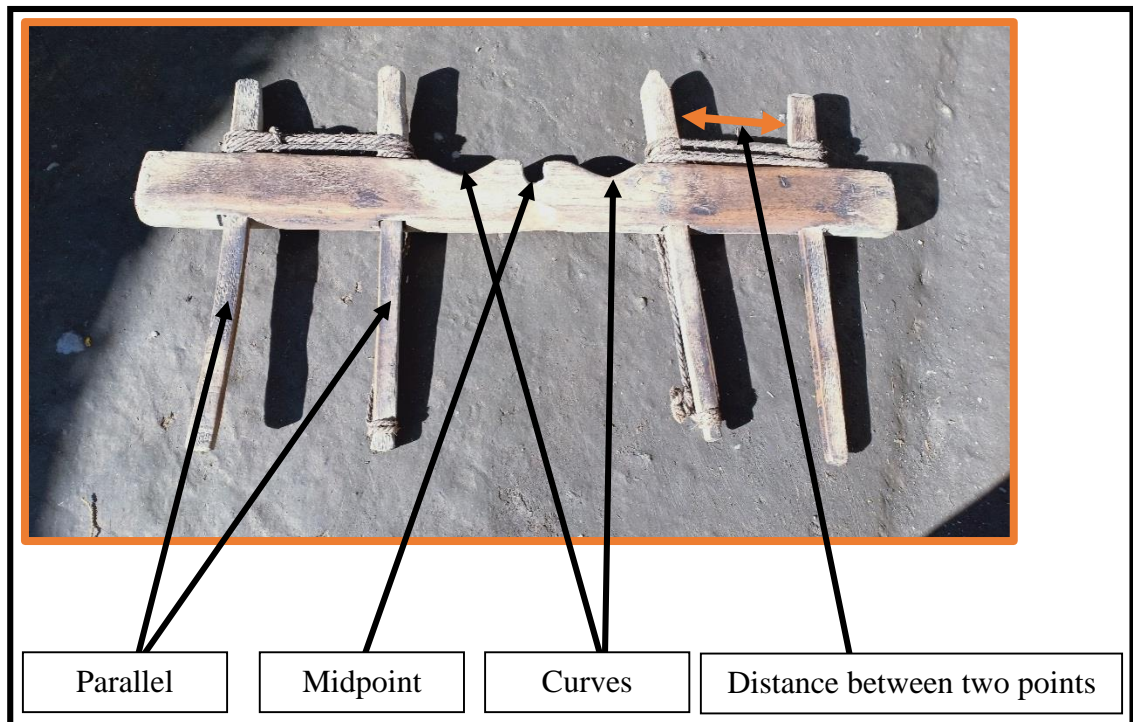
We can see four bamboo straight legs of Juwa, which is called soila, and they are perpendicular to Juwa. It is a slope form but four legs are parallel to each other. The distance between a pair of soila has around one Bitta(5cm). We can see that the Hadula ghar at the midpoint of Juwa and the cureve shape at the left and right of the midpoint (Hadula ghar). Therefore, by using this object, we can teach the basic geometrical concepts of parallel lines, curves, midpoint, slope, straight line, perpendicular lines and distance between two points at the school level.

Window and Door. At that time of field study, I asked one of my respondents who was a carpenter about using mathematics, geometrical concepts used to make the window and door with the help of guidelines.

According to respondent carpenter (Jagdish Mewahang Rai)

"He replied that the shapes of these objects were perfect rectangular and used for making attractive rectangular holes on the wall of a house. These were

constructed by wood of saal. I found that the rectangular window was divided into many sub-rectangular parts. But the rectangular door was not divided into many sub-rectangular parts. These objects were made by using the concept of parallel line, Perpendicular line, right angle and combinations of many rectangles are again rectangles."

| Parallel Lines | Right Angle/ Perpendicular line | Combination of | Parallel Lines |
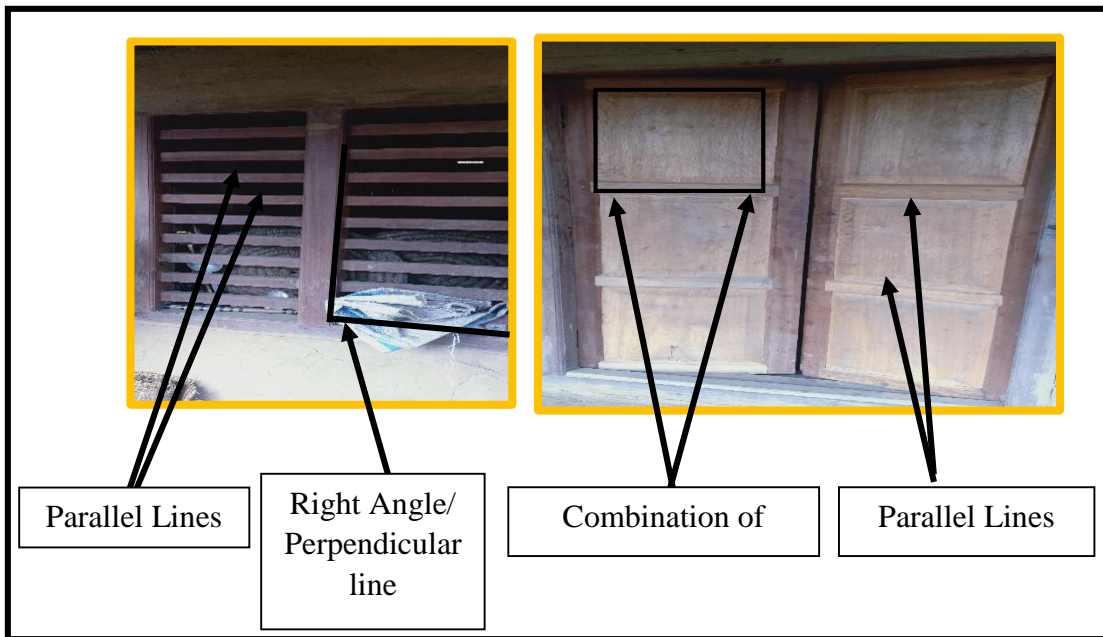
The different types of basic geometrical concepts are used in these materials. We can see that the combinations of rectangles are again a rectangle. All corners of the window and door are right angles. Some straight pieces of wood are parallel and some are perpendicular to each other. As a whole, these are rectangular in shape. Therefore, by using these objects we can teach all the rectangles as a parallel line, perpendicular line, right angle, straight line and combination of rectangles are again in a rectangle shape if we use these materials as teaching materials.

CHAPTER V

FINDINGS, CONCLUSIONS AND IMPLICATIONS

This study was done to explore the indigenous mathematical practice of Mewahang Rai people. The study was conducted in an ethnographic base. It is descriptive in nature. I collected data from the sources like primary and secondary as the findings of this research study and carried out the conclusions of this study. During the analysis and interpretation periods of my research work in the previous chapter, I have answered my research questions; what is the nature of counting system practice by the Mewahang Rai community? What is the measurement system practiced by the Mewahang Rai community? How to find out the basic geometrical practices in the Mewahang Rai community? How can their geometrical concepts be linked with teaching learning mathematics?

For this purpose. I selected the study area of the Sankhuwasava district of Shilichong municipality. I visited Mewahang Rai community, where Mewahang have their own types of customs, language, and culture. Also, they have their own number system, measurement system, geometrical practices and also have their own calendar (date&time) then observe their work. Then I interviewed ten people (one teacher, two students, five male and two female at the same time I took photos of different domestic goods. Based on their information and field data I have listed the following findings, conclusion and implications of the study:

Findings of the Study

- Mewahang people do not have their own script but they followed the Kirat script. Mewahang people have their own name for numbers 1 to 100. Such as, : *Ibom for 1, Hikbom for 2, Sunbom for 3, Likbom for 4, Nakbom for 5,*

Tukbom for 6, Rekbom for 7, Bakbom for 8, Nukbom for 9, Ipon for 10. And so on to 100. (See appendix III)

- Mewahang Rai celebrates its own New Year. Their New Year starts on the 15th of Push .They have a very long history.

- They have their own calendar.

- They did simple mathematical operations orally but illiterate persons could not solve large numbers problems. They have no specific numerals so the recording system is not clear. Nowadays these activities have remained only in elder persons. And literate Mewahang know the numerals of Nepali to represent numbers.

- Mewahang has their own name in their own native language for basic mathematical symbols.

- In Mewahang people's length is measured with hands and fingers.

- Mewahang people measure different things in their culture in different ways: Tulo was the main traditional material of weighting. Traditional units were dharni, bisauli, sher, athapol, hamali.

- Mewahang people the volume is measured with different types of pots. The units of volume are: chimti, mutthi, pasar, mana, kuruwa, pathi and muri

- In Mewahang people's length is measured with hands and fingers. The units of length are Kuret, Bitta and Haat. They used kosh to measure long distance.

- The area measurement is reflected in the construction of the house. The area of the house is measured in terms of Haat and the area of land is measured in terms of ploughing time.

- Almost none of Mewahang farmers are literate and unfamiliar with formal geometry. But they always used the concepts of formal geometry to construct

domestic goods knowingly or unknowingly. For example: while to build a
house, while making okhal, while making alcohol, while chhapani and so on.

- The circular, conical and rectangular shaped objects are mostly preferred.

- The parallel, straight line and perpendicular line procedures are mostly
preferred to construct different types of domestic goods.

Conclusions

In Nepal, there are various ethnic groups with their own typical traditional
mathematical ideas and practices. The Mewahang community of Nepal is also one of
the ethnic groups. This study was conducted in Shilichong municipality in
Sankhuwasava district over Mewahang Rai community. And this study is concerned
with the basic mathematical concept and numerations system used by the Mewahang
Rai community. They used their own types of counting system, and measurement
system. Also they use their own traditional geometrical knowledge and practices in
their daily life knowingly and unknowingly.

Counting systems and measurement systems were locally developed in the
past, when there was no need of standardizing the measurement units and no pressing
need of the use of numerical. They felt upon this system as appropriate for their daily
life needs. They have their measurement scales. They generally use Kauret, Bitta and
Haat to measure the length and unit of distance of Kosh. To measure weight, they use
dharni, bisauli, sher, athapol, hamali. They measure volume in their community using
chimti, mutthi, mana, kuruwa, pathi, and muri.   Therefore, the system seems to be of
practical utility in their life. They used their own system of counting and measurement
as well as mathematical processes for their normal day- to-day activities. And
Mewahang Rai people use geometrical objects that they mostly prefer to construct

such as: Okhal, Chhapani, Nanglo, Pathi, Dalo etc. by the shape of various conical, circular, rectangle, and cylinder.

In conclusion, mathematical knowledge is strongly embedded in the socio-cultural activities of the Mewahang Rai community. It would be a good idea to link the school mathematics with the socio-cultural activities of the Mewahang community. The government of Nepal is trying to apply the formal education up to primary level in their mother tongue of different ethnic groups. Most of the Mewahang Rai people are unfamiliar with the formal mathematical concept. Therefore, people think mathematics is a difficult subject. Thus, there should be a strong connection between mathematics and culture.

Implications of the Study

This study was conducted for a short period of time, with small numbers of respondents and limited area within only one Mewahang Rai community. This study was based on the qualitative design with ethnography approach. This study may have covered a certain field of mathematics of the Mewahang Rai ethnic group. Therefore, the findings of this research may not cover the entire aspects of mathematics and the Mewahang Rai ethnic group. So considering these limitations of the study the following suggestions and implications have been made for further research.

- This study was limited to the basic mathematical concept and numeration system used by the Mewahang Rai community only. Which have not covered it like ethno-mathematical practices in the classroom.
- The Mewahang Rai measurement system is traditional, simple and practical but lacks standardization. They need to be developed, standardized and preserved.

- This study was confined only in Shilichong municipality, Sankhuwasava of Nepal. So further studies should be done in other places.

- The teaching and learning of school mathematics should be linked to their culture and mother tongue.

- This study helps to promote and explore ethno-mathematics of the Mewahang community.

- This study was useful for students, curriculum planner, textbook writers, teachers, and policymakers to develop their professional development.

- This study was conducted in a few days' field work with a small number of samples. So that future study can be done intensively with a larger number of samples.

References

Acharya, B.R. (2015). *Foundation of mathematics education*. Kathmandu: Dikshanta prakashan.

Acharya, B.R. (2015). Relevance of primary level mathematics education in Nepal: A cultural perspective. Unpublished dissertation of Degree of Doctor of Philosophy in Education, Tribhuvan University. Kathmandu.

Acharya, B.R. (2017). *Diversity in mathematics education, Kathmandu*: Pinnacle Publication.

Adhikari, D.A. (2012). *Basic mathematical concept and processes of Dhanuk community*.

Unpublished Master's Degree Thesis, Department of Mathematics Education, T. U. Kirtipur, and Kathmandu.

Bell, F.H. (2008). *Teaching and learning mathematics*. USA, W.M.C. Brown Company Publisher

Bhattarai, B. (2019). *Mathematical practices in the Dhimal community*. Unpublished Master's Degree Thesis, Department of Mathematics Educations, and T.U. Kirtipur.

CERID. (1990).*The elementary process of learning mathematics concepts and process of Rasuwa,* Tamang. Kathmandu.

Chemjong, A. (2013). *Basic mathematical concept practiced by the Limbu community*. Unpublished Master's Degree Thesis, Department of Mathematics Education, T.U. Kirtipur, and Kathmandu.

Creswell, W.J. (2004). *Research design: Qualitative, Quantitative, and mixed method approaches.* New Delhi: Sage Publication.

D'Ambrosio, U. (1985). *Socio-cultural bases for mathematical education,* New York: UNICAMP

Dhakal, P.K. (2008), *Basic Mathematical concept and process of Raji ethnic group.* Unpublished Master's Degree Thesis, Department of Mathematics Education, T.U. Kirtipur, and Kathmandu.

Dhakal, R.P. (2009). *A carpenter developing mathematical concepts in this surroundings*. A Thesis, to Department of Mathematics Education, T.U. Kirtipur, and Kathmandu.

Eves, H. (1993). *An introduction to the History of Mathematics*.

Gurung, M. (2014). *Mathematics in the Gurung Community: Ethno-mathematical Study*, (Unpublished Master's Thesis), Kathmandu University.

Government of Nepal (2011). *National Population Census. Kathmandu Nepal*: Central Bureau of Statistics.

Karki, R. (2017). *Basic mathematical concepts practiced by the Hayu community.* Unpublished Master's Degree Thesis, Department of Mathematics Education, T. U. Kirtipur, and Kathmandu.

Khanal, S. (2008). *Ethnographic study of mathematical concepts and processes used by Potter*. Unpublished Master's Degree Thesis, Department of Mathematics Education, T.U. Kirtipur, and Kathmandu.

Khanal, P. (2062). *Educational research methodology*. Kathmandu: Sunlight Publication.

Majhi, C.J. (2018). Basic geometrical concepts practiced by Majhi Community. Unpublished Master's Degree Thesis, Department of Mathematics Education, T. U. Kirtipur, and Kathmandu.

Pandit, R.P. (2014). *Foundation of Mathematics Educations*: Kathmandu Indira

    Publication.

Rai, B. (2019). *Geometrical concepts practiced in the Rai community*. Unpublished

    Master's Degree Thesis, Department of Mathematics Education, T. U.

    Kirtipur, and Kathmandu.

Rai, M. (2011). *Mathematical concept and process practiced by Dumi Rai at Khotang*

    District.

Thapa, M. B. (2011). *Basic mathematical concepts and processes used by the Magar*

    community in Sindhuli district. Unpublished Master's Degree Thesis,

    Department of Mathematics Education, T. U. Kirtipur, and Kathmandu.

UNESCO, (1998). *New Trends in Mathematics Teaching*.

Wagle, B.R. (2009). A study of mathematics concepts and processes practiced in the

    Magar community. . Unpublished Master's Degree Thesis, Department of

    Mathematics Education, T. U. Kirtipur, and Kathmandu.

Retrieve *http://www.ethnomath.org/ethnomathics*

Appendix I

Observation Guideline

To find the answer of the research questions, I observed the Mewahang Rai Culture and use of mathematics in daily activities. Also I observed the use of the counting numbers system in daily life. At that time, I observed the use of measurement systems in daily life. At last I observed, use of different geometrical objects and the use of different mathematical concepts. After completion of observation I prepared a field note.

Appendix II

Interview guidelines

In–depth interview schedule for Mewahang Rai people

Personal Details:

Date of interview: - ……………………Sex: - ……………….Age: - …………

Name: - …………………………   Address: - …………………………

Religion: - ………………………   Qualification: - …………

Occupation: - ……………

The interview with Mewahang Rai people were taken in the following basis:

- How many members in your family?

- How many domestics' animals do you have?

- How many numbers can you count in your own Mewahang Rai Language?

- Have your own calendar?

- How do you measure rice, cone, wheat and oil, butter, milk, alcohol and meat?

- How do you measure your farmland?

- How do you measure the area of land to build like a house?

- How do you make marcha, jaad and raksi (alcohol)?

- What are the most used domestic goods in the Mewahang Rai Community?

- How to make different parts of the domestic goods?

Appendix III

English	Nepali	Mewahang
One	Eka	Ibom
Two	Dui	Hikbom
Three	Tin	Sunbom
Four	Char	Likbom
Five	Panch	Nakbom
Six	Chha	Tukbom
Seven	Sat	Rekbom
Eight	Aath	Bakbom
Nine	Nau	Nukbom
Ten	Das	Ipon
Eleven	Eghara	Ipon ibom
Twelve	Barha	Ipon hikbom
Thirteen	Terha	Ipon sunbom
Fourteen	Choudha	Ipon likbom
Fifteen	Pandra	Ipon nakbom
Sixteen	Sorha	Ipon tukbom
Seventeen	Satra	Ipon rekbom
Eighteen	Athara	Ipon bakbom
Nineteen	Unnais	Ipon nukbom
Twenty	Bis	Ikup
Twenty-one	Ekkais	Ikup ibom
Twenty-two	Bais	Ikup hikbom

Twenty-three	Teis	Ikup sunbom
Twenty-four	Choubis	Ikup likbom
Twenty-five	Pachchis	Ikup nakbom
Twenty-six	Chhabbis	Ikup tukbom
Twenty-seven	Sattais	Ikup rekbom
Twenty-eight	Aththais	Ikup bakbom
Twenty-nine	Unnantis	Ikup nukbom
Thirty	Tis	Ikupipon
Thirty-one	Ekatis	Ikupipon ibom
Thirty-two	Battis	Ikupipon hikbom
Thirty-three	Tettis	Ikupipon sunbom
Thirty-four	Choutis	Ikupipon likbom
Thirty-five	Paitis	Ikupipon nakbom
Thirty-six	Chhattis	Ikupipon tukbom
Thirty-seven	Sattis	Ikupipon rekbom
Thirty-eight	Athtis	Ikupipon bakbom
Thirty-nine	Unnanchalis	Ikupipon nukbom
Forty	Chalis	Hikkakup
Forty-one	Ekchalis	Hikup ibom
Forty-two	Bayalis	Hikup hikbom
Forty-three	Tirchalis	Hikup sunbom
Forty-four	Chouwalis	Hikup likbom
Forty-five	Paitalis	Hikup nakbom
Forty-six	Chhayalis	Hikup tukbom

Forty-seven	Satchalis	Hikup rekbom
Forty-eight	Athchalis	Hikup bakbom
Forty-nine	Unnachas	Hikup nukbom
Fifty	Pachas	Hikup ipon
Fifty-one	Ekkaunna	Hikpaipon ibom
Fifty-two	Baunna	Hikpaipon hikbom
Fifty-three	Tirpanna	Hikpaipon sunbom
Fifty-four	Chaunna	Hikpaipon likbom
Fifty-five	Pachchpanna	Hikpaipon nakbom
Fifty-six	Chhapanna	Hikpaipon tukbom
Fifty-seven	Santaunna	Hikpaipon rekbom
Fifty-eight	Anthaunna	Hikpaipon bakbom
Fifty-nine	Unnansathi	Hikpaipon nukbom
Sixty	Sathi	Sunkukup
Sixty-one	Eksathi	Sunkukup ibom
Sixty-two	Baisathi	Sunkukup hikbom
Sixty-three	Tirsathi	Sunkukup sunbom
Sixty-four	Chousathi	Sunkukup likbom
Sixty-five	Paisathi	Sunkukup nakbom
Sixty-six	Chhaisathi	Sunkukup tukbom
Sixty-seven	Satsathi	Sunkukup rekbom
Sixty-eight	Athsathi	Sunkukup bakbom
Sixty-nine	Unnansattari	Sunkukup nukbom
Seventy	Sattari	Sunkukup ipon

Seventy-one	Ekatar	Sunkukup ipon ibom
Seventy-two	Bahattar	Sunkukup ipon hikbom
Seventy-three	Tirattar	Sunkukup ipon sunbom
Seventy-four	Chourattar	Sunkukup ipon likbom
Seventy-five	Pachahattar	Sunkukup ipon nakbom
Seventy-six	Chhiyattar	Sunkukup ipon tukbom
Seventy-seven	Satahattar	Sunkukup ipon rekbom
Seventy-eight	Athattar	Sunkukup ipon bakbom
Seventy-nine	Unnanasi	Sunkukup ipon nukbom
Eighty	Asi	Likkukup
Eighty-one	Ekasi	Likkukup ibom
Eighty-two	Bayasi	Likkukup hikbom
Eighty-three	Tirasi	Likkukup sunbom
Eighty-four	Chourasi	Likkukup likbom
Eighty-five	Pachasi	Likkukup nakbom
Eighty-six	Chhiyasi	Likkukup tukbom
Eighty-seven	Satasi	Likkukup rekbom
Eighty-eight	Athasi	Likkukup bakbom
Eighty-nine	Unnannabbe	Likkukup nukbom
Ninety	Nabbe	Likkukup ipon
Ninety-one	Ekanabbe	Likkukup ipon ibom
Ninety-two	Bayanabbe	Likkukup ipon hikbom
Ninety-three	Tiranabbe	Likkukup ipon sunbom
Ninety-four	Chouranabbe	Likkukup ipon likbom

Ninety-five	Panchanabbe	Likkukup ipon nakbom
Ninety-six	Chhiyanabbe	Likkukup ipon tukbom
Ninety-seven	Santanabbe	Likkukup ipon rekbom
Ninety-eight	Anthanabbe	Likkukup ipon bakbom
Ninety-nine	Unnansaya	Likkukup ipon nukbom
Hundred	Saya	Iphyaaa

Appendix IV

Pictures of Mewahang Rai Community

Mewahang Rai in Culture Dress

Theki (made by wood)   khat, Doko, Dalo, Thunchey (Made by bamboo)

Mewahang Rai House

Khamang and Chula

Knitting Charkha Mewahang Women   Knitting Taan Mewahang Women

Weaving Sukul   Weaving Chitra