CHAPTER I

THARUS

This Chapter includes socio-cultural, economical and educational backgrounds of Tharus in Dang, statement of the problem, rationale of the study, research questions and significant of the study.

Mathematics is perceived as a basic human right of all children and as a means of social and economic development. Over the last couple of decades, Nepal has made remarkable progress in achieving access to education. However, achievements in mathematics are very low. The primary aim of this study is to shed some light on the causes and consequences of the effect of e*thnomathematics* on the Tharus community. Therefore, policy makers and planners have more informed basis for making decision on localization strategies. Since, the ethnic effect has not been studied in this region, the study would also add to the body of knowledge. The national policy of education of Nepal has also focused on the importance of mathematics. It is realized that mathematics is the vehicle to train the child. It promotes the logical and productive thinking.

Ethnicity is derived from Latin word that is defined as "The sense of belonging together as the cultural group of the given society". In abstract term, ethnicity is defined as "The self-consciousness of the group people integrated or closely related by shared experiences such as language, religion belief, common heritage, economic interest and political institution (Paudyal, 1986, pp. 5-7)." Mathematics is a practical science. It is developed from experience. We use

mathematics consciously or unconsciously evry day. Not every common person can behave his behavior without mathematics. Not only human, all living beings practise mathematics. Our surroundings are full of mathematics. In each house work, numerous practical ideas of mathematics are involved. Farming, industry, business and even languages use practical concept of mathematics.

Tharus Community in Dang

No ethnomathematical study is considered complete without knowledge of the surrounding area and a general socio-cultural background of the people under study. All aspects of culture are interlinked directly or indirectly. Inhabitants of geographical region necessarily seek adjustment with their physical environments in order to fulfill most of their needs. Thus, an attention has been made in this chapter to give a brief description of the ecology, history and socio-cultural foundations of the Tharu tribes.

The southern low flat region of Nepal is known as the Terai. In the past, various tribes migrated there. The Terai is neither small nor insignificant in a Nepalese national policy sphere. The most popular among the tribes now living there is Tharu. They reside in warm plains of inner Terai, spreading out into the thick tropical jungle region from eastern Nepal across to the far western regions of Nepal.

The habitats of the Tharu are Morang, Sunsari, Saptari, Bara, Parsa, Chitwan, Rupendehi, Kapilvastu, Dang-Devkhuri, Banke, Bardiya, Kailali and Kanchanpur. Up to 1950, the Nepali lowland was an untouched edge on the periphery of national concerns. At that time, the Terai was a wild malaria ridden region. After the eradication of malaria in 1950, the Terai became

accessible for outsiders to settle. However, the Tharu settlements are found in the middle of malarial forests, the hot plain of Mahabharat range and around the Churia range. They are generally more concentrated in the central and western Terai regions. Their settlements and villages are found in tropical malarial areas and in small clearing in the middle of forests full of wild animals. These animals are elephants, rhinoceros, bears, tiger and poisonous snakes. They do not live in easily accessible open areas.

Historical Background

Many scholars regard the Tharus to be the aborigines of the region and they were the first people to inhabit the Terai. The traditional territory of the Tharu is called Tharuban or Tharwat, the southern-forest region of the Siwalik Hills and the southern part of the Terai.

The origins of the Tharu tribes are not clear. Some say that they may be migrants from the Thar Desert of Rajasthan, India. There is a variation on the narration of the historians of their origin, of the Tharus. The scholars who had tried to trace the origin of the Tharu offer conflicting views on the subject. However, regarding the Tharu's origin, entry and migration to Nepal, there are not definite dates or evidence to support any of those theories. According to Nesfield (1885, p. 115), the name Tharu is derived from the word ‘Thar’ which is the colloquial dialect means, 'a jungle'. Thus a Tharu is one, who resides in the forest, 'a forest man'. According to Nevill (1901, p. 107) the Tharu are said to be the descendants of the Rajput women who fled with their domestic servants from the Muslim invasion rather than fall victim to their enemies. After a long time living without their spouses, they started to live with their servants and had children by them. These offsprings were the Tharu. Even today, they have the tradition where Tharu women

push a plateful of food toward their husbands with their feet. This implies that they possess Rajput blood and are of higher status than their husbands.

Another theory states that if they had been migrating tribes, they would almost certainly have settled in more easily accessible and open places and would have selected to settle in the unhealthy flatlands of the Terai regions. Another theory for the Tharus' origins suggest that after Buddha attained Nirvana and Buddhism flourished, the Mahasagahik and Sthiver school were established. The Kpilvastu's Shakyas included toward Sthvir and were known as Sthvirbadi or Sthvir. Latter this was corrupted into Tharu. Crooke (1896, p. 381) trace their origin to the word ‘Tharu’ denoting a 'wine bibber'.

Physical Characteristics

Tharus are seen to have many Dravidian characteristics. Dravidians are a group of intermixed peoples, mainly Tamil, who are found in south India and in northern Sri Lanka. However, in a minute study, difference can be seen. They are in short figure and are not heavily structured. Their facial features exhibit nasal roots that are depressed so that they tend to have short low noses. However, some of them have wide nostrils too. Their eyes are slanted but do not have epicanthus's fold, which is a Mongoloid racial stock characteristic. Their skin is dark brown to fair completion, but some are extremely dark. Their lips are of the medium thickness and they have straight black hair. Danguriya Tharus' average height is nearly one and half meters. They have wheat-brown complexions, low nasal roots with wide flat nostrils, slanted and integument lips with an eversion (turn outward or inside out) between the upper and lower lips. They have more Mongoloid eyes and their physiques are strong, wiry and sturdy.

Cultural and Anthropological Aspects

Language: Nowadays, Tharus have their own language because they have their dictionary, region, literature and philosophy. Their language is known as 'Tharu language' that is the mixtures of local languages and dialects like Maithili, Awadhi, Hindi, Nepali and Urdu language. Bara Tharus speak a language mixed with Bhojpuri and Tharu from the west, Banke, and Bardiya, Kailai and Kanchnpur speak the mixture of Awadhi. Dang Tharu speak a mixed language of Nepali, Hindi, Maithili, Bhojpuri and Awadhi. Dang Tharus use ancient and almost extinct Nepali language words. The Deukhuri Tharus dialect contains more Hindi than anything else. The language of Tharu is a Hindi and Nepali dialect belonging to the Indo-Aryan group of languages. Grierson (1903, 311) has, however, not recognized a separate language of the Tharu, who, according to him, "do not have a language of their own and speak more or less currently the language of Aryan race with whom they are in immediate contact. ……." It has proved helpful not only for developing contact with other groups but also a facilitating as a smooth and convenient tool of the communication between them.

Dress: The traditional Tharu attire is more or less falling with only a few women the traditional *ghanghria* and man used to were a *nogota* and *phatuhi*. However, today men have totally adopted the urban style of clothing and women are closely following their example. The dress of the Dangaura Tharu women is *nahaga*, *bullayat* and *aghran* or the *lungi* and *bullayat*. The

Dangura *nahaga* is quite different from those worn by other Tharus, in that it is devoid of any embroidery and decoration and since it does not have a *goath* or *gumpti* stitched on to it. The Dangaura *nahaga* is longer than the others and reach just few inches above the ankle. It takes about 3.5 to 4 meters of cloth to make a Dangaura *nahaga* which is much less cloth used by compare to others. Due to this, there are hardly any plates in the Dangaura *nahaga*. Apart from these, the part of the *nahaga* and method of wearing it is similar to others. The *lungi* is another dress item worn by the Dangura women. This is sometime worn in place of the *nahaga* and is simply 2.5 meters long printed linen or cotton cloth that is wrapped around the waist. A front opening blouse called *bullayat* is worn with the *nahaga* or *lungi*. The Dangura women wear an *aghran,* which is a 1.5 to 2 meters long printed muslin or linen cloth. It is worn when one goes to market place or special occasions. Usually Dandura women are seen without it. Dangura women wear the *aghran* in special way. It is folded in the middle and this person is kept toward the left side. Now it is either taken over, or from under the left shoulder. The other free end is taken over from front to the right shoulder and tie to the end that was brought from the backside, forming a knot that rest over the right shoulder.

When spread out completely the *ghangaria* is trapezium or quadrangle in shape. A unique feature of this garment is that it is not stitched on the side to make it cylindrical like usual skirts. Thus, it can describe as a wrap around. For the sake of description, *ghangria* may be divided horizontally into four parts which are made of different colored cloth piece stitched together and may even be of different materials, the first part is called it a toi, the second part is the lehanga or ghangaria, the third part is called the *mangji*, while the last part is called *ghutta* or *ghota*.

Vertically the *ghangria* may be divided into three parts. The vertically center and horizontally topmost part is the *ghota*, and extensively embroidered and decorated patch, approximately 9x12 or 12x15 inches in size. Above the *goath* an ever way is made through which a thick cord called the *jhampa* is passed. The *jhampa* is sometime decorated with woolen balls or ribbons called *phula and pheeta* respectively, and are used to tie the skirt around the waist. Just below the *goath* being the horizontally second part of the *ghangaria* consists of several tiny and closely stitched pleats. The other two parts are horizontal continuation of the same pieces of cloth neither have any pleats nor they consist of a continuation of the *jhampa*. Vertically on the side edge of the *ghangaria* a decorated by *pattha* (lece) or *pheeta* (ribbon) is attached for the further beautification. This part comes in the front when wearing the *ghangaria*.

The *ghangaria*, which is worn below the navel, is fastened onto the waist with the help of *jhampa* in such a way that the *goath* faces backwards. The part hanging to the left side is taken around the waist from the left and stuck into the *jhampa* in front. After this, the part hanging on the right is taken over the right side of the waist and stuck over the part that had been brought from over the left, upon its middle. Thus, in front the *ghangaria* forms a somewhat inverted 'V' shape at its lower end. Until the fifteen years, girls begin to wear the *Ghangaria* from the tender age of 4 and 5 years. These dresses are stitched by their mothers or other elder women of the house. However, nowadays girls, who wear the traditional Tharu attire, begin wearing it from the age of 12 to 13 years i.e. by the time they become adopt in the art of stitching and embroidery.

Different kinds of fabrics are used to make a *ghangaria*. Earlier only cotton, poplin and linen were used, but nowadays' synthetic fabrics, like tricot, polyester, etc. are used because of their easy availability, durability and convenience in washing. However, many Tharus until date prefer cotton clothes since it is more comfortable and affordable. A great liking for red, cobalt blue and white can noted among all the Tharus. The traditional colour used for the *Ghangaria* and *nahanga* are red, cobalt blue and white. In the traditional garment, the *toi* and *mangji* were made of white colour cloth, the *lehanga* or *ghangaria* of particular hand woven red colour cloth with thin white, black and green stripes and a green border made by weavers around the tribal belt. The *ghutta,* which forms the lower border of *ghangaria,* was always cobalt blue in colour. Some girls of younger generation were noted trying their hands in using a very different colour scheme; the colour chosen in such case are usually bright one, such as parrot green, bright yellow, shocking pink and so on. A point to be noted here is that whatever colour may be used, the *ghutta* is always made up of a plain cloth devoid of any print whatever and every *ghangaria* or *nehaga* usually has some shade of red in it. Traditionally, the Tharus never wore undergarments, but today gradual change can be noted.

The practice of covering one's face with an avil is not prevalent among the Tharus. However, all those who wear the *ghagharia* must cover their head with the *urhnia* as the mark of respect toward their elders because it is considered shameful to show ones *Juda* (hair tied in a bun) publicly. Among to the older generation of Tharus, the tradition of covering face in front of one's father-in-law and husband's elders brother exists, but this too is for a certain time period, i.e., until the women have a first child. This rule is, however, followed only by a few families at

present and not in general practice. Since widowhood is not considering a stigma among the Tharus, widowed women wear clothes similar to those worn by other women of the society. Thus, no restriction, in general, to dress or adornment is found among them, except that widows do not wear glass bangles.

The effect of the cultural contraction can easily be seen on the Tharus. In recent years, they have been greatly influenced by the attire of the town dwellers. Nowaday, a lot of Tharus have started wearing salwar suites while only married women wear saris. Some young girls are seen wearing skirts and tops or shirts. All these clothes are similar to those worn in the cities.

The traditional dress of the Tharu men is *dhoti*, *saluka*, and *fatuhi*. Saluka is short sleeve cotton shirt without collar. It has a big pocket on one side, which generally serves as a tobacco pouch. The *fatuhi* is a thick black sleeveless cotton jacket, sometime decorated with several coins. A few men used to wear a *nagota* which was a white cloth, approximately 8 inches broad, that was tied in between the legs fastened to the waist with the help of rope or cord. Today, the Tharu men have greatly changed their way of dressing. At present almost men are seen wearing trousers, shirts, jeans and T-shirts. Some wear *dhoti*, *pajama* and *kurta*. 20% of Tharus mainly comprises of the older generation, who, though have changed with time to a certain extent, find themselves comfortable only in their traditional clothes. The use of undergarments that did not exist among the Tharus earlier has gradually been adopted. The Tharu men generally prefer to use *terri cota* or other synthetic material in place of cotton material because these are easy to clean and more durable.

Rituals

A series of action that are always carried out in a same way, especially as part of religious ceremony are called rituals. Birth, marriage, death, songs and food are known as rituals. The other activities such as agricultural, fishing, basket and weaving are not rituals.

Birth: Life cycles rituals form an important and integral part of every society although performance may differ even with the same society. Like most of the societies, the Tharus also attach a great importance to the timely performance of different rituals. Among the Tharus, no rites are performed before the child's birth with the desire to have boy or girl. Until the *satti (chatti)* ceremony, mother and child are not allowed to step out of the house. The *satti* ceremony is not necessarily held on the six day, but may also be held a day two or before or after. It is the main social function of child birth. On this day, mother and baby are bathed and dressed in new clothes. The *dhai* (mid wife) takes the baby to the *kola* (the husband deities) for the first time and dresses new white clothes. In the evening, a fest is arranged for the entire village. The naming of the child and feeding of the first grains pass unnoticed. The *mundan (*head shaving) ceremony is held formally only by those who declare to do so, generally in cases where previous children have not survived or the life expectancy of the child is very low. In such cases, a feast is given to villagers on the *mundan* day. The maternal uncle any male member, usually of the mother side, shaves the child's head on the banks of the river. He also gives the child a token gift in the form of cash and clothes. In return, he receives some money and a feast of meat and liquor.

Food: Most Tharus are non-vegetarians and their usual food is rice. They consume fish, meat and alcohol more than vegetables, curries and bread. The kinds of meat they consume include chicken, pork, rabbits, pigeons, mutton, and tortoise and so on. One of their favorite foods is *Kawa*, which is cooked by mixing lentils and pulses with rice. Tharus call their breakfast *Kalewa*, lunch *Migo* and dinner *Baeri*. All these three meals include rice.

Family and Marriage: Tharus live in an extended joint family structure, where about three or four generations live together. The elder member is the head of the family, who is obeyed by everyone. The woman who is the domestic head is called the *Ghar-dhurnia*. The women head do the household chores and men do all the outside works. The women servants or other employees collect fodder for the animals. In joint families, the father is the head of the family with full authority and rights over all the family members. After the death of the father, his younger brother may take his place. If he has no younger brother then his elder son takes his place, regardless of intelligence or capability-which is of no account, with the order of seniority being the only important consideration. Among women of the household, the same rules apply. After the mother, the eldest daughter-in-law and so on is seen as more senior.

Marriage of various forms, beside the regular form, is practised by the Tharus, e.g., marriage by capture, *dola* (by purchase), *gharbaitha or chutakata* (martilocal residence), widow remarriage, and polygamy. Regarding the rule of hexogamous, Traditional hexogamy does not exist and one may marry within one's own village. Among the Tharus, the marriages are settled at childhood with the help of middleman, the *majhpatia*, who knows about all the eligible boys and girls.

Engagement, i.e. the *mangni* takes place when the children are 3-5 years of age mostly in the month of the *Baisakh*. It is an important ceremony that many people sometimes the entire village, accompany the groom pattern to the bride's house. The girl's parents are presented with sweets or *batashas* and cloths for the bride. With the acceptance of the gift, the *mangni* is formally decided. In the evening, the members of the groom's side are treated to the feast. The marriages take place once the bride grows up, usually at the age of 18-20 years, in the month of *Magh* and *Phalgun*. Marriage dates is fixed by the family member according to their convenience as there exists no belief in auspicious dates, i.e., *muhurat*. About eight days before the marriage, the *phichocho* ceremony takes place. On this the groom's side brings to the bride's house a token gift of rice, pulses, potatoes, turmeric, chilli, jaggery, fish and liquor as the contribution to the marriage feast that will be held at the latter's place. A day before the marriage a *haldi* ceremony, locally called *nyota darna*, is held at the houses of both bride and groom, in which villagers and relative apply turmeric mixed with oil to the bride and groom and given them some gifts. The village deity *Bhuiya Devi* is appeased on this day by the parents of the groom and bride.

One the wedding day, the *Barat* or marriage procession comes to the bride's place with the groom sitting in a *Chandol*. The first ceremony is that of *Pav Poojan* where the brides' relatives wash the feet of bride and groom. After this, the *Bhanver* takes placed, on which the bride and groom perform seven circumambulations around the lit *diya* (lamp) that is placed over the pot of the water. Later, the entire gathering is treated to the feast. The next morning, the *Bhitana* rites are performed on which the groom is fed food and given gifts by relatives. The *Barat* leaves after

the lunch and the bride accompanied a few of her closed relatives leave in the *Doli*. The bride stay over the night at her in-laws place, where again the feast is held along with a lot of singing and dancing. The next morning she return to her parents and goes again to her in-laws house a few months later.

Death: Among the Tharus the dead body is either buried or cremated. Hindus influence has led to increase the case of cremations. Children, young and unmarried are usually buried after their death. Cremation and burial takes place on the bank of a river or pond. The *pyre* is lit by the eldest son and in his absence it is done by the next of male kin. Thereafter, the ground is reveled and no identification mark is left. The participants in the funeral rites take bath and return home. In the evening, a feast, known as the *Bhaat and Rotipani*, is held on which the participants are served food, generally liked by the decreased. A few months latter, the *ghara* or *barshi* rituals are performed on *amavasia* (no moon night day). Earlier this ritual was held only in the month of *Kartik*, i.e., on *Diwali* day. This ritual is necessarily performed within the year of the death and is meant for the peace of the departed soul. However, this ceremony is not performed for children as their souls are believed to be very weak. Food items liked by the deceased are prepared on the *ghara* day and a feast is given to the villagers. Some food and liquor is also kept outside the village boundary with a lit *diya* next to it and is meant to attract the departed soul out of the village. On the same night, a continuous music and dance programme takes place and in the morning (sweets in the form of *prashad)* are distributed to the villagers. The *ghara* rites symbolize the end of all funeral rites.

Literacy/ Education

For a long time, formal education is not considered important by the Tharu. The knowledge of reading and writing acquires as a matter of personal interest and choice. The family functioned as school and its members as teachers. Children get training and guidance in different aspects of their life, which would be proving essential when they entered the society to take up the responsibility. Even today, children are taught the norms and ways of their society in the house. From the age of 7-8 years, both the boys and girls begin to assist their father and mother respectively in the day-to-day tasks. Thus, from the young age children begin to take part in economic pursuits. In such conditions, the condition of formal education no doubt remains very little. However, gradually the Tharu have begun to realize the importance of education and several people have started encouraging their children to go to the schools. The census of 2001A.D noted that in total there is 6.8 % Tharus in Nepal. Tharu language is spoken by 1,331,546 of people. Dang has 147,328 population of Tharu.

The Tharus represent the most interesting of the tribes and exhibit a validity that has helped them to tide over various crises and to adapt themselves to changes. Overall, the Tharus generally have a common culture. Their customs and practices, rites and rituals are more or less same. An important person taks the responsibility of every village community among the Tharus maintains law and order. This is done by the social approval and encouragement of its member to develop

skill and competence in work. Although several schools exist in their area, the awareness about the education is still needed. There is a high degree of absences and dropouts.

Tharus village community

Landlord of Dang often exploit the ordinary person specially Tharus. It was a kind of prehistoric land covered with forest only for the benefit of the Tharus politically. Dang has become a wide issue and challenge too. What the researcher stress here is that Dang has always been a very valuable land. Himalayan kingdom, in the middle ages, planned to control commercial trails as well as lands in the plains to grow rice or collect woods. Dang involves the desire of Himalayans. The *Dangaura* Tharus had been under the guidance of unknown powers for a long time. Many aspects of their social organization are rooted in an ancient process of political centralization. During the field work, the researcher knows that it was stroungly connected to the political centralization. A strange religious and social organization is based on hereditary relationship between the hereditary priests (*ghar gurwaa*). The priest hereditary relationship is strange to *Dangaura* Tharus. It is more than a *jajmanni* relationship. This very durable and strong linkage between houses and even genealogy has created a twofold division of society that is between priestly clans also called *Gharguruwaa* and others, called *Kusumyaa*. There is worship of god attached to the soil. This is more specifically to the part of the valley called *pargannaa*.

Clans or *gotyaar* belong to of divinity they worship. The case of the priestly onc is dominated by a specific god who influences certain area known as *pargannaa*. The *desbandhiyaa*, have a very specific privileges. They are in charge of village rituals in the area where their ancestral god is the master of the soil. To sum up, there are priestly gotyaar and cliens' gotyaar. Other people

who do not belong to either group are called the *kusumyaa*. Like the village persists and the domestic priests, the hereditary priests and the non-hereditary ones called *dhararyaa*, who have relation to the soil god. By linking the invisible world through rituals to the soil on which a group lives, the priest and the god of the soil play an essential role in the social and political organization. The priest who has a ritual relation to the soil is stroungly attached to the land because of this we exploits the Tharu villagers. On nineteenth century *desbandhiaa* priests and *chaudhary* tax collectors of administrative units are called *pargannaa*. The huge amount of available land and the scarcity of the human labors have influenced the agrarian system all over the Dang. Dang, for centuries had huge estates during Rana times usually one or several full villages *(maujaa)* cultivated by Tharus *Raiti* or tenants farmers. Local chiefs' *chaudhari* is incharge of a *pargannaa*. *Mahataahwaa* is in charge village. Dangaura Tharu tenants used to till the land under a tenure system called *potaayat* or *potet*. These systems provide free labours to pay the taxes on the land. Without registered title on the land on their names was in practice. User has the riths of the land.

This research, does stress on those agricultural conditions. It involves more than a village-based field works, by opening the research to the general political conditions in relation to the local society. One example of the fixed relationship between agricultural condition and religious organization is the strong village unity. This unity is expressed through village ritual done under the shared responsibility of the chief and the village priests. They have divided the land into the different parts; and supposed that each piece of it is possessed under the specific God with respect to *Mauja*, and different rates of tax are collected.

Statement of the Problem

The government of Nepal has recently begun ambitious program of achieving 'Education for All' by the year 2015. In the background of 15- year long intensive as well as extensive government involvement through PEP and BPEP attempts to fulfill EFA goals. Now it seems that approximately 20 percent of the primary school going-age children are still out-of-school. These children, with some exceptions, appear to be mostly from families who have less concern to education. This may be partly due to prevailing culture and economy in which relevance to education is marginal, partly the quality of education in schools, partly equitable access, and to some extent family neglece and / or lack of awareness. Mathematics results from the discovery; it is the application of patterns of inductive and deductive thinking. It is systematic development, which are drawn by formulation. It consists of structure of related ideas. The structure is developed from a long period of practice, which leads to a greater understanding of mathematics and its applications. The principal reason that mathematics is widely studied is its usefulness. It was easy in the past to identify a minimum usefulnss of mathematics. Nowadays mathematics is needed not only as part and language for effective everyday living but it is also use as a language of industry and science. Modern science cannot learn without an understanding of mathematics. Physical sciences open basic course in mathematical language and use mathematics continuously to formulae result and to make principle. Social and behavioral sciences are using mathematics to our increasing extent.

In Nepal, students memorise their mathematical knowledge. They cannot use their rote learning knowledge effectively. They fail to see the transfer of their mathematical knowledge in new situation. In Nepal, the social context of its knowledge would be thought as irrelevant. Due to the lack of social context and experience, the transfer of knowledge does not work. The methods of instruction are not based on the experiences which discourage the critical thinking and intuition.

Traditional mathematical knowledge of Tharus' people is going to extinct. It is necessary to document their mathematical knowledge and practice. The educations taken from western country diminish our social cultural value and norms. Therefore, the researcher wants to focus Tharus' ethnomathematics to interlink with mathematics education in Nepal. Mathematical learning is required for all human beings in their social lives as well as private lives. Democratic sphere demands mathematical learning for their social justice. The good deal about mathematics affects ones personal identity. The information society is indicated by the rise of networks, and network economy, which depends on concerning global communication, is certainly mathematical one. However, mathematical economy and society of today are quite different from those of the past. The expansion of mathematics is based primarily either on the work or the manufacture of material goods. Instead, telecommunication, genetics engineer and computer are based on mathematical ideas.

Research Questions

The study is planned to discuss the features of mathematical activities or mathematical knowledge as known to all Tharus communities from their daily life experience. The mathematical object and ideas are invented or created by Tharu community from the need of the daily life is crucial in their community development. The following research questions have been developed for this study.

i) What kinds of Tharus traditional mathematical knowledge exists in basketry, clay works, dancing and house painting?

ii) How and where is the mathematical knowledge practised?

iii) Where can the culture mathematical knowledge of Tharus community are used in school mathematics curriculum?

Significance of the Study

The main objective of this research is to identify the range of mathematic concept used by Tharus community and to seek linkage between ethnomathematics and their practise. How they used mathematical concept to perform their traditional work concerning both pedagogy and content are focused. This study is intended to inform national policymakers about the causes and consequences of the effect of ethnomathematics of Tharu community so that they can have a more informed basis for making policies that will better achieve the goals of providing

education: as a human right and as a tool for social and economic development. Due to the lack of the clarity of research evidence on ethnomathematics, there is the dilemma to construct curriculum. So is the selection of content. The present research aim is to describe the naturalistic setting where the learning takes place. Mathematics has the great value in real life situation. Knowledge of mathematics helps the childern to enable to their quality of life and skill of works. Because of its practical value and utility, mathematics is an interesting subject. It is concise and exact. When we begin to learn it, we get immediate feedback. No exaggeration is possible. However, in Nepalese context many experts, educationists and even general people express that only theoretical aspects of mathematics are emphasized.

Learning is a life long process. It begins with womb. Parents, peer groups and environment help childern to construct and reconstruct his /her knowledge. Cultural phenomena are the world of childern setting. Culture set the boundary of childern. Children organize their experience continuously with their environment. Children have capacity to construct their knowledge. Creativity, self-knowledge / confidence/ esteem as well as other skills have influence to construct the way of thinking, knowing, willing and doing. Observation, perception of reality and interpretation design their habits. Children can develop their understanding of their own situations. Childern can draw reason and make habit by observing the contexts and situations. The need of study about children's habit, experience and behavior of childern construction of knowledge is essentials for improving quality of education. There is lack of student's oriented activities. There is no applicable type of daily life problems in textbooks. The content of

mathematics textbooks should be improved with respect to specify group works, practical experience and be written with behavioral form of social context.

Mathematics deals with various fields. They are agriculture, fishing, architecture, building, astronomy, exchange, trade, calendar development, civil engineering, roads, bridges, canals, decorative arts, design of household items, kinship, relationships, land ownership, medicine, healing, music, chanting, dancing, playing musical instruments, singing, navigation, religious practices, sewing, quilting, beading, basketry, plaiting, sports, scoring, tattooing, body painting, body adornment, taxation, toys and games.

CHAPTER II

RELATED LITERATURE

What is ethnomathematics, what are the factors of ethnomathematics, and what is its philosophical view with contemporary technology and pedagogy have been dealing for fundamental basis of the ethnomathematical research work.

Ethnomathematics: Why and What?

Ethno comes from ethnology, so ethnomathematics refers to the study of mathematics in relation to culture. Etymology of Ethno-mathematics come from ethno + mathematics: The prefix ‘ethno’ comes from the word ‘ethnology’ "the science that analyzes and compares human cultures; cultural anthropology” and ‘mathematics’ "the study of the measurement, properties, and relationships of quantities, using numbers and symbols (TAHCD, 1993).” Again ethno + mathema + tics: The prefix 'ethno' refers to identifiable cultural groups, such as national-tribal societies, labor groups, children of a certain age bracket, professional classes, and includes their ideologies, language, daily practices, and their specific ways of reasoning and inferring. '*Mathema*' means to explain, understand and manage reality specifically by ciphering, counting, measuring, classifying, ordering, inferring and modeling patterns arising in the environment. In addition, the suffix *'tics'* means art or technique. Thus, ethnomathematics is the study of mathematical techniques used by identifiable cultural groups in understanding, explaining, and managing problems and activities arising in their own environment.

Some definitions of ethnomathematics: D'Ambrosio (1985): Ethnomathematics is the art or technique of understanding, explaining, learning about, coping with and managing the natural, social and political environment, relying on processes like counting, measuring, sorting, ordering and inferring which result from well-identified cultural groups. D'Ambrosio (2001): Ethnomathematics is the mathematics practiced by cultural groups such as urban and rural communities, labor groups, professional classes, children of a certain age bracket, indigenous societies, and many other groups that identify themselves through objects and traditions common to the groups (Powell, 1997). D'Ambrosio (2001): Ethnomathematics is the application of mathematical ideas and practices to problems that confronted people in the past encountered in present contemporary culture. Bishop (1988): Ethnomathematics includes playing, designing and locating as other environmental processes rich in Mathematical ideas. Powell (1997): ethnomathematics also suggests that ethnomathematics is a special type of mathematics. So ethnomathematics is related with the term 'mathematics' in various ways as 'mathematical knowledge', 'mathematical ideas', 'mathematical activities' or 'mathematical practices of specific ethnic group and culture.

Hammound (2000, p.7) has quoted ethnomathematics is however, called as indigenous mathematics (Lancy, 1976), sociomathematics (Zaslavsky, 1973), informal mathematics (Posner, 1982), spontaneous mathematics (D'Ambrosio, 1982), oral mathematics (Carraher et al., 1982), oppressed mathematics (Gerdes, 1982), hidden or frozen mathematics (Gerdes, 1982), folk mathematics (Mellin-Olsen, 1986) and non-standard mathematics (Carraher et al. 1982, Gerdes, 1982; Harris, 1987).

Since different cultural group may have different ways of knowing, ethnomathematics implies mathematics of culture. In a particular culture people share common experience of language

belief and costumes. Cultural mathematical concept of the student is crucial. Today mathematics is part of western partitioning of knowledge that does not occur in the same way in other cultures. Over the last two decades in education, constructivism has become the dominant theory. It deals with 'making connection' with everyday world of student, prior knowledge within school and outside it. From this perspective, ethno-mathematics is starting with some notions that making connection with prior knowledge, with the world of the student. It requires us to see knowledge not as the independent of individual and their environments or as the something that tested, matched against external standards but rather as embodied action with all of us being responsible for our actions. Kieren (1995) mentions enactivism as an embodied action when we maintain the ying-yang of self and world and of ideas "out there" and "in here". From this perspective, the aim of teaching is not to link learners' experience to some external curriculum, but to view the curriculum as being occasioned by the learner experience in their school environment. The Enactivism classroom constructs as the dynamic system that "the teacher listionning not to check or models the student, but to participate with them" (Ibid). Enactivism provides a different perspective from the usual constructivist that is it assumes that the separation of self from the others and separation of knowledge into the subjects are false. It emphasizes, "Being connected" is even stronger than the notion of "making connection". It raises new issues for some of us including how might be emphasized being connected when considering different ways of knowing including non-cognitive ways that are not thought about in western education.

The people of particular culture need to be considered. It is very easy to assume that Tharus are bound with their own language and culture, to undervalue profound issues of the other culture. It cannot support the decisions making that are made because of dominant and oppressed culture. Hammond (2000, p. 54) has written that "mathematics is constantly evolving and co-existing

with and around the culture". Mathematics is forefront of communication and trade and is tool to the logical conception of our mind. Without it, there could not be communication and trade.

Historical Background of Ethnomathematics

The struggle for existence and the drive for the survival is the nature of species. The species seek and find other for manifests itself. The human species obey this instinct. Man seeks and finds knowledge, exchanges and leads behaviors. They use common interests and are communicative between them. Ethnomathematics now considers sub field of the history of mathematics. It deals relationship between anthropology and cognitive science. Nowaday society is very complex. The dignity of the individual is violated by its social exclusion. The well-known society to established unfair central society and create inferiority. The educational institution is not listening in the classroom from that inferior society. In reality, the different forms of mathematics have developed because of the interaction of human with the environment. It creates the diversity of mathematics.

Ethnomathematics has been argued with strong support from the different fields. They are anthropology, educational pedagogy, history, psychology and philosophy. The academic mathematics is the combined expression of variety of informal mathematics developed throughout the different parts of the world.

The emergence of mathematical thinking in individual is primitive. What is thinking? What is consciousness? What is different between mind and brain? It is equally important for neurologist and including neurosurgeons. However, in practice, the human species works deal everything, which is need in human life.

> D' Ambrisio state, "the species Homo sapiens sappiness is new having been identified approximately forty thousand years ago. The species that preceded it, the Australopithecus, appeared nearly five million years ago, close to what is known today as Tanzania and it spared over the planet. In this expansion the species underwent transformation, influence by the climate, food, habits and various other factors and develop technique and abilities that allowed their survivor in the new region they encountered. When confronted with new situation we greater experience from previous situation, adapting them to new circumstance, thus incorporation to the memory new way of knowing and doing. Thanks to an elaborate system of communication, the way and models of dealing with situations are shared transmitted and disseminated. Through communication, the information received by another. The knowledge generated by the individual which is the result of processing the totality of information available, is also through the communication, shared at least partially with the other. This is extended obviously to others and to the group. Thus the knowledge shared by the group is developed. (D' Ambrisio, 2000.)"

All species have deep connection with the surroundings. They obtained nourishment and defense. Knowing environment is easy to support and protect them, it helps to master techniques of agriculture. Today we have constructed genetic engineering to consum nutria and sufficient food. We are living in a period of information get-together and each person gets information by computer technology. Interaction between individuals is also found. A great prospective yet difficult to welcome and to generate common action i.e. the diversity is the essence of life. Thus it begins a new era that opens up enormous possibility. However, for the harmonious co-existence of the different through an ethic of mutual respect, solidarity and co-operation is essential.

> According to D'Ambrosio "When Australopithecus first chose and began to chip a pieces of rock with the objective of picking the flash of the bone. His mathematical mind was disclosed. To select a rock, it is necessary to evaluate its dimensions, and to chip it, it is necessary to evaluate compare dimensions, (D'Ambrosio 2001)."

This comparising and evaluating dimension is one of the most elementary manifestations of mathematical thinking. This mathematical Australopithecus developed idea considered as one of the first examples of ethnomathematics. The Ramapithecus was found in Nepal about 1.5

million years ago, which was ancestor of Australopithecus (Chaudhari, 2007, p.28). In Nepal, we get stone weapons between 0.5 millions and 4 thousands years ago. It implies that ethno mathematical prospective in Nepal is primitive.

There was the complex interaction between the many diverse civilizations. That generated an intense cultural dynamic seen in this context, mainly through trade and commerce. As a fact that China is interested with India and India influences the Arabs and maintains a relationship with them. In this prospective, Teresi stated that "Our modern numerals Zero through Nine were developed in India during the so called dark age of mathematics".

In accordance with Joseph the importance of the Arabs and other civilizations such as China and India as transmitters and creates of mathematical knowledge has been ignored in the study of the development of mathematical concepts during the Dark Age. The rules of mathematics are historically determined by the working of society that evolves under pressure of the inner working and interaction of social groups and the physical and biological environment. The 20th Century seeks the emergence of anthropology and much attention given to understanding the way of thinking of other cultures.

We do because we know and we know because we are doing. The process of acquiring knowledge is the dialectic relation with knowing and doing. Knowledge generates knowing which is decisive for action, and subsequently, it is the behavior, the practice, and the doing that equivalte, redefine and reconstruct knowledge. The ethnomathematics has been influenced from constructivist practice. It ts concluded that different cultural groups may have different ways of knowing.

> Hamilton (1997) states that "for me ethnomathematics implies mathematics of culture and my definition of culture (and sub-culture) not only refers to ethnic culture, but also to any sets (or subsets) of people who share common experience such as language belief, customs or history. Using this definition obviously an ethnic group from a culture, similarly religious group a group involved in a sport a group a people, who cannot hear, an artistic community, a gender group, or the reside of a district all from either a culture or a subculture."

Over the last two decades in education, constructivism has become a dominant theory. One phrase that is common to many recent mathematics curriculum documents that reflect this is "making connection". Making connection implies connection with the everyday life of the students, the prior knowledge of the student, the familiar context both within school and out side, other topics within mathematics, other school subjects, and the past and future. Where present is interfacing of past and future, it evolves mental maps with vivid experience. The connection to other subject gives the justification of holistic approach. Enactivism is an emerging learning theory that moves from constructivism to holistic view of knowledge. It is the inclusion of Buddhism and Eastern way of thinking. It involves becoming aware of that we are doing without judging it. It moves from a cultural base on judgment to one based on possibility. Enactivism requires seeing knowledge not as the independent of individuals and their environment as something that can be tested and matched against external standard but rather as embodied action with all of us being responsible for our actions. Embodied actions mean we maintain the Yin-Yang of self and world of the ideas not "out there" but "in here". From this prospective the aim in teaching is not link learners experience to some external curriculum but to view the curriculum as being occasioned by the learners' experience in their school environment.

> "Enactivism provides different prospective from usual constructivist one in that it assume that the separation of self from others and the separation of knowledge into the subject are false. In rejecting those traditional Western thinking patterns, Enactivism emphasize being connected which is even stronger than the notion of 'making connection' it raises new issues for some of us including how might one emphasized being connected when considering depend different way of knowing including non cognitive ways that are

> not thought about in Western education. In assuming the error of separating mathematics from other subjects it highlights the need to address the issue of the western partitioning of knowledge (Kieren, 1995)."

Enactivism implies that individuals' society and nature cannot be separated. None of them can permanently exist to the abcence of other. Like triangle, the vertices and side are integrated and indissoluble. The equilibrium harmonization of those relations constitutes a learner ethics that we call the ethics of diversity. Peace in its multiple dimensions is the realization, in everyday life, of this ethic. The pursuit of equity in society in future, where the cultural diversity will be the norm, demands an attitude without superiority and prepotency in education particularly in mathematics education.

The Arabs invaded Europe in the Seventeenth century, and brought with them their tradition and mathematical knowledge as acquired in India. They influenced Europe by exchanging food, customs, culture, science and new form of technology, In turn when the Europeans went on to conquer and colonize the people across the world, they again imposed their systems into the new world. The invention of zero and the notion of place value had been attributed to the Hindus. Place value notion was transmitted to Arab peoples through religions and commercial activities, war and conquest. Again number system did not satisfy the demand and necessities of new capitalist society. There were emerging and developing decimal number systems which are in India and they were brought to Europe by Arabs. The Hindus absolute advantage of this cultural interchange is that they learn the important cncept of Greek mathematics especially through the Arab culture. Hindu assimilated habits and customs of Arab culture and had learned important concept from Greek. The contribution of Greek - Arab - Hindu and Hindu - Arab - Greek for the development of mathematical concept enriched modern development of academic mathematics. Greek and Hindus also experience the different relationship between the ray and chord of the

circle in the development of astrology. However, Hindus mathematical concept of half chord concept has fecilitated astronomical development. Mathematics is purely conceptual ideas created to help us understand the world. We can think of common phrase "If we know the enemy, then we can defeat". It means the unnamable is the unconquerable. Mathematics is slowly made of definitions, and inferences based upon those definitions. It uses these definitions and inferences to act as a tool to expose the incomprehensible world. An axiom seems as the foundation of mathematical proofs and inference by providing us with model for assumptions or assertions.

> "The rule of language and of mathematics a historical determined by the working of society that evolve under the pressure of the inner working and interaction of social groups and physical and biological environment in earth, they are also simultaneously determined by the biological properties, specially the nervous system of individual humans (Hersh, 1997)."

People realized that time and space was not perceived identically to everyone. While studying the mathematics of non-European cultures, we find that not all cultured count nor start the same, nor do they have the same conception of these "Universal" ideas. Mathematics grows more and more universal as communication ensues. The more people communicate, mathematics become a tool for communication and trade.

Ethnomathematical Philosophy

Contrasting to the platonic view is one in which mathematics is regarded as a creation of human thought. Aristotle's notion of mathematics as the concept that the human mind derived physical world, and Kantian impression of mathematics as the organized power of mind are precursors to logistic, intuitionism, and formalism arrangement. This changes the philosophical concepts of mathematics. How can we be certain about mathematical truth? Latest philosophical writing appears to have formed room for relativistic perception. Thus, it might be understood and it has created an opening for establishing cultural basis for mathematics. Thus, there many diverse historical standpoints from which mathematics and each is correct at that time. Thus, mathematics may be historically relative. However, problems continue for cultural relativism because changes are evaluated as progressive. In addition, it is direction to the growing objective conception, against which earlier conception are seen to be inadequate. Ethnomathematics then again requires immediate progress in different ways under the assumption of equal validity and objectivity. Silarly Barton (1996) has quoted that neo-realism (Maddy, 1990, Rusmk, 1993) similarly falls down two unusual mathematical worlds meet: it is assumed that they would need to be set on into a ‘best’ view, although the criteria are not specified.

Wittgenstein (1997) suggests that this is just a "way of talking" Circle exists because and only because we talk about them. For two hundred years many important mathematicians denied the existence of negative numbers. They were right. For mathematician who did not talk about them, negative numbers did not exist. It was only accepted they began to use. When their products were discussed, they came into existence like infinitesimals. This demonstrates that probability is

a "true" thing. This is human construct. How we construct it after the result that we obtain. Neither of those worlds is right or wrong. They are simply functional or not. Powell (2002) theorizes that in ethno mathematics, the prefix "ethno" not only refers to a specific ethnic, national, raical group, gender, or even a professional group but also to cultural group defined by a philosophical and ideological perspectives. According to Fairchough (1995), Institution such as ethnomathematics constructs their philosophical, ideological and discursive subjects. For example, to be a mathematics educator, one is expected to master the philosophical (way of being), ideologies (way of seeing) and discursive (way of talking) norms to which the mathematics education community is closed. Those ways of being, seeing and talking are inseparably knotted in the sense that it helps the process of acquiring the way of being. Powell suggested small group discussion as a useful pedagogy.

Ethnomathematics results in action against the operation and domination. Dowling (1993) says ethnomathematics has something to do in modern mathematics. In constructing his reasoning, he refers to the existence of an "ideology of monoglossism" in the field of mathematics evolution in which constructivism is one of its forms. According to Dowling (1993, p 36) the second manifestation of the ideology of monoglossism in mathematics education is plural monoglossism and ethnomathematics is the example per excellence. In this form of monoglossism, emphasis is changed from individual subject to cultural subject and society is viewd as constituted by a plurality of cultural communities, because there is complete absence of moglosissism. Skovsmose & Vithal (1997) argue about the lack of discussion regarding relation between

cultural and power in the research developed in ethno-mathematics. He writes: Ethno-mathematical practice, generated by a particular cultural group, is not only the result of interactions with the natural and social environment but subject to interactions with the power relations both among and within cultural groups. Ethnomathematical studies have demonstrated how this has been played out between the eurocentrism of academic mathematics and mathematics of identifiable cultural groups, but not equally applied this analysis to an analogous situation that occurs within the an identifiable cultural group (Skovsmose and Vithal, 1997, p.11).

Teaching Learning with Technology

The implementation of technology in our classroom is mostly controversial. Many teachers assume that technology refer to calculator and computer, and television, OHP. But the concept of technology should include non-electronic media and tool as well. It refers to all the tools that human beings use to search for meaning, to resolve problem, to communicate their finding and to measure and to explain phenomena around them. It is therefore tools one used to search, sort, create and report information in our own unique socio-cultural context.

Technology includes the many diverse tools that human beings used to resolve the problem. People use different methods, algorithms and different ways of thinking and seeing the world to solve the problems. Student must learn this and able to appreciate the diversity of thought. From an ethnomathematical perspective, technologies should be used to assist teacher and students alike helps convey knowledge, develop and respect the many unique ways of measuring, explaining, comparing and classify day to day phenomena. What might be important in terms of

class and social standing might in fact be determined by a number of factors: cultures, access and equity, and cultural values of our immediate community. Access to the varied use of textbooks, manipulative, divers form of print media, television, computer, calculator, chalk and whiteboard, paper and pencil technology, and how and how much we emphasize the "wetware" of our brain should be included in any discussion of technology.

One important purpose of using electronic tools in the mathematics classroom is to learn how to organize and make the sense of information. To use an expensive and sophisticated tool for basic skills and drills is not only technologies. The tried and true techniques such as concrete manipulative, paper, pencil, chalk boards and games work better. Learning to integrate the use of woard processing, spreadsheets, and simulations do make good cognitive sense. These technologies have come about because they make sense in the real world. We all need to learn how visual images influence and manipulate us into making decisions about information. The issue of technology is very much an access and equity issue. The growing division between have and have not referred to by many as the "digital divide" is serious and need to be addressed by all educators. We expect children to rise to higher and higher standards to do this without universal access to the tools and resources they successfully need to accomplish those standerd. All children have the right to get good mathematics and technology resources. Availability of alternative form of technology need to be made available allows learners to practise quantifying, comparing, classifying, and measuring day to day phenomena. Convenience manipulative, paper and pencil, chalk and boards, art supplies, data base, spreadsheets and word processors should be made readily available at all times for the students to use.

Issues related to the growing digital divides access, and equity is issues directly related to the core of ethnomathematics. It is very important that the technology which is frequently used in

their community should be accessible. Educators must find ways that effectively communicate the new ways of teaching and learning.

Aspect of Creative Class

Mathematics has been regarded as the essence of rational truth, the study of essential features of quantity, relationship and space. We know that the mathematics we study tell the truths about numbers, point, lines and circle at that it can be used to build bridges which don't fall down. It works therefore it must be right. Mathematics is the world's greatest circle of self-justification. The value of the ethnomathematics is great for the creative class. Mathematics pedagog critics say that ' there are useless exercises' and 'there is no real reason to include those concepts in school practice'. It is not only the function of education to provide student with mechanical instrument that solve the problem but also necessary for educators to promote creativity and preparation for citizenship. The perspective of the teaching and learning process that D'Ambrisio (2002) has stated is: Education in this era of science and technology challenges traditional approaches. The goal of education does not go much further than merely preparing for professional success. Education has a responsibility in building up attitude toward the self, toward the society, toward the nature. Indeed, education has the responsibility of fostering creativity.

Florida (2005) describes the three concistance variables, in a dynamic and creative community. They are creativity, tolerance and talent. He describes for creative category the three variables; Technology is a human attempt. These, libraries, zoo, books and material in schools for all

students come under technology. Talent is the capability for achievement toward success in practice and daily life, e.g. the creators of music, architecture, literature, software, dynamic and variant arts. Tolerance is just tolerating others it encourages to celebrate diversity inrespective of social class, race, gender, sexual orientation, language and religions. It is difficult to reject that education does not provide an important instrument for social-political analysis. Social-political analysis cannot be done product or understood if individuals do not have a basic understanding of mathematics. Basic mathematics is not just a basic 'skill and drill'. It indicates tools that allow the individual perform fully in the world. Performance refers to a capability to appreciate and to analyze and interpret the social - economic – political system. Performance refers to the talent to get the communicative skills. Communicative ability (literacy) refers to reading in order to get new meaning as social concepts i.e., making sense of interpretation of graphs, tables, and other ways obtaining interpretative information. The ability to understand, comprehends, and uses the language of codes and communication. The analytic skill (mathracy) is the ability to draw the conclusion from data, and inferring, proposing hypothesis. It is the first step toward the intellectual posture, which is practically absence from our school curricula. In mathematics the concern was not only with counting and measuring but also with ways to explain, understand, and comprehend their natural and social environments, often with insight and philosophy. The technology is a critical and ability to use and combine different technology instruments such as advance scientific and simple technologies is essenssial. Creative class workers are paid consideration to creative, rather than to perform a task. Students studying from an ethnomathematical perspective have a higher creative component, rather than merely performing

mathematical technique with little or no context. Creative-based education system that unleashes talents is committed to the development of tolerance, and fully integrated technology for all and emergeing active critical thinking are vital.

Rich Cultural Diversity

Mathematics is absolutely integrated with western civilization, which conquered and dominated world. Building the planetary civilization depends on restoring dignity of the losers and makeing new. Ethno mathematics in this sense is the step toward peace. Some people maintain that ancient mathematics systems are irrelevant today. This is unfortunate. Many non-western mathematics systems remain 'alive', some Mayans, still use traditional calendar for religious purpose and determing the agricultural cycle. Western mathematics does not meet the need of all people and is not always easily understood outside the mainstream culture. Australian educators have noted that western mathematics has little in remote Aboriginal communities and is therefore difficult to communicate. An approach that takes into the account the cultural context and the mathematical systems in use within the community is likely to be much more effective.

The literature review of this study tries to explore and manifest the ethnomathematical ideas from different ideological and philosophical perspectives. Its attempt is to relate those ideas with school environment and contextual natural setting. Every person has his/her own cultural background. Without studying it the meaningful perceptual learning doesnot take place. The studies of history provide strength of cultural and pedagogical exploration. The procedure context deals meaningful and productive as well as critical thinking. In the context of Tharu

community, there is no connection between school mathematics and ethnomathematical ideas. As a result, Tharus' children have been facing difficulties in learning mathematics. One of the causes of maximum dropout and unsuccessful in the mathematics is the knowledge gap between culture and school environment. Ethnomathematical knowledge is practical in verbal communication but it is lacking in school curriculum. The modern trend of mathematical ideas is advance, complex, short and symbolic in nature, which is difficult to adopt by Tharus' community. In addition, there is technology gap between modern and local contexts. The lack of the access to the modern technology and forgetting the traditional technology create the transitional period of technologically void. Similarly pedagogical process lies in the crisis. Modern creative class models are not adopted and traditionally processing procedure is forgotten. Therefore it is necessary understand the reality of actual context where the learning is facilitated. Dahal (2007) said that the transformation of learning from old generation to new generation can be exited in the similar context but in different situation it can not be applicable and it is likely to disapper.

In conclusion, the spread of information technology is already influencing education in school in a number of different ways. The present world demands a computer literature workforce and it is increasingly clear that education can, and must, play a crucial role in meeting this need. The rise of education in its modern sense was connected with a number of other major changes happening in the nineteenth century. One was the development of printing and arrival of book culture. The mass distribution of books, newspapers and other printed media was as distinctive feature of development of industrial society as were machines and factories. Education provided the skill of

literacy and numeracy giving access to the world of practical media. Yet the gap of technology within local societies appears major compared to digital divide separating cities classrooms. As the cities economy increasing becomes knowledge based. The poorer villages become much denserand more marginalized because of gap the between information rich and information poor. Ethnomathematics also talk about local contemporary technology that can be breathtaking and open important doors. It is to be recognized that there are no such things as an easy to techno-fix. Where do we focus local and advance technology to convey a mathematical ideas and practice?

CHAPTER III

RESEARCH METHODOLOGY

Mathematics education research discourses various research workes in the world. This chapter discusses some of the conceptions, which provide strategies and design for research work. Thus, it deals with conceptual framework, sampling, limitation, delimitation and observational tools.

Research Design and Strategies

Mathematics education and rural education researchers seem to have little understanding of each other's work. In response to this disconnect, the resercher describes ethnomathematics in mathematics education and place-based pedagogy in rural education, discusses how research in place-based pedagogy can benefit the research methodologies of ethnomathematics. Ethnomathematics refers to a cluster of ideas concerning the history of mathematics, the cultural roots of mathematics, the implicit mathematics in everyday settings, and mathematics education. The five thematic patterns are cultural studies, natural studies, interships entrepreneurial opportunities, real world problem solving and critical pedagogy. The cultural studies: Engage students in learning about their local culture and history; nature studies: that focus students on local natural resources; real-world problem solving: involves students in solving community and local problems; internships and entrepreneurial opportunities: engage students in building the economic base of their communities; and induce into community processes where students are engaged in community decision-making. Critical pedagogy: as proposed by Fieire based on the belief that education should help students engage in the struggle for social justice, particularly in their own lives.

Barton (1996) identified four types of empirical methodologies that characterize ethnomathematics research: descriptive, archaeological, mathematizing, and analytical. Descriptive activities expose how mathematics used in a particular culture. It describes how members of a culture intuitively use mathematics in everyday life. Descriptive research focus on: how mathematics is used to regain land ravaged through mining or logging; how mathematics is used in local businesses and industry; or how mathematics can be used to explain why a local lake, river, or stream is changing. Much of the current work in place-based pedagogy seems to fall in this category. Descriptive research includes studies that explore community, parent, teacher, and student beliefs about mathematics as well as beliefs about teaching and learning mathematics. Archeological ethnomathematics research is historical in nature and describes how mathematics is used to create cultural artifacts (Barton, 1996). Thus, ethnomathematics research reveals the importance of mathematics in developing local culture. How local people use concepts of geometry and measurement to design and create quilts, how early settlers used mathematics to map out clear land for communities and musicians to create indigenous musical instruments. In these instances, individuals were often not aware that they were using sophisticated or formal mathematical ideas. Mathematizing the ethno-mathematics research involves connecting the informal mathematics developed in a culture to formal mathematical ideas. This research is similar to archeological research. However, the focus is on current, rather than past uses of mathematics in the community. For example, quilt designs reflect formal geometric concepts like symmetry, similarity, congruence, transformations, rotations, reflections, and fractals. Other examples include examining how local engineers control water flow in Greeks and rivers or studying the economic impact of a particular industry (e.g., coal, timber, manufacturing, technology) on the community. Researchers would study teachers' strategies for

transforming local uses of mathematics into classroom mathematics activities or tasks. Analytic ethnomathematics research and activities involve using mathematics to investigate or explain existing cultural circumstances. Gutstein (2003) used analytical research to study how Latino middle school students in Chicago developed a sense of social justice and sociopolitical consciousness. Over 2 years, he asked students to work on what he called "real world" projects. These projects required mathematics found in a middle school curriculum to explore and understand local social issues. The projects focused on issues like abortion, teen pregnancy, homosexual marriage, race discrimination, power, and justice.

Summing up it might start that mathematics is one of the high points of individual expression, a vehicle for conveying intense and refined human emotions, which can be recognized as being of universe order. However, all mathematics composed in a social setting. It has cultural content, and to understand this content, it is indispensable to study more than just the mathematical activities of a society. Even in what it is broadly called primitive or tribal mathematics, it is usually possible to identify the cultural region, and summative even a community, from when an object comes.

In mathematics education, there are three research traditions. The pedagogue tradition is probably the oldest one. It deals research is an integral part of being good teacher in which experiment and observation being key concepts of research. The research methods are disciplinary and try out ideas with pupils and observe repeatedly. Learning from the children is crucial evidence. The idea and concepts are intended to be intuitively reasonable. The second tradition is empirical-scientific tradition. It deals with the evidence, which is the key to the

knowledge, and the research process is focused on the method of obtaining that evidence and analyzing it. In this tradition, the research methodology is very important. Indeed to a large extent, one tries to minimize the influence of the teacher individuality. Improvement of mathematics education is an ultimate goal of this tradition but it comes about by the gradual accumulation of relevant evidence and research procedure used. Assuming that acceptable procedures have been followed, the evidence must then be explained with reference to the theory. The third are is the scholastic-philosopher tradition. It deals with education as to be one of the humanities. It provides analysis; rational theorizing and criticism, which are important. Real classroom and real teacher are being somewhat important manifestation. This research, adopts the critical theory as its principal components. The improvement in mathematics education under this tradition implies the imperfect reality coming closer to the perfect theory. Improvement would be recognized in the development of a greater critical and reflective awareness but the real research goal is to develope theoretical knowledge by analysis and criticism with evidence assumed to be known.

This study uses an evolving and flexible design to identify the range of mathematical concept used by the Tharu community in Nepal. The sample area is observed for a period of three months. Semi-structured interview/observation guides developed to trace mathematical concept, family backgrounds and mathematical activities. However, sufficient provision is made in the interview and observation guides, including open-end response for new and emerging factors.

It is not researcher's task to define, describe and analyze the different research paradigm used in this field. It is necessary for the researcher to be clear cut to the application of grounded theory in this field. The researcher takes the view that to qualify as research in mathematics education, a study in our field needs three qualities they are enquiry, evidence and theory. Enquiry concerns the reason for the research activities. Evidence is necessary in order to keep the research related to the reality of mathematical education. The theory recognizes the existence of value assumption and generalized relationship. The term "Grounded theory" refers both to the method of inquiry and to the product of inquiry. However, researcher commonly used the term to mean specific mode of analysis (Charmaz, 2002). Grounded theory provides a set of flexible analysis guidelines that enable researcher to focus their data collection and inductive analysis. The major strength of this method is that it provides tools for analyzing process and these tools hold much potential for studying social justice issue. Grounded theory methods consist of simultaneous data collection and analysis, with each informing and focusing the other throughout the process. In grounded theory we begin our analysis early help us focus further data collection.

The grounded theory applied here is at the data collection and interpretation of information. Every activity was looked in natural setting. Ethnographic study demands to achieve information like their mythical story, poem, dialogue, painting architecture, activities of fest and festivals. It provides processing ideas how to start, how to precede what sensitivity toward are sincerely adopted. The researcher did the field work without setting any interview question. He made relation with informants. Moreover, he began to talk about issue. The resercher got some clue to make further observation and discussion. The field experience guided him repeatedly. Analysis is

started in the beginning with coding and phasing during the data collection. Grounded theory is applied for systematic analysis and interpretation of data. Research interpretation procedure has used. Grounded theory is grounded in data in inductive ways, which helped the researcher to dig out from complex behavior situated on cultural heritage of nature setting.

The rigid procedure donot be deal in grounded theory. The data are collected through interview, field notes, observation and reports. Sensitizing is a guiding principle for starting point of research. The researcher asked open question with prior understanding. The most important intellectual activitiy in analytical process consists of comparison. Coding may be described as deciphering or interpretation of data and it includes the naming of the concepts and the explaination of the text. The concept is coded. The target of the first analysis is the production of code that is related directly to the data. Concepts are provisional characters. They are differentiated and abstracted through analysis, which is known as categorization.

The data had been broken down analytically, which is the principle of grounded theory. From the data the succession of concept is developed. Its learning ability is difficult which demands the creativity of investigators. The requirement initially seems to be liberating. The researcher should distance oneself from exiting theories and allow the theory to grow out of the data, which had done seriously. The investigator gradually reveals theoretical memos, which is in broad sense interrelationship. The writing of theoretical memos requires researchers to distance themselves from the data, and help from to go beyond purely descriptive work. When the researcher has begun to data collection, data analysis, interpretation and formulation are started

theory starts. Moreover, these are closely interrelated ideas that make the researcher to think critically. The research area is mathematics that contains many consistent interrelated and differentiated ideas. It makes the resercher suitable for the production, description and explanation of mathematical phenomena. First, open coding is difficult for the researcher, because there is not any prescriptive way. So the resercher starts wrestling with data and deciphers it. Moreover, the resercher names the concepts by explaining and discussing more details. The concepts are in provisional characters that are analyzed; they are more differentiable and viable. There are numerous different mathematical concepts, which are abstract. The resercher feels difficult to categorize but when he tries repeatedly then the emergence of categories seen. The broad interrelation those are gradually chaptered. Moreover, data are broken down analytically, then categoried of differentiated are refined. The main categories are located at the center and network relationship is built around it. This type of axial coding begins initially. It provides flexible analytical guidance that enables the resercher to focus data collection and analysis. The different process relationships provide the resercher tools for analyzing. The data tools develope integrated set of theoretical concepts from their empirical evidence. At finally, the researcher has not only synthesized and interpreted it but also integrated on a refine theoretical concepts. The reality of present may differ from the past but the researcher has emphasized on process. He has used logical, analytical procedure, and comparative methods etc. Open coding, axial coding and selective coding guidelines and activity help the resercher to search the final documentation. Following the, Struss's version of the grounded theory the researcher has emphasized on meaning, action and process and seeked consistence with pragmatic view. For

social justice issue, there has focused on fairness, equity, equeality, democratic process, status, hierarchy, individual right, collective right, and obligation. Exploring tension between complicity – consciousness, choice – constrain, indifference – compassion, inclusion – exclusion, poverty – privilege and barrier – opportunity are critically analyzed.

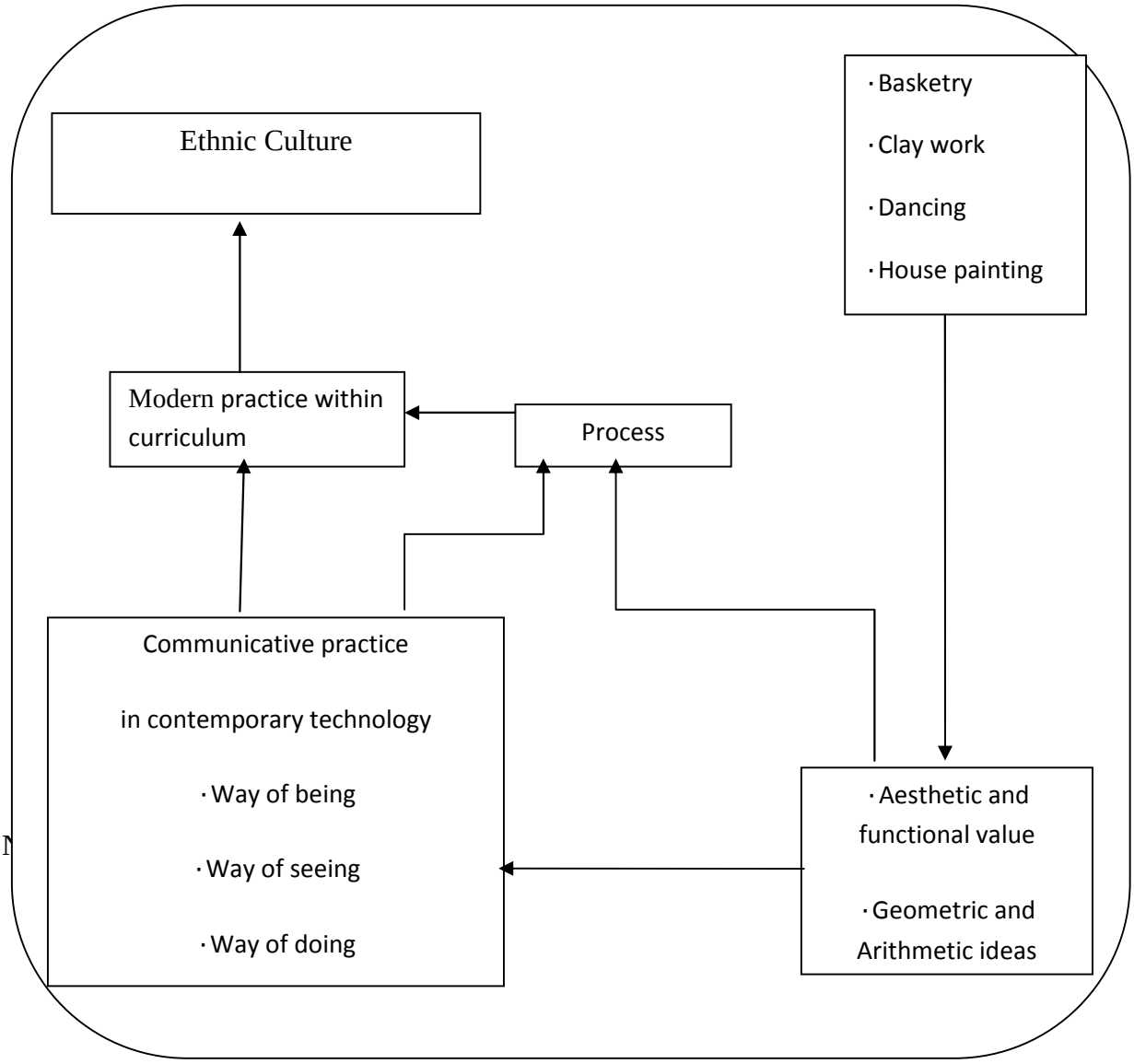
The nature of research assignment requires field visits. The researcher has first hand information about the Tharus' and their mathematics in the changed scenario. The present research work makes a record of the Tharu mathematics one of the most fascinating aspects of their life. The study attempts to give a comprehensive in depth survey of all major Tharu mathematical concepts. The investigation has been carried out on their dwelling types, drawing and paintings, pottery and clay work, basketry, mat making, rope, net and other mathematics related activities. It mainly deals with details such as material used, preparation, orientation of younger generations and skills techniques, and designs.

Theoretical and conceptual Framework

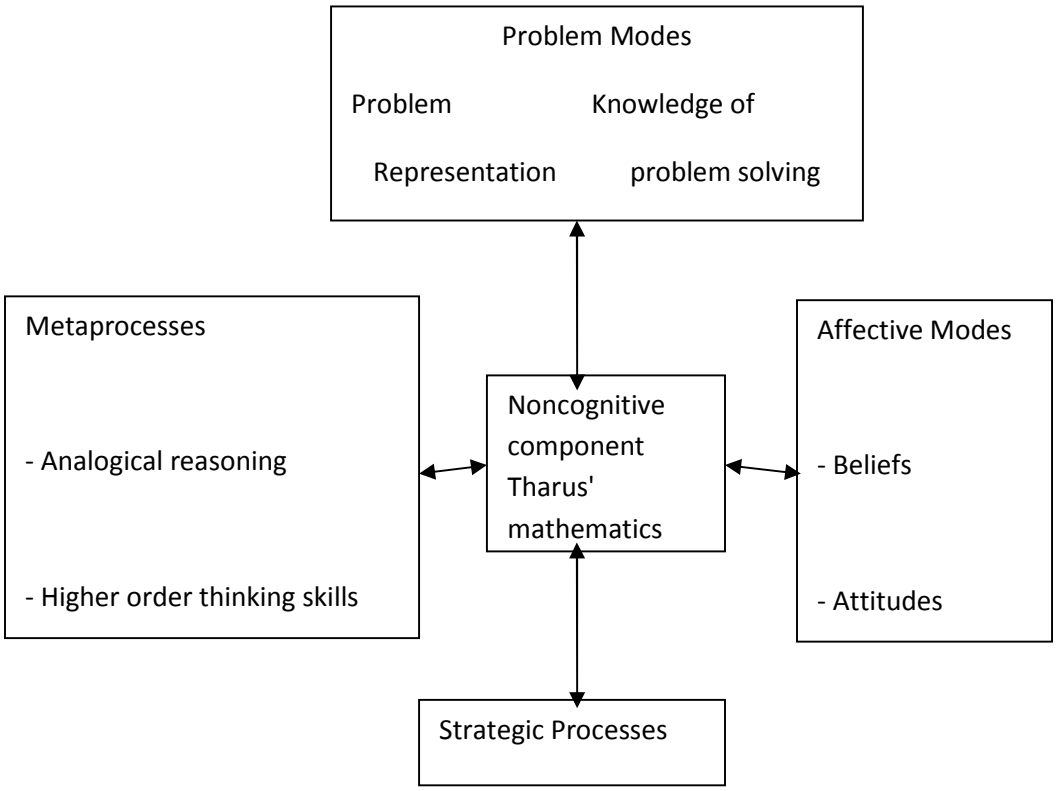
The different linkage between mathematical concepts investigated with respect to practice is difficult to mention. There are several theoretical perspectives on the nature and implication of modern education for creating inequality. One is the concept of cultural capital that has been important in helping us understand why social class influences school success (Bourdieu, 1977). The cultural resources: knowledge, practice and artifacts are differently valued by the society. Therefore, they are obtained differently for personality developments. Bourdieu (1986) offers

that the cultural experience in one's home facilitate the interactions of the children with schools and authority of their achievement. As a result, the transformation of cultural resource into the cultural capital is used for social benefits. The schools standers or resource distribution also are not indifference. Moreover, Bourdieu (1986) has described three types of cultural capital. Embodied cultural capital refers to styles, manners, cultural performance and closeness, and valued type of cultural knowledge. In this stage, cultural capital is rooted in individual. It is both the inherited and acquired properties of one's self. Inherited means not genetic, but more in sense of time, culture, and tradition donating the elements of the rooted state to another usually by the family through socialization. Embodied cultural capital powerfully links to one's habits, character and way of thinking. Objectified cultural capital deals artifacts and goods with includes literature, music, museums, art, dance forms, historical side and the like. Institutionalized cultural capital on the other hand submits to academic qualifications. Social and cultural capital is affected by each other and by the resource of economic, physical, technological or informational, and human capital (Bourdieu & Coleman, 1991). Bourdieu (1977) has developed the idea of cultural reproduction concept. He states that the function of the education system as being to reproduce the culture of dominant class helps to ensure their continued dominance. The other perspective emphasises linguistic skills. In 1970s Basil Bernstein agued that children from variety backgrounds developed different of codes, or form of the speech, during their early life, which affect their subsequent school experience (Bernstein, 1975). The speech of the working class children represents a restricated code – a way of using language containing many unstructured assumptions which speaker expects other to know. A restricated code is the type of

speech, which is used in one's own natural setting. Language in restricated codes is suitable for communication about the practical experience and discussion of ideas that are more abstract, processive related. The language development of middle class children, by contrast according to Bernstein, involves the acquisition of an elaborated codes style of speaking in which the meaning of words can be individualized to suit the demand of particular situations. Reflecting the theoretical appreciative, the resrcher has realized that mathematical understanding is not liberated in local context. Moreover, the resercher developed conceptual framework to investigate ethnomathematical perspective on the heritage of Tharus.



The modes of thinking and reasoning, and the modes of communicating are emphasized in the research process. The flexible creative thinking, inductive and deductive reasoning, spatial visual thinking, pattern perception and critical thinking are the manifest of the work. Spatial visualization involves the skill of mentally manipulating, rotating, twisting, inverting a pictorially presented stimulus object. How are Tharus able to interpret, visualize, construct, transform and classify geometrical shapes, patterns and diagrams in the better way? This is present in the following diagram.



The dialogue (connected talking or discourss) and observation among the Tharus becomes primary tool for constructing mathematical knowledge.

The research adopts qualitative design, which demands natural setting and focus on empirical inquiry. More emphasis is given to the field study. For the convenient coverage of maximum information, interview and participants observation are applied. More time is given for the collection of data and for analytical and critical interpretation. This study follows on ethnomethodological technique for data collection while analyzing data, the grounded theory is used. The analytic description, informants, tools and procedure of study are major focusing points.

The Sample

The sample of this study is the Tharu tribe of Dang districts. This specific geographical location is selected since the Tharu population of this area is fairly dense and large. This facilitates coherent and clear-cut study of the Tharu vis-à-vis their contact with non-tribals. However, The most important consideration while selecting Dang as a field is that the Tharus of this area belong to primitive inhabitants. They are less developed compared to those living in other areas of Tharu. Therefore they provide greater details above varieties of traditional Tharus mathematical ideas. Data collected from three tribal villages of the district are Sukaura, Hakuli and Baibang. These villages was selected deliberately i.e. through the purposive sampling. The research work is based on the analysis of primary data collected though fieldwork. Data

collection is done through the observation. Both participants and non-participants observation and interview techniques are used. It has not been possible to stick to a single and standard schedule since the various mathematics demanded different kind of questions at a time. The interview schedule consists of open-ended questions with supplementary questions added on the sport when required. The actual fieldwork has been conducted May 2008 from to November 2008. Finally, a last visit was made to make sure that the data collected was consistent. During the entire period of data collection, the researcher stayed at different places in the tribal area himself, which made the villages easily accessible at any time. This facilitated the collection of data until late hours in the evening and early in the morning. The data presented in the work was based on in depth interviews conducted on seven informants. Some judgment sampling was used as supplement to cover many artist and crafts persons. Apart from primary data, relevant books Journals reports, photo, and C.D. were consulted as a secondary source of information. The study does not specifically deal with the testing of any hypothesis or proposition. It is broadly descriptive and analytical in nature, aiming at identifying the various characteristics of Tharu mathematics. Qualitative research balances between varieties of theoretical and broad-spectrum concrete methodological procedure. The methodology of qualitative research is concerned with theory, method and conceptualization of procedure in empirical studies beyond the concrete details of methods and data collection or analysis.

Rationale of site selection

Tharu as a whole have a common culture. Their customs, practice, rites and rituals are more or less same for all within their group. Kamaiyas on Jaminder estate is still in practice in Dangura Tharu. As Jamindars themselves do not engage in agricultural work and typically have large land holdings, they commonly engage at least three four kamayias. The area, which is taken for the study purpose, is Dang district, which lacks the transportation and communication facilities, and people are still illiterate and backward. Their way of living has not been influenced by globalization. The agricultural techniques are still depending on traditional manner.

The resercher selected Sukhura, Heakuli, and Baibang of Dang district where all of the inhabitants are Thatus. It is the dense area of Tharus which is rich in cultural heritage and experience. They perform many festivals, Jatra and specialization of work occupation. Other peripheral sites were taken for informal information and discussion. This tradition and culture evidence and experience certainly could help the resercher to study ethnomathematical concept. This research was conducted from their cultural identity, house building, exchange system, geometrical pattern and mathematical thinking.

Informants Selection

Qualitative research employs several methods for collecting empirical materials. In the case of sampling design, the resercher took non-probability sampling. This purposive sampling procedure adopted for the selection of key informants. For the coverage of cultural identity,

exchange ideas, house building, geometrical pattern making, informants were chosen social elite, aged men and women who took interest in providing the information without any hesitation. The people who are not very much influenced by the modern culture were takes as the informants of the study. Seven social elite informants were chosen purposively to observe day-to-day activities. In addition, their experience was dicussed. The study did not categorize the informants with gender perspective.

Limitations

Good research includes original text or data and covers larger area of concerned field. Mathematics includes mainly arithmetic, algebra, geometry, and so many other systems. The numeral system of modern mathematics and Tharu mathematics are similar. So it is not the topic of interest for study. The algebraic concept is more abstract and difficult to study because it requires more cognitive thinking. Geometric concept which is not more cognitive in nature is practical work- oriented and activity- based. The algebra and arithmetic are generalized within geometry where geometric system influences human life and aesthetic value of people. Therefore, this study gives primary emphasis on geometrical and mathematical ideas of Tharu community. In addition to this, the focal point is the non- cognitive (practical work based/ work related activities without understanding) aspect. The ethnographic study demands at least two years of the data collection or participant's observation that is not possible for the case of this research. The analysis of this research is only mathematical, cultural and pedagogical background. The triangulation of mathematical concept with respect to other researchers is not

possible because it is the first study of Tharu mathematics. The instrument that is participant's observation, interview, and photography were used. The review of literature provides the strong background of contemporary technology, pedagogy and feeling of being. It is the descriptive research so as to collect functional informations that describes existing phenomenon with diversed form of objective but it is not to make comparison with respect to mathematical ideas.

Delimitations

This is the descriptive study of ethnomathematics of Tharu community. There have been much ethnomathematics in the world that every ethnic group has their own specific features. It is argued that modern mathematics is the result of any one of the ethnomathematics. That is why unless one is familiar to the concept of some ethnomathematics one cannot do well in modern mathematics. It is the wingless bird to study the modern mathematics without studying the background of ethnomathematics. In this context, it is difficult and impossible to study all the types of ethnomathematics delimited this study to particular ethnic group, The Tharus.

Tharu culture is most ancient culture and is well developed in ancient time. It has the rich cultural heritage. Next emphasizes to Dang district because the origin of the Tharu of Nepal are from Dang. It has the ancient cultural heritage, which is not affected by the modern cultural practice. Therefore, the researcher claimed that data from the Tharu from Dang would represent the eastern and western region of Tharu of Nepal. The researcher didn’t study the Tharu community of other countries because of huge expenditure and other time constraint. The

operation on mathematical knowledge is difficult to explain and discourse. Based on concept discuss above finds that mathematics has been created in response to human need both in mathematical, aesthetical and intellectual. Since the very earliest time, man discovered himself on aesthetic sensibilities through which we can complete the form of things to satisfy human needs. The Tharu has extended over the different areas of the Nepal. Their concentration is in the Terai. They may be categorized into various ways, in different places, and they have the different identity and way of living. The research work has been concentrated only on the Tharus of Dang district. This purposive sampling is supposed to be representative of the population.

Tools/Instruments

The ethnographic study adopts many methods of inquiry. The interview and participants' observation is focused on the study. Document analysis is also used. The main tools or instruments of the study are participant's observation, discussion about main issue and interview. In interview, specific task was carried out. First the interviewees were found and placed and theme of the interview was fixed. The favorable atmosphere for conversation was created and agreement was taken. Ethnographic research is flexible use of different methodological approach in accordance with the particular situation and issue. Moreover, there is not only the utilization of procedures that have to adapt to the situation but also under certain circumstances, the procedure should be carried on. Ethnomethodological procedure is open to all research. Quantitative data was collected arrangeing the conversation in nature setting. Historical and

contemporary documents of every kind were gathered and everyday practice was elicited in different forms of self-presentation, video, and series of photos.

Observation

Observation has known as fundamental basis of all research methods. It manifests body language and other gesture cues that lead meaning to the world, where researcher can use their direct knowledge and judgments. The empirical investigation demands everyday practice and life-worlds. The conversations with participants are about their action, which helps to collect appropriate documents in real natural setting. The resercher collected research information about the particular practice in which it is interrelated with mathematical fields. The resercher looked for ways or strategies for taking parts and was familiar with everyday practice, to observe everyday performance of participants. It is ethnographic study so participants observations demands cultural impact and practice. It expects to live in the society for at least two years, but the researcher actively participated only for three months. First, the resercher concerned to established considerable closed relationship with the Tharus community. For this purpose a long time is require, the resercher capture everyday life of community. The resercher carefully observeded the participants daily lives member of their joy and suffer. As observer, the resercher stayed in Tharus' house. He observed that they were busy in their agricultural occupation. Without disturbing them in natural setting, the data collected overtly and covertly. Sometimes he used open ways and sometimes-on hidden ways without disturbing them.

The inductive procedure is not peculiar to mathematics. Observations play an important role in discovering the result. Usually scientific observations are deliberately made to test some research questions. Then theory is used for further observation. Some findings are lucky guesses but discoveries rest on observation. The observation should be well organized, and all observations should be accurate. Noticing the findings is partly a matter of innate ability, but it also depends on the interest and knowing of the kinds of patterns to look further observations. Observations indicate several structure, some true, some false, some relevant and some irrelevant. Thus the researcher selected all kind of observation with concern with reserch objectives. It is important that one is able to recognize the kind of structure whose truth can be established by means of the few observations. When the resercher entered the field, he built up relationship of trust and set his role as a participant. He made note in the situation to serve as a basis for more detail reports. He was conscious how to behave in dedicate and dangerous situation and how to find informants. Moreover, he was conscious how to use the technical equipments and available documents how to prevent oneself from being overwhelmed by the volume of information and data, and loosing the track of research questions in the vastness or the fascination of everyday life.

Interview

In qualitative research, open interviews are widely used. Interviews play an important role in ethnographic research, which is based on participants' observation. It imparts expert knowledge and is recorded. The informants' subjective perspective is analyzed. In an interview, specific tasks are carried out. The first stage is the fixing of a productive atmosphere for the conversation.

This was created and agreements were obtained to use the field notes. For the information collection, the open interview was used with the informants. Observation and interview was conducted simultaneously. Interview was used to search past activities and experience, which might not be found in observation. Some data were collected from participants' observation but some may not be possible. Then the resercher used interview tools. The open-ended questions were asked to the informants to get realistic data. The center to those interviews is the focusing on the subject or topic of conversation determined. To address the spectrum of problem in the interview, the researcher made broad observation.This means that interviewees could have maximum opportunity to react to the stimulus situation. The question used in interview was dealt with specified way and subject depth appropriately. The personal context was analyzed and meaning and reaction were simplified. The resercher used a conversational or dialogic style of interviewing, which encouraged the participation more and more with subjective way, interviewed in informal manner. Like most good ethnographer, the resercher developed a set of intimate, trusting relationship with community residences. That relationship helped me to develop an insider's perspective on local life. The resercher focused the study on field setting. The field area was accessible so it was easy to meet the informants. It was not necessary to make schedule of fieldwork. The researcher was in surrounding in their daily life setting. In fieldwork, the resercher discussed every time with informants helped to collect more and more reliable field data. First, the resercher was fully involved in the observational inquiry. He then took interview and discussed about their concepts. The discussion, interview, observation, analysis and interpretation were also being conducted simultaniously.

Photography

Photographs were collected from the field where the Tharu mathematical knowledge and ideas are embedded. They were critically analyzeded and interpreted after grouping them with respect to their mathematical ideas. Other document reports, books, conversation related to mathematical ideas were also used.

CHAPTER IV

ETHNOMATHEMATICS IN THARU COMMUNITY

Various ethnomathematical descriptive ideas and analysis are described in this chapter. The descriptions are based on anthropology, culture, and pedagogy with respect to contemporary technology. The critical analysis is carried out simultaneously.

Interlacing is of the oldest handicrafts work known to the entire world. The skill of joining plants fibers into ordinary patterns to produce the various containers, mates and other gadgets is known as interlacing. The manufacture of basket does not require the use of tools other than an occasional pointed tool for making small hole or needle of wood, bone or any metal. It is feasible to make baskets and mats. It is the fact that weaving and basketry started from the Neolithic site in Egypt and Iraq dating back to 5,000 B.C. Baskets made by hand by interlacing two or more sets of strands in different ways are closely similar to weaving. Another use of the plant fiber is to make thread and bindery materials which play vital role in many primitive cultures. The plants fibers are used to obtain different goods after complicated rotary process or twined and twisted together in their original stage. Baskets provide simple and day-to-day need. The two techniques are used to make it. It is the interlock strands of threads. The original types of basketry are in regular use. Tharu maintains more or less self-sufficiency as far as their economic needs are concerned. The important additional occupations of the Tharu include the making of baskets, mats, fishing traps, fishing nets, ropes. Most of those activities are either seasonal or energized in

one's spare time when one is free from the farm related activities. Every Tharu family fulfills its needs for honor. No specialization of these activities has taken place until date among the Tharus. If they give up those additional occupations and industry, which have proved very useful to them, simply because several workers can undertake with greatest advantage the result is unlikely to be beneficial for them. Basketry and its related crafts are not only important because of their usefulness to Tharus but also because of its symbolical meaning of love for beauty, mathematical pattern and colures. The manipulation of special materials in making these articles and a variety of designs woven on them explain their skill in using natural materials.

Basketry Work

The most essential interwoven objects are many and varied. The basket containers, which prepared by Tharus are used to keep their belongings. They make baskets in their spare time. Like all other crafts, the skill to learn to weave the basket by the children is by observing and supporting their elders engaged in this craft. They learn by observing, practising and the assistance and guidance from their elders. Both the boys and girls master the craft very soon. There is no formal training given to the children in the basketry whatsoever, nor are any rituals performed when the child is about to weave his or her first basket. It is taken as an essential skill, the knowledge of which is required for every Tharu for their survival. Men and women who are skilled in making beautiful and pioneering designs are fashionable and are respected by all for their skills. Women make the finer and more complex designed baskets using the coiling technique whereas men make those using the other techniques or rough and rude materials.

All materials used in making the baskets are easily available in the nearby forest area. Materials used are *baans, dudhi laar, rangwa laar or rangoi* and wild grasses such as cans, punja and muj, Baans both green and brownish-yellow are used for making baskets. *Rangwa laar of rangoi and dudhi laar* is stem of plants that are used for making baskets. On drying *dudhi laar* is some what light brown in colour and has a rough texture whereas *rangwa laar* has a soft texture.

Ponja, Kans and muj are all grass blades that are used for making coiled baskets. *Ponja* being a bit rough in texture is used as the base for filling or making the coil of a basket whereas *muj* and *kans* being smooth are used as the stitching strands. *Muj* being considered stronger is preferred over *kans. Punja* is a yellowish brown in color whereas dry *kans* and *muj* are light yellow. Basket making materials are collected from the forest. The men and women are often given main instructions for particular material according to the type of basket they intend to make or the pattern they propose to weave. The bamboo is collected from the forest, or from nearby every house.

However, before using these materials they require some processing. All the above-mentioned materials are soaked in water for 7-8 hours before they are used. Usually it is convenient to soak them over a night to use them the next morning. Once soft enough, they are divided into the desired thickness and the strips and made polished with a moist cloth to remove the rough of the surface. This activity of making strips and polishing are done by men, since it is considered a rough job. For making coiled baskets with different designs on them, *muj* has to be coloured to

bring out the designs. To colour the grass, the grass blade is soaked in boiling water, colored powder is put for about an hour or so, and then it is dried in the sun.

Among the Tharus different techniques are used for making different kinds of baskets, mats, traps, and the like. However, before mentioning the techniques used by the Tharu and the baskets that they make with them, it would be better to offer a brief explanation of all the known techniques of basketwork and a little detail on of those used by the Tharus. Basketwork may be categorized into two main groups, they are plaited and coiled works.

Plaited Work

It is prepared by the crossing of two or more steps of elements i. e. weaving where warps (twists bend) and wefts (crosswise weave) are used. The series of strings or rushes stretched are called warps and the one woven through them is the weft. However, when the warps are impossible to differentiate by direction, both sets of elements may be called wefts. The main varieties of plaited basketworks e.g. the mats of bamboos' baskets (Doko, Dalo) are as follows. See Appendix A and B for figure.

Check: The making process is which the warp and weft pass over and under each other singly, at right angle, as in darning or weaving. It is specially bamboo mat where combination is taken one by one for weaving time. For Figure, See Appendix B, Fig. 4.1.

Twilled: It is building procedures in which each weft passes over and then under two or more warps, producing diagonal bands or lines across the baskets. By using varying breadth and colour

contrasts and continuous variety of effects can be achieved. It is also specially bamboo mat where combination is taken two by two for weaving time. For Figure, See Appendix B, Fig. 4.2.

Hexagonal Work: In which the wefts, instead of being horizontal and vertical, are used in three directions to form hexagonal shape in open work six pointed stars in close works. This process is specially used for making bamboo baskets (Doko) where they first Tharu make base by using check pattern on the horizontal plan of about one feet then weft are bent vertically about 75 to 85 degree angle with respect to the size of bamboo basket, then bamboo wefts are crossed in different direction putting one over another and under, and third is traped between them making triangular closed shape. They further make open hexagonal shape. When gap is more they add bamboo splints by bending in one direction to increased the size, at the end they use coiling technique to make rim. It is hollow truncated frustum in shape. For Figure, See Appendix B, Fig. 4.3a to 4.3d.

Twined: Two or more wefts pass alternately in front of and behind each of the warps, crossing them in an angle. This technique sometimes called twined plait or twined weave is half way between a plait and a weave. There are many varieties in twined work plain-twined, wrapped-twined, and "bird-cage" or latticework in which the foundation consists of both horizontal and vertical elements, often rigid, at the crossing of which the wefts may be twined, or wrapped. In completed specimens, wrapping and twining are often impossible to differentiate on the outer surface, though usually noticeable on the reverse side. For Figure, See Appendix B, Fig. 4.4.

Wrapped: It is a manufacturing process in which elastic wefts are wrapped arround by taking a circular bend right round each, or the bunch of, warp in passing, i.e.; over two and under one warp. The bamboo basket (Tokri) is made by wrapped process. It is wrapped in cylindrical shape and, the base uses plaited technique. For Figure, See Appendix B, Fig. 4.5.

Plaited: Plaits are made separately, and then sewn into the essential shape in such a way that the joint does not demonstrate. For example: this process makes Woolen sweater. For Figure, See Appendix B, Fig. 4.6.

Coiled Work

This is the creative and the most important form that has been continued to the present day in most parts of the world. This kind of work is not relating with weaving, but with sewing and it usually done with a pointed implement. Coiled work requires two elements, the coil or core, and the wrapping or sewing strip. The core, usually consisting of a bundle of grass, rushes, or fibers, is coil in spiral form in the shape, the different layers being surpoted together by a sewing strip. The work always begins at the base, and there are three chief varieties of centre: a simple coil or snail; a rosette with radiating stitches; and the four-cross with centre of four pieces of palm or reed laid crosswise, with the free ends split and drawn into the coil: A few variations in the method of wrapping are noticeable. See in appendix – A for figure.

Simple Oversewn: Every stitch passes over the new portion of the foundation coil, and pierces a portion of the coil below. For Figure, See Appendix B, Fig. 4.10 to 4.22.

Furcated (branch out): If the new stitch splits the stitch in the previous coil, a forked effect is produced, having a superficial support of chain stitched or crocheted (knit). The stitches usually lie closely side by side, covering the base. For Figure, See Appendix B, Fig. 4.8.

Bee-Skep : When the stitches are spaced far apart connecting the coil at intervals, each stitch passing just at the back, and appearing to emerge from the stitch in the coil below. For Figure, See Appendix B, Fig. 4.9.

Lazy Squaw: The noticeable feature of this is the long stitch passing over two coils at once. The sewing passes in front, up and over the new coil, twisting right round it once, twice, or more times as preferred; then it passes behind and down under the preceding coil, and right up over the new-coil, making the feature long stitch. For Figure, See Appendix B, Fig. 4.10.

Cycloid: This work may be grouped with coiled work but there is no base, the coils generally of cane or similarly free material, being coiled or looped into each other. For Figure, See Appendix B, Fig. 4.11.

Knot Stitch: The stitch passes in front, up and over the new coil, and behind, down and under the preceding coil, as in the long stitch of "lazy squaw", but the sewing is brought out between the two coils, to the right of the last stitch, which it crosses giving the appearance of a row of knots between the successive coils. For Figure, See Appendix B, Fig. 4.12.

For construction of baskets, the Tharus use the plaiting and coiling techniques. It includes special patterns such as check, twilled, wrapped, twined, simple over sew, furcated, and lazy squaw. The

basket making is characterized by the fact that it is done by manipulating the movements of the hand while making coiled baskets, an iron needle about 3.5 – 4.5 inches long called *suja* and an awl known as *chedna* are used. Tharu baskets include all ceremonial baskets that are made using the coiling techniques. It is considered rather easy compared to the other techniques. However, the coiling technique is a time taking activity. The further techniques although being relatively complicated takes less time to make. All coiled baskets are made using the simple methods compared to over sewn methods. However, for making designs, sometimes the furcated and lazy squaw method is adopted. The base either has a snail or rosette pattern depending on the wish of the basket maker and the design to make. Among the Tharus, all the coiled baskets are made by the women. However, the men generally make using plaiting or wickerwork. The materials selected for making baskets depends on the procedure to employ in making the particular basket. Thus, for the baskets made with coiling technique, wild grass blades such as punja or muj are used, while those having a twilled or check pattern are made of bamboo splints or *laar*.

Basket production is a seasonal works. *Chaumasa* or the four months or *Sawan Bhadon* is thought to be the most suitable time for making baskets. The materials usesed for making baskets are especially *muj* and, *rangwa laar*. It is soft and flexible matters facilitate to manipulate. Therefore, during the rainy season's basket production seems to be the main concern of the Tharu men and women excluding agricultural activities. On the other hand if the demand are arises, baskets are made in the month of *Kartik* also. It is never done during the summers because the material becomes very dry and brittle. Though it is only a seasonal activity, making baskets is

keenly done by the Tharus, since it represents their creative urges. Depending on the size of the basket and the complexity of the design to weave, it may take a day or about a month to make a coiled basket. To create a plaited or wicker basket, it takes only a few hours, i.e. 2 to 10 hours, depending on its size and shape.

Every Tharu household possesses at least 8 -12 diverse kinds of baskets.There are many shapes and designs worked out by the Tharus on the baskets. The size and design differ according to the use, and the same kind of basket may not be found in all houses. Baskets found among the Tharus fall into two broad categories daily used baskets and basket used on particular ritual occasions.

Types of Baskets

For making diverse kinds of normal or daily used baskets, dissimilar techniques are used. They are coiling, plaiting and wickerwork. Daily used baskets are not decorated at all. But when a ceremonial basket is taken out it and is put for daily use. It has designs and also decoration on it. Common baskets are used for different purposes: keeping cooked food, grains, chaff, clothes, and twill items, for getting clay from the pond, keeping dung, and throwing garbage. However, according to their shape, size and the use these might be named differently. Here is given a brief explanation of the common baskets and their uses.

Bhaunka/Pitara: It is prepared by employing the simple oversewn coiling technique and has a snail base. *Punja* is used for make the twisting coil or base with *muj* as the stitching strip. This

basket is globular in shape normally having a diameter of about 45 – 50 cm. at its mouth (opening). It is prepared in such a way that its greatest width is at the middle and it decreases uniformly to form the mouth and down to the base. The basket may also be in the shape of a globe cut into half. In such a case, the greatest diameter is at the mouth and is generally 50 - 60 cm. wide. This basket is used for storing food grains such as rice, wheat, and pulses. It takes 5-7 days to complete. Starting from the base, *punja* coiled up a *muj* strip is put into the eyehole of the *suja* and muj is used for stitching the coil. The spiral base (coil) is put in the most wanted shape and each stitch passés over a new portion of the coil shooting a segment of the coil below. This process continues until the preferred shape and size of the basket is made. If the *chedna* is used, a hole is pierced into the previous coil and the *muj* strip passes through it. Once a thread of the *muj* is totally coiled, it is pushed into the coil and a new thread is use beginning from the same place. See Appendix B, Fig. 4.7b.

Lauka /Dalwa: Because of its shape, this basket is slightly difficult to make. The *dalwa* is also known as *Lauka* since it looks like the squash container, has a circular mouth or opening not more then 5 inches which gradual lessening of wide down all the sides, up to 8 – 10 cm. to form a slim neck and then again starts increasing in diameter gradually as one goes downwards to the base. After attaining a greatest diameter of about 40 – 5o cm. the diameter once again begins to decrease and at the base. It is reduced to about 6 inches. The height of the *dalwa* is 20 cm. and takes about half day to make. This basket is made of bamboo splints using the plaited wicker method, while the border of the basket is made using the wrapped twining procedure. This basket

is made by men. It is is tied around the waist while fishing and used for keeping small fishes. Latter *lauka* is tied with rope and make in desire shape. See Appendix A, Fig. 4.8.

Dalia: This is a basket similar to the *bhauka/pitara*, but smaller in size having a maximum diameter of 20 – 25 cm. at the middle portion and a mouth of about 17- 18 cm.. It takes about half a week to make this basket, which is used for keeping make-up items such as comb, oil. It is also used by children for playing. For Figure, See Appendix A, Fig. 4.13.

Tupna/Tokri: This basket is made of *punja* and *muj* or *kans* using the coiling method. It has a wide mouth 25 -28 cm. in diameter and a base of about 12 cm. The basket, thus, has a nearly triangular outline when seen from the face. Sometimes a stand is also prepared at the base. It takes about 2 to 3 days to complete a *tupna.* The *tupna* is used for keeping grains, flour and even cooked rice when need to serve a guest. The procedure for making this basket is the same as in the other coiled baskets but here first the stand is made and later attached to the base of the basket. For Figure, See Appendix A, Fig. 4.12.

Dabri: This is a tiny basket with a spherical mouth having the maximum diameter or 20 – 22 cm. It is prepared from *dudhi laar or rangwa laar* using the plaited wickerwork procedure for weaving the whole basket and the cycloid or the twining practice for making its edge. The basket is made by Tharu men and it takes about half an hour to complete it. It is used for keeping fishes. It is taken to the river or pond when one goes for fishing. See Appendix A, Fig. 4.1a & 4.1b.

Pitara: This basket is of *punja* and *muj* using the coiling practice; it has a diameter of approximately 12 cm. the mouth and base and a height of about 10 cm. A lid or cover called *pehna* is also made for it using the same procedure. It is a circular box like the basket used for keeping small materials. For Figure, See Appendix A, Fig. 4.14.

Jhau/Jhabia/Dabki: These baskets are made of *rangwa laar* using the plaited wicker work procedure in which one flexible weft passes alternately over and under the thicker warp rods. When one weft finished, another one started from the same place, the process continues until the desired size, and shape is achieved. Once the prepare size is obtain the edge of the basket is made by turning the wrap rods towards one inside downward. The *jhau, jhabia* and *dabki* are similar but vary in size. The *jhau* is the largest; the *jhabia* is smaller than the *jhau,* whereas the *dabki* is the smallest of all the three. It takes about 2-4 hour to make a jhau, 2-3 hours to make a *jhabia* and 1 to 1.30 hours to make a *dabki*. These baskets are generally constructed by men but there is no restriction on women doing the job. Since *rangwa laar* is a harder material compared to the grasses used in coiled baskets, women avoid making such baskets. The *jhau* has a greatest diameter at its mouth of about 40 cm. the jhabia has a diameter of about 10 inches, and the *dabki* of about 15 -17 cm. Weaving of these baskets start at the bottom, where a number of warp rods are crossed over each other at their middle or central point. The weft is passing over and under these rods from the middle point until the desired shape is made out. These baskets are used for different purposes such as storing grains, keeping food to feed the cattle, for throwing waste and transporting clay from the ponds. For Figure, See Appendix- A, Fig. 4.1.

Dalo: This is a large sized basket prepared of bamboo splints employing the plaited wickerwork or easy plaiting procedure. It has a check pattern. It has a big circular mouth i. e. 50 to 55cm. in diameter. It is completed by the Tharu men. It takes about one day to total and use for keeping quilts, blankets, bed sheets and so on. The work of weaving begins at the foundation where about 25 to 38 cm warp strips in number are placed crossing each other at the centre and the thin flexible weft strips pass alternately over and under the warp rod until the desired size is obtained. The rim of the basket is made by using the wrapped twined procedure and it takes 2-3 days to complete.

Chitwa: It is a basket having a mouth of about 35 – 40 cm. and a height of about 30 cm. The base is usually 25 – 27 cm. in diameter. This basket is made of bamboo splints that are soaked in water for at least 3-4 hours before weaving the basket to facilitate weaving. The technique used in making the chitwa is the plaited wickerwork. The rim of the basket is made by using the lattice twining technique and at times the bee-skep coil technique. It takes about 4-5 hours to make such a basket and use for keeping paddy, wheat, fodder, etc.

Chhapar: This basket is very similar to the *chitwa* as the substance and practice used in making it is same. The only variation lies in the shape of the basket. This one is cylindrical in shape, having a base as well as edge of 30 – 35 cm. and thus is a bit larger than the *chitwa* and takes one day to make. The *Chhaparia* is used for carrying and storing grains. See Appendix A, Fig. 4.2.

Pitra/ Pitara: This basket is completed by using the check pattern of the plaiting practice. Making the basket both *dudhi laar or rangwa laar* is used. The *pitara* is a bit bigger in size than the *pitra*. It normally has almost globular shape with a smooth bottom and an open mouth. The maximum diameter of the basket is at the centre. The mouth and base normally have a diameter of 25 cm. and the greatest diameter is about 40 – 45 cm. A cover or led is woven for this basket. It takes about half day to make this basket. The basket is muddy on the outer side with mud and cow-dung paste mixed in the ratio of 1: 1. These do because of the articles kept in it do not fall out. This basket is used for keeping articles, daily uses such as clothes, ornaments, and toiles. The use of the *pitra or pitara* is, though, on a decline as boxes are accessible in the market. For Figure, See Appendix A, Fig. 4.3.

Kanjalo: This is a globular basket with a flat base and mouth having a diameter of about 20 cm. and 30 cm diameter at the middle. The material used is *rangwa laar* and procedure used is either twilling or check plaiting, while the circumference of rim is made of the wrapped twinning practice. It takes about 2-3 hours to make this basket is used for keeping food items such as fish, eggs, red chillies, garlic, potatoes and so on. For Figure, See Appendix A, Fig. 4.4.

Sara: Sara is 25 cm. in tallness with a base of square shape about 30 cm. Sara is a rectangular shaped basket made by using twilling method. The edge is made of either of the wrapped twined method or wefts coiled with a string to secure the rim. The material used for making this basket is setha (reed). Tharus houses posses this basket for multipurpose uses.

Tupl: This basket has a square base about 12 cm. and a height of about 12 cm. Therefore, it is in cuboids in shape. The check-plaited practice is used for constructing this basket. At its rim, a strong splint of bamboo or stick is attached to the walls of the basket with the help of *muj* grass to give extra strength to the basket. The complete basket is made of thin strips of bamboo having a width of about 2 cm all over. This basket is used to take out little quantities of grains from the large amount of grains used for daily use. It takes an hour to make. For Figure, See Appendix A, Fig. 4.6.

Nuiya: This is a small basket, which may either be made by employing the coiling technique or simple plaited wickerwork. If coiling technique is employed, then *punja* and *muj* are used, whereas if wickerwork is employed *rangwa laar* is used. When a wickerwork *mana or nuiya* is made, the mouth or rim is prapered using the coiling technique. This basket has a diameter of about 12 – 15 cm at both its base and mouth and a similar height, while its maximum diameter is at the centre and is about an inch and a half more than its mouth. When this basket is made using the coiling technique it may have different colorful patterns coiled on to it. For Figure, See Appendix A, Fig. 4.16.

Ritual Baskets

Although the baskets are used regularly for daily purposes, there are also ritual baskets. These baskets are used on special occasions such as birth and death. In marriage, baskets are normally taken as a part of the property given to a girl on her marriage .Therefore young girls make a lot

of beautiful baskets of different shapes, sizes, colours and designs. They plan to take the baskets to their in-laws house. It is considered essential for a Tharu bride as a proof of her skill. Numerous baskets are taken and one basket is gifted to every adult member of the in-laws house. It takes extra time and deliberation to make such ritual baskets as they have different colored designs woven on them. Baskets are often beautifully decorated with beads, shells, and colorful cloth pieces. Almost all ritual baskets are made of *punja* and *muj* employing the coiling procedure throughout the entire baskets. All baskets taken by bride to her husband's house are specially decorated. Some of these ritual baskets have specific names. All ritual baskets are kepts aside and brought out for use only on special occasions. There provide a brief explanation of main ritual baskets found among the Tharu.

Dalwa: This is a semi-conical basket which has a slowly reduction outline. It has ever a flat foundation with stand. It keeps the base of the basket a few centimeters above the ground. The *dalwa* has a rounded mouth normally 25 – 30 cm. in diameter, having a base of about 5-7 inches diameter and a height of 8-10 inches. Its size usually depends on the wish of its weaver. The *dalwa* is made of *punja and muj* using the simple oversewn coiling procedure. Coiling begins at the base kiping in mind the preferred designs. The stand for the dalwa is made separately and later stitched on to the base. The *dalwa* is extensively decorated using special decorative materials such as beads, shiny flecks, peacock feathers, shells, and pieces of colorful cloth, woolen balls and mirror pieces. These baskets are carryed by every Tharu bride after her groom as part of her dowry. For Figure, See Appendix A, Fig. 4.17.

Dalai: This dalai is also made of *muj* and *punja* using the simple oversewn coiling practice. It takes many days to complete. The *dalai* is in semi globular or basin shape. It has its widest diameter at the mouth and gradual lessening of wide downwards forming a semi circular outline. The bottom is flat and occasionally has a stand attached to it. Attractive designs are made on the dalai, with colored *munj*, which may be decorated later. The *dalai* serves relatively many purposes. It is brought as a part of the dowry. It keeps groom's belongings and the gifts sent for the bride by her relatives. On a person's death if he/she is buried different pulses, grains and few other household articles are put in dalais and buried with the person. The size of a dalai depends on the articles that a person intends to keep in it. Therefore, *dalai* with a diameter of 10 to 18 cm are found. The height of the dalai is proportionate to the diameter and shape to be constructed. For Figure, See Appendix A, Fig. 4.18.

Pitara: The *pitara* is a basket, which has a lid that may not be necessarily attached. It is made of *punja* and *muj* using the simple oversewn coiling procedure. This type of basket is taken by every girl to her husband's house for keeping her valuables goods. It takes many days to make a *pitara* and its lid depending on the time dedicated the size and the designs on it. The mouth and base of the *pitara* are usually of the same diameter varying from 24-42 cm. Its greatest breadth is in the middle portion of the basket and varies from 30 – 35 cm. Sometimes however, the base may be slightly less in diameter than the mouth of the basket and the greatest width a bit to the upper end, but the basic structure remains the same, i.e. one having an outwardly curved outline. If the *pehna* is to attach, after making the basket and lid separately, the lid is attach to the rim of

the basket with a *muj* strip that is loosely looped to the rim of the lid on one side. The *pitara* has the most complicated patterns made on it, but it is never decorated with additional materials such as beads. For Figure, See Appendix A, Fig. 4.14.

Tukna: This is a big basket. It has a mouth of about 35 – 40 cm. diameter. The base of *Tukna* is about 15 – 18 cm. and a depth of 20 cm. The outline of the basket shows a steep tapering of the diameter from the mouth to the base and may be nearly basin shape. It takes about 15-20 days to make a *tukna* and usually it is not decorated with any material. However, beautiful patterns with colored muj re coiled on it. The *tukna* too is made of *punja* and *muj* using the simple oversewn coiling procedure. The *tukna* is put for two main uses. Firstly, when feasts are held at a Tharus place guests are served with foods kept in the *tukna*. Secondly, on the *roti-pani* ceremony (a feast held after the death of a Tharu) a little portion of all the different delicacies prepared for the feast are taken out in *tuknas*. It is kept covered outside the house over night. The next morning, at daybreak, these are left outside the village. For Figure, See Appendix A, Fig. 4.20.

Tokri: This basket is made of *punja* and *muj* employing the coiling procedure. It has a handle attached to its rim or mouth. The *tokri* has an open mouth, about 25 – 30 cm which is gradual lessening of width down to form a base of about 15 – 18 cm. It has a height of about 25 cm. usually a stand is prepared and attached to the *tokri*. For making the *tokri* first, the complete base is made. Its walls are made gradually by coiling new strands over the *punja* foundation or core. Once the most wanted size is attained the coil is wrapped around the core. The wrapped core rises up to form a curved handle of the basket. Then the free end is stitched tightly onto the rim

of the basket. It is just opposite to the place where the handle starts to curve upwards. A stand is made and stitched on to the base of the *tokri* which has beautiful designs coiled on it, and it is sometimes decorated too. This basket is not used for any precise purpose. A bride generally brings it as a part of the dowry. It may be considered as a sheer pride and joy. For Figure, See Appendix A, Fig. 4.20.

Dhakli: The *dhakli* is like a plate. A bride brings it after her marriage along with the other ceremonial baskets. This basket item has a mouth or rim of 16 - 25 cm., a base about one and a half inch lesser to the mouth and a depth of about 5 cm. It is made of *muj* and *punja* employing the coiling procedure. This basket may either have a snail or rosette base depending on the design that is coiled onto it. Occasionally toffee wrappers or silver and golden biscuit packets are cut into thin strips and used for coiling. The *dhakli* serves as a cover to other ritual baskets too.

Panjhapna: As the name suggests this shallow basket is made of *punja* and *muj* employing the coiling procedure. It is used as a lid to cover a glass, jug, jar, or lota of water. The *panjhapna* has a maximum diameter of 12 – 18 cm. at its mouth. The base is usually an inch smaller and a height of about 3 – 5 cm. This basketry item may or may not be decorated with beads, and silver foils. It is usually very colorful because of the use of bright colored *muj* strips. For Figure, See Fig. 6.34.

Pantupni/Tukni: The *pantupni* looks like a small *dalwa*. It is extensively decorated with woolen balls, peacock feathers, beads, and shells. It is made of *punja* and *muj* employing the coiling

procedure. *Tukni* has a maximum diameter of 12 – 18 cm. at its mouth from where the width gradually tapers. The base has a diameter of about 8 – 10 cm. and a depth of about 8 - 10 cm. This basket is used as a lid to cover a glass or lota filled with liquid. Several such *pantupnas* are made and taken by a bride to her husband's place to offer as gifts. These *pantupnas* are beautifully coiled with colourful *muj* and different patterns are made on it to show one's skill at making basket. For Figure, See Appendix A, Fig. 4.20.

Mithaura: Tharu men make *mithaura* which is an indigenous umbrella cum rain hat. It employs the open hexagonal procedure. It has a diameter for about 100 cm. The *mithaura* is made of bamboo strips and *mohlain* leaves. The *mithaura* shape is like an umbrella. However, the centre is slightly raised and concave portion is created, which fits onto a person's head like a hat. Starting at the centre, first two separate frames are woven. Leaves of *mohlain* are then spread in 2-3 layers between the two frames. It is passed in and between the two frames. A single weft then passed in and out through both the frames to fasten them together. To form the rim of the *mithaura*, two relatively thick splints of bamboo are curved round the border on both sides and tied together by coiling them at short distances. It is generally called a *chhatri*. Use of this indigenous rain equipment is rapidly decreasing. It is used mainly in the interior villages. It is found during the field visits. For Figure, See Appendix A, Fig. 4.9.

Udia: This basket has a maximum diameter at its mouth of about 40 – 45 cm. Its height is of 20 – 25 cm. It is semi-circular in its outline. Moreover, it is made of bamboo strips. The simple plaited wickerwork is employed for making this basket. It is made by men; it takes about 4-5

hours to complete such a basket. The rim of this basket is made by employing the wrapped twined procedure. It is of special importance on the death of a person. After completing the last rites of a dead person, edibles liked by the deceased are prepared, put on a banana leaf and left outside the house covered with the *udia* over night as an offering for the departed soul. The next day, just before dawn, i.e. at about 4 a.m. this food is put in the *udia* and thrown into the river. The *udia* is never reused and it may be thrown into the river or donated to some poor persons. Sometimes a ready made *udia* is purchased from a non-Tharu who visits the village to sell their goods. For Figure, See Appendix A, Fig. 4.7.

Despites the baskets there are a few other utility objects made by them using the same methods. Given below is explanation of such things that cannot be keept as a container but are used to serve for significant purposes in the day-to-day life.

Pine: This basket item looks like a basket container, which does not have a base. Pine is used for preparing *dihkari* i.e., *mitho bhaat*. It is made using the coiling procedure and has a big opening of approximately 35 – 40 cm. diameters on one side and on the other side a smaller one of about 17 – 20 cm. For preparing sweet rice, which is generally prepared on festivals and ceremonies, a vessel full of water is kept on the *chulha*. Next, a sieve is put in the pine towards the smaller opening filled with rice and kept over a vessel of water. The rice is cooked due to the steam that rises out of the boiling water. Once the rice is cooked, sugar is sprinkled over it. For Figure, See Appendix A, Fig. 4.20.

Supa: This is a flat circular plate on dish used for winnowing and sifting crops like wheat and paddy. It has a diameter of about 55 - 65 cm. It is made of twilling procedure. On the rim a thick bamboo splint is attached using the coiling procedure. It has a raise border. For the stitching coil, either thin bamboo strip or *muj* grass is used. The bamboo splints are scraped repeatedly on both sides to make it smooth. It is also seen on polished appearance. It takes about half day to wave a *supa*. These days winnowing platter is bought from the market too. These are yet different in shape, size and material.

Khandra: The *khandra* as a cage is meant for housing young ducts, pigeons, chicken and birds. It is made of bamboo splints mainly three techniques twilling, open hexagonal and coiling or twilling is employed. The base is prepared by using the twilling procedure. The walls are formed by twisting the weft and warp elements. For twilling, upwards to form two of the weft is used upwards in the open hexagonal procedure. The height is about 30 – 35 cm. The wefts are twisted and twined with another weft or coiled with a thin bamboo strip. The bottom has a diameter of about 35 – 40 cm. Once this structure is constructed, cotton net is tied on to the border of the *khandra*. This net has a rope looped on its upper end, which is used for hanging. A slightly big gap is left on the upper side of the net through which one can put in and take out the birds. It cannot be opened easily. Thus it prevents the bird from scapping. For Figure, See Appendix A, Fig. 4.26.

Tatri: Tatry is made of *setha* or reed sticks. It is used wrapped procedure. The *tatri* may be either square or rectangular and has a size of about 30 × 40 cm. or 35 × 35 cm. depending on the desire

of the person. Tharu men make it. It takes about a day to complete a *tatri*. Reed sticks of similar diameter collected and cut to an equal size. Each reed stick attached to each other by wrapping a rope that acts as a weft round. Each reed stick passes over two and under one that acts as a warp. This process is carried out on both sides of the *tatri.* It leaves about 8 cm. on both sides to ensure the sticks attached properly. 2 to 3 bamboo sticks are futher attached in the opposite direction horizontally at the base, ensuring that it remains straight. The *tatri* is used as a drying board on which fish and sometimes meat pieces are kept and dried in the sun. Some people attach a rope on all the four corners of the tatri and tie it in the centre to facilitate its hanging in a corner when it is not used.

Chatai / Patki: This mat is not commonly used nowadays since the material used for making it is not easily available. Earlier the use of the *chatai* is known as *patki*. These mats are made employing the simple plaiting procedure and having a check pattern. The *chatai* can be made of either *narkul* or of *bendhu.* Boths of which has to be brought from the forest. Both *narkul* and *bendhu* have a smooth texture that makes it suitable to sit on.

Before using *narkul,* it is to be soaked in water for a few hours. The bark of *bendhu* is dried and used directly. The strips of equal breadth of the material are used. They are woven together. The selvedges are turned inwards and woven in the opposite direction, thus locking the ends to ensure the weaving does not open up. It takes about a day to weave a *chatai*. It is woven by men. In addition, this mat can be made of any size. Apart from sitting, this is used to dry different edibles in the sun.

Gadri: The *gadri* is a vessel about 12 inches height. It is used to keep fishes while fishing in the river or pond. This basketry item is made of bamboo splints. It is held together in shape with the help of *sanai* rope. It has a maximum diameter of 8 inches at the centre. The *gadri* is gradually lessened down to form a nearly pointed end on one side. Similarly the diameter gradually decreases on the other side but has a rounded and closed end here. The mouth of the *gadri* is thus slim. Near the mouth, a rope is tied to form a handle. The twining procedure use to bind the bamboo sticks. Men generally make it and it takes a few hours to complete. For Figure, See Appendix A, Fig. 4.23.

Khong: The *khong* is a manually operated valveless fishing trap. It is conical in shape. *Khong* is made up mainly of setha. The wrapped or twined techniques may be used to give shape to the trap and to hold the reed sticks in place. One end of the *knong* closes strongly. The other end is open and serves as the mouth through which fishes enter. The *khong* measures 60 – 66 cm. in length and has a mouth 12 – 18 cm. in diameter. For fishing, the *knong* is placed in a narrow passage of running water with the mouth facing the current to the water. Fishes thus pass through the mouth and are trapped since the other end closes while the water flows out. It takes about an hour to make a *khong*. For Figure, See Fig. 6.32.

Dhimri: The *dhimri* is a rectangular fishing trap made of bamboo splints. This is a self-operating trap having two valves. The dhimri is oval shaped. The trap gives shape by tying the splints together with *sanai* rope using the wrapped procedure. To hold the splints in place, a thick bamboo frame is also added. The dhimri has a rectangular base made of reed or bamboo on to

which the wall of the corner is fixed firmly. The two valves are situated on one of these walls towards the lower side. The walls go upward and converge, thus looking conical from the side. At one end of the upper end where the trap is closed, a small circular gap is left open from where one can put their hand in to take out the trapped fishes. Men make the dhimri and it takes 2 - 3 days to complete. For fishing, the *dhimri* is placed in a pond, or ditch full or water overnight with the base down and the valves are placed against the current of water. Fishes that enters is caught through the valve but is unable to swim out due to the splints of the valve that pains them. The coming morning, fishes are collected from the trap. For Figure, See Appendix A, Fig. 4.24.

Mats: Mats of the significant items are made by the Tharus using the basketry techniques. Three different types of mats are found. It is made by employing three different basketry techniques. These are:

Gadda/ Gundra: This is a mat made out of paddy stalk locally called *paira* and thus the mat is generally termed as *paira ka gadda*. The wrapped procedure is working for making the *gadda*. The wrapping strand, a rope in this case, passes round the bundles of paddy stalk passing over two and under one bundle. This process is continued until the desired length is achieved after which the rope is tied into a knot and passed between the last bundle at a short distance, and the process is continued. Therefore, a mat is wrapped at distances of about 30 – 35 cm. throughout its breadth to ensure that it is tight enough and the stalks do not begin to come off after some time. The process of wrapping is completed if the sides are finished. Apart from sitting this mat

is used as a mattress in winters for sleeping because it provides heat. The *gadda* is also used as a cover over the *bakhari* in which grains are stored. For Figure, See Appendix A, Fig. 4.25.

Baithchi: The *baithchi* is a cushion like mat having a length or diameter or 25 - 30 cm. It may be found in round oval square or rectangle shape depending on the will of the maker. It is used for sitting. Several *baithchies* are found in every Tharu house. *Dhan ka paira* or paddy stalk is used to make it. The plaiting technique is used to make the *baithchi* in which a bunch of paddy stalks is tied with a rope at one end and plaited after dividing the bunch into three equal parts. The *baithchi* can be made either by one single plait or by stitching two plaits next to each other in such a way that the joint is not shown. Once a plait of the desired size is made, it is either coiled or folded into the desired shape. The end, which is tied with a rope, passes through the plait with the help of a *chedna*, i.e., awl. One medthod is that this rope is tied round the *baithchi* to hold the plait in place. Another method is sometimes adopted in which instead of a rope, a strand of *muj* or paddy stalk is used instead of tying it round the *baichthi*. The sides of the plait are stitched neatly to the previous layer providing the desired shape. *Baithchi* is generally made by men but if the need arises, e.g., when men are busy in the field and women make *baichthi*. They are free to make it.

The above description of basketry items shows the extent to which the Tharus are capable of manufacturing a number of articles to meet their daily and occasional requirements. Among the Tharus a clear-cut picture cannot present regarding the distribution of techniques. There is no doubt that coiling and simple plaited wicker works are the two main techniques for making

basket containers. However, the knowledge and use of other techniques such as hexagonal, wrapped and plaited work also exist, though not to a great extent. Therefore techniques are used according to the requirement keeping in mind its particular qualities. Thus, coiling and simple plaiting are used to make containers and vessels which close the surface of the basket tightly not allowing the articles in it to fall out. Wrapped work is mainly used for making trap so that the sticks can be held in shape and the gap in between facilitate the draining out of water. Another special feature of Tharu basketwork was a combination of technique and raw material selected to serve the required purpose. Thus, materials such as bamboo, *rangua laar or dudhi laar* combined with the simple plaited wickerwork technique are used to make containers having adequate compactness and strength for holding heavy contents.

Basketwork suggests as the basis for the shapes of pottery by several scholars. However, the basis for the shapes of basket has not been dealt. The shapes and forms of the baskets are so varies among the Tharu that it is not possible to trace its origins from a particular group of objects or articles.

Goldenweiser (1937, 160) has opined that art is coexistent with man and it is true with primitives wherever a particular industry is highly developed. He observed that many material objects of primitive technology better than utility would warrant and rightly pointed out the inherent beauty in the workmanship, such beauty can be noted in the Tharus basketwork. As previously mentioned Tharu, basketwork is not only utilitarian but also depicts a high level of artistic and

mathematical skill. Here it should specially be mentioned that it is only coiled baskets that have different mathematical patterns and designs, technique and process. All coiled baskets are made by women only. As far as the different plaited or woven baskets are concerned no ornamentation and decorations is noted. Thus plaited or wickerwork baskets have any patterns or decoration done on them using higher mathematical ideas. Such baskets serve purely as utility items made by men.

Clay Work

The essential material for making pottery is clay. It is easily available around every Tharu village from nearby ponds. Clay is found in great quantity around the area. This clay is commonly available in nature is very plastic and can model into a great variety of shapes. Pond clay is known by several names among the Tharus, viz, *paror mitti, chitkar mitti* or *sheta mitti*. This clay is dug out by women from the bottom of the pond with bare hands or if necessary with the help of implement for digging. It is then put into big baskets and transported to the house. When a lot of clay is needed, the men go along with their women to help. On the unavailability of *chitkar mitti* sometimes *khudwa mitti* which is relatively soft and smooth soil is dug out from the nearby areas and used. *Khudwa mitti* however cannot be used on its own and will have to be mixed with a part of *chitkar mitti*, cow dung, and water and paddy husk. *Chitkar mitti* being plastic helps connect it and make it lighter in weight. Whereas paddy husk prevents the object from cracking when dried.

Paddy husk is unavoidably mixed with *chitkar mitti*. It provides longitivity to the product. In addition it saves it from cracking up after drying. Paddy husk being smooth in surface is chosen over any other husk. Wheat and other cereal's husk have a rough surface; therefore, their use is avoided as much as possible. Cowdung mixed to the clay is better while making larger articles, such as *bakhari* and *dehari.* It has capacity to reduce the weight of the product when dried and it makes them easy to move.

All pottery is hand made and no equipment or tools are use by the Tharus. Sometimes a stick may be used to make the straight edge of a square base object. No moulds are generally used for giving shape to the vessels but for the base sometime broken pitchers are used. Thus the bare hands do all shaping and structuring.

The preparation of the clay is a most significant part of the potter's art. To make the article the clay has to go through some necessarily initial preparation. The crude clay is kneaded and pressed between the hands and any unwanted objects such as stones or pebbles are removed. The clay is usually wet when it is brought from the pond. In the next step, the clay is mixed with paddy husk in the proportion of 1: 1 (in volume). If necessary, extra water is added to provide an appropriate constancy for moulding the clay. To make better clay, rice husk and water are added and kneaded by the hands or feet to mix all its contents evenly. The preparation of clay is the same for making most clay articles. However, as mentioned earlier, while making huge storage bins, cowdung is mixed with the batter to reduce the weight of the product.

There are no rituals or taboos attached to the making of clay articles. On the other hand, there exists a belief among the Tharus that if the making of a vessel is completed in the same month, the articles are stored in it especially grains remain free from insects throughout the period of their storage. For this reason, construction of *bakharis* and *deharis*, i.e., huge grain bins begins at the starting of the month so that they are completed by the end of the month. In addition, Sunday is believed to be an auspicious day to start work on any clay article. Once the clay is ready, there comes the actual task of treatment and moulding it into different forms. Hand made pottery is fashioned in three ways all over the world they are moulding, modeling and building up processes.

Coil or Building up: The building up technique to make the pot is in one or more of a variety of ways. The most widely distributed of which is the coiling technique. This involves the use of long or short rolls or pencils of clay. The rolls are arranged one upon another and pressed into union. It is used to shape the pot from the base to upwards. A very small coil is pushed on with consistent force. The regular intervals can product in a pleasant design. Generally, all traces of the coiling are smoothed out. Other building methods involve the use of thick rings of clay, or slabs bent round to the form of a cylinder or of various combinations of the moulding and modeling methods. For Figure, See Appendix B, Fig. 4.13a to 4.13b.

Mouldling: Pottery is developed and learnt by diffusion processes. The mould is made mainly from some other objects such as a basket, gourd or old pot. In this way, the pot gives the desired

shape. Some primitive potters begin all their pottery in a basal support of this kind though this is uncommon and in not used firing. See Appendix B, Fig. 4.14.

Modeling: Modeling is a far more widely distributed into the shape required by hand, often with the aid of simple tools for a part or the whole of a vessel. See Appendix B, Fig. 4.15.

Among the Tharus of Dang, all the three techniques of hand are used to make pottery as per the convenience of the maker and the shape and size of the article to make. The thin vessels are made by the moulding techniques, small to medium size vessels by the modeling techniques and larger vessels by the building up techniques. Details of the techniques used while building up the different articles and vessels given are with the description of each article as follows.

Once the prepared clay has been moulded, then it is air-dried. It is necessary to avoid cracking. Thus drying should proceed at a steady temperature and uniformly throughout the pot. When the clay has reached a leather-hard stage, polishing or burnishing is commonly done to reduce porosity. This process involve in the application of mechanical friction to the surface with the aid of a smooth pebble or some other hard implement. This process helps to close the surface pores of the clay. The effectiveness of shine depends on the excellence of the clay polished. It is economical to give the pot a finer surface by dropping it in. A similar method known as *parhorna* is adopted by the Tharus to give a final change to their pottery. Once leather hard, the pottery items are muddy with the finest of all made of *chitkar mitti*. This is speared on to the pot

with the help of a piece of cloth, and then pressured lightly exerting on the pot from the inside to help close its pores. This process gives the product a smooth and refined look.

The last stage of making pottery is firing. However, the firing has not until been adopted by the Tharus. Pottery articles are sun baked. The reason they offer for is that their ancestors never did fire. Therefore, there should not be any great importance of firing. In addition, they do not have the adequate knowledge and skill required for firing. Any effort in firing could waste of resources and time. The articles that they make have a life of on 8 - 10 years. Therefore, fire baking would only add to their labour cost. The fuels for firing increase much of the cost of pottery. The pottery objects made by the Tharu are quite large or huge so the fuel essential for firing them would be out of their reach.

Goods Prepared

Tharu women produce some useful articles of clay. These articles are fundamentals and therefore every household set has 8-10 pottery items of various shapes and sizes. In many ways, they are used as substitutes for metal containers. These items are proved to be important economic resources too. Most of the clay articles prepared by the Tharus serve as vessels for storage. Given below are the details of the different articles made out of clay by the Tharus.

Dehari: The *dehari* is an important grain bin found in Tharu houses. These are huge in size measuring 4-6 feet in height and have a proportionate width or diameter; *Deharis* are made by Dangaura. Danguara makes a large number of *deharis* of different shapes and sizes - rectangular,

cubical, pitcher shaped, and truncated triangular for storing their farm product. Each household has at least 5 - 6 of such *deharis* in which they store wheat, rice, pulses, mustard, and other crops. For Figure, See Appendix B, Fig. 4.13.

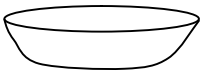
In the beginning of the day of *Chait* most women initiate to manufacture deharis. It takes about 10 to 20 days depending on the size to complate the constructions of a single *dehari*. There exists a faith with the Tharu that once the construction of a *dehari* is started, it ought to be finished within the same month if not it would be *ashubh* that is ominous. The grains stored in it would get either dirty or infected with insects if it were not finished on the same month. Large size *deharis* are generally constructed while building the house itself. In addition, the huge size of a *dehari* would stop its entry through the door, thus making it necessary to prepare it at the time of house construction. To deal with this problem, some Tharus have started constructing their *deharis* in separate pieces outside the house. Once ready part, well known as a *pata* is brought into the house and joined together to form the complete *dehari*. This method of production, different parts and joining them up later is adopted when large size *deharis* are built. *Deharis* are made using a combination of the modelling and building up procedure. The first step in the building of any clay vessel is to construct the base. The base of the *dehari* is either square or circular in shape. The base is horizontal plane. It makes on the ground itself. A big piece of prepared clay is taken and spread on the ground by beating it down with the hands in the desired shape. This is usually done in such a way that the sides are thicker than the central portion. The help of a stick is taken to make the edges straight if the base is to make square or rectangular.

The building up procedure is brought into use. Clay in the form of extended piece is pressed and muddy to the clay below it, all around the edges, which is risen from the base. The *deharis* are large, these cannot rotate around and so the potter has to move round to continue building. When one such chunk of clay is used up, another is joined to its end and the work proceeds. This process continues until about one-two feet height is attained. The incomplete *dehari* is then left to dry up. Which it attains some strength and is leather hard; the building of its walls is continued. A notch like structure is generally made on the wall so that the next part can be built up easily to fit onto the lower part. The area where the joints occur are once again coated with clay both from inside and outside, thus, providing it additional strength apart from giving it a smooth and finished look. They are made in separate segments to facilitate the transporting. In such cases each part that is to form the wall of the *dehari* is built by the coiling (building up) procedure. They are built in such a way that each part has its lower side wider than its upper end, as one move towards the rim facilitating the fitting of the different segments or *patas* onto each other.

Near to its' base of *dehari,* a hole known as *aan* is made. It is used to take out grains stored in it. Once the grains are taken out the hole is blocked by stuffing a cloth or some grass it is covered with some clay. This is made to make sure the entry of rodents and insects. The mouth of the *dehari* is a large circular or square opening that allows the easy pouring in and taking out of grains. The mouth is enclosed with a lid particularly made for it. This lid is known as *pehnam dhakkna*. It is of a similar shape as the mouth of the dehari is.

Square shaped deharis are occasionally called *uajania*. *Deharis* serve a double purpose. It provides a safe storage for grain and takes action as partition of walls. Two *deharis* are joined by a common side or wall and called *judiadehari*. They are particularly made to serve the twin purpose of a partition as well as for storage. The *deharis* might have a width or diameter greater than or equal to its height. The *deharis* are made on clay stands called *goda* so that these might be out of the reach of rodents. The average life of a *dehari* is 8 - 10 years. However, these might last even longer until ultimately broken down by the Tharu to make new ones.

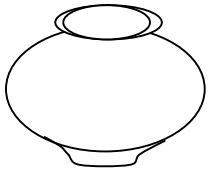
Jhabra and Mohkar: The *jhabra* is a basin like urn that can be made either by the modeling or by moulding procedure. It is approximately 40 cm. in diameter and its depth varies from 25 – 36 cm. The mohkar is a thin plate with raised sides. It is made by the modeling procedure and has a diameter of about 12-18 inches. Both the *jhabra* and *mohkar* are used to keep paddy's waste part of grain.



Jhabra

Mohkar

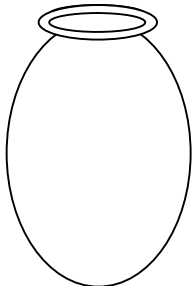
Bhamra: The bhamra is a circular pitcher shaped container made by employing the modeling and building up procedure. The bottom is made on a circular stand that is slowly made up to form the walls of the bhamra. The *bhamra* has a height of about 45 - 55 cm. and a proportionate width. The greatest diameter of the bhamra is at its centre, with the mouth and base of a lesser diameter. It takes about 4 to 7 days. The *bhamra* is put to numerous diverse uses i.e. to store grains, pulses,



flour, salt, paddy chaff, wheat, and so on. It is used to keep apparatus and to feed cattle and keping in it.

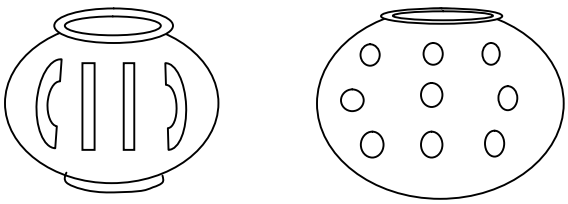
*Bharkhan/ Dhakkna: T*he term *bharkhan* is used by most *Dangaura* Tharus for a lid or cover made of clay. This lid is called *dhakkna* by some. Lids of diverse shapes are made according to ones need and the use. Some are simply flat circular or square shaped slabs made by the modeling techniques, some are similar to the flat *Bharkhan* but have their edges a bit risen, while others are made like shallow dishes, having a convex base. Many a times instead of modeling out a convex based *bharkhan*, the moulding procedure is adopted. For moulding, the *jhabia* (a basket) or the lower part of a broken pitcher that has been purchased from the market is used. In some cases while making a lid for the *bhamra* or *lohra*, slits or holes are made with the help of a sharp utensil on the lid when the clay is leather hard. This to allow air into the *bhamra or lohra*

Bhakri: This globular pitcher is made by the building up technique and it takes about a week to make. This is the only clay article that the Tharus fire or relatively try to bake by firing. Once the bhakri is leather hard, it is filled with burning cow dung cakes and allows drying with the heat of the burning cow dung. This pot is used to prepare and store jar. This article is not commonly found or used. After fermenting jar once in the bhakri, the *bhakri* is not reused for the same purpose. Instead, it is washed nicely and used to store grains or water.

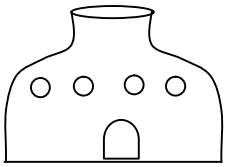


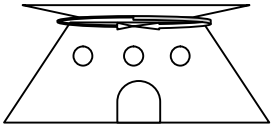
Laiya/ Lei: Laiya are indigenous poultry houses made of clay. These are of two kinds — those that can be hung from the roof and those that are to be kept on the ground. For making *laiya* cow dung is added to the clay to decrease its weight, thus making it convenient. The number of *laiya* in a hutment depends on the number of poultry owned by the family. The *laiya* that can be hung from the roof are relatively small and basin shaped. They look like a globe cut into half and sometimes are four-sided in shape instead of circular. It takes a day to make a hanging lohra and it takes day or two to dray they are used for keeping the egg. It is also used for housing chicks at night so that they are safe from other animals at a height. Usually the eggs are also hatched while still hanging in the *laiya*. At night, the lohra is covered either with a jhabra i. e. basket during the summers or by a clay pehna having a number of round or elongated holes in it during the winters. These holes are made air to pass air freely through the lid.

The additional kind of *laiya* is occasionally called *bhamr*a because of its similar shape and size. It is kept on the ground. This generally has a stand constructed first on to which its base is made. It looks closely like the *bhamra* but that when the clay is wet, holes or long slits are made in it so that air can pass in and out of it freely. The *laiya* ground is also enclosed at night either a *Basket* or a *pehna* that has holes in it. It takes about 5-7 days to make one such *laiya*. The basic difference between the two types are that the first, i.e., hanging *laiya* is used for housing chicks, keeping eggs and for hatching them, whereas the second one, i.e., ground *laiya* is used for housing 2 to 4 hens or ducks at night.



Darba: These big poultry houses are made on the ground. It looks like small huts. They are found in different shapes - square, rectangular, semicircular and so on. The *darba* normally measures 3 feet in width, 45 – 55 cm. in depth and 60 - 65 cm. in height. It takes about 3 to 4 days to make a *darba*. These poultry houses are placed in one corner of the covered verandah in front of the house or at a corner in the cattle byre. A blend of the modeling and coiling techniques are used to make the *darba.* The lower side of the *darba* has a greater width compared to its top portion. The construction of *darba* sometimes starts from the top instead of its base. The reason for this is that the upper portion being smaller in width or diameter. It is much more convenient to build up the walls to cover a larger area. The *darba* does not have any foundation constructed and the ground acts as a floor. On one side of the wall, an opening is made that serves as a door for the poultry. As the clay is still wet, a few small holes are made. It allows free pass of air. The upper portion of the *darba* has an opening wide enough for one to put their hand inside and take out the poultry. The door has an opening cover at night with a wooden slab called *patuli.*

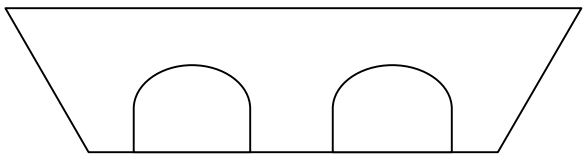




Khabra: This clay article is not found in all the houses. There is a *khabra* box shaped and divided into two chambers, upper and lower by a clay slab. The upper chamber is open from the

top and used for keeping utensils, while the lower chamber serves as a lohra. The lower chamber has an opening on the side that serves as a door for the hen and covered with a *patuli* at night. It also has a few holes on the other side to let in air. The *khabra* measures about 1.5 feet in length and breadth and 60 - 70 cm. in height. This article too is made by using both the modeling and building up procedures and it takes around 8 -10 days to prepare single *khabra*.

Andhari: This is quite similar to the *khabra* and is made for keeping small iron tools and equipments in one chamber and broken pieces of iron in the other. Its width is usually smaller at the base line and wider on the top. On one side of both the upper and lower chamber, three fourth of the wall is open so that equipment can easily be put in and taken out.



Aukharan: The *aukharan* is a cylindrical object used as a stove for preparing *jar* (rice beer). The *aukharan* is divided into an upper and lower chamber with a clay slab that has several holes in it. On one side of the lower chamber, an opening is left so that fuel for burning may be put through it. The top portion of the upper chamber has a slab with a large round hole in it for the base of the *bhakri*, containing all ingredients for preparing jar, to fit on it. This upper slab thus works as

a burner, with the flames from below passing through the perforated slab and reaching up to the bhakri. Some Tharu make the *aukharan* with a square base and top, instead of a cylindrical one. The *aukharan* is found in all houses where jar is prepared and used instead of the usual *chulha*. The preparation of jar requires putting on slow fire for several hours. An *aukharan* usually has a width of about 30 - 45 cm. and a height of 45 - 60 cm. It takes about 10 to 15 days to construct an *aukharan*, which has a life of about 8 to 12 years.

Dancing

Danguriya celebrate the *Shrawn Sankranti Guriha* as their main festival and they celebrate *Hardawa* after planting the rice. They celebrate *Maghe Sankranti* for three days. Danguriya Tharus' main *puja* is *Hareri* and they celebrate merrily by singing and dancing. The main dance is known as *Shikya Nach*: the male plays the *madal* and other musical instruments in the centre while the girls dance in a circle. As they dance, they wave a baeru or a manjira creeper. There is another very popular Tharu dance which is known as *Tihhuwa*. In this dance, men and women dance in separate rows. Men have sticks in their hands and peacock feathers in their waistbands and arms. The women are in rows and hold *manjira* creepers in their hands, which they wave as they dance. Another famous dance is known as *Kathghori Nach*. Man who uses effigies of wooden horses, camels or elephants as they dance performs it.

Tharus start celebrating *Maghe Sankranti* three and four days earlier stop bring all their work. The whole of the last night of the month of *Poush*, they drink alcohol and dance. At Tharus' *Saewer and Kattui* girls perform dances. They go around the village singing. Money is offered to

them. The collected money is then used for a grand picnic. As they start singing, they beat the ground with a stick to keep rhythm. This rhythm is known as *Bhutuwa*. They believe that it chases away evil watches. When performing it, man and women remain in separate rows and sing devotional songs. Before *Bada Dashain*, the unmarried girls or *Bthini* go to the village of elders' house and sing their devotional songs from the Mahabharata epic following their tradition on *Nawami* after *Tika*, they go to dance at nearby towns. On this occasion, they prepare special fish dishes. This special dish is known as *Guita Macha* which is offered to them. Tharus celebrate *Holi, Maghe Sankranti, Diwali, Vijaya Dashami, Nag Nanchami* and *Krishna Asthami*. In *Shrawn* when the fields are green with paddy crops, they have a feast to celebrate the greening of their lands. They celebrate *Diwali* as a festival and in this festival they remember and worship their ancestors. They believe that when they sing, worship and remember their ancestors, their ancestors may attain heaven. In the *Dashain* festival, they offer animal sacrifices to the goodness *Kali* and *Bhagabati*. *Badka Itvar* is one of the greatest festivals of those people. It is celebrated on the last *Aiterbar* (Sunday) of the month of the *Bhadra*. On the occasion, they worship their deities. They also wear new clothes, eat good food and drink. Tharus have unique tradition and beliefs. Their deities can classify into two groups. One as the deity of their house, other is the enshrined deity of common village. Those houses deities are located in the compound, fields, bushes and other personally owned places. *Deurahar* is a human image. It is made of a piece of leather, stitched on the bag, and placed at a *Puja* room. The soil beneath the bag is then removed and other deities, evil spirit and warlocks, and mud image of those can be seen.

At the bottom of large trees, they erect stones and mud moulds and worship them as their deities like *Diuhar*, *Samaymai*, *Churia*, *Raksshasa*, *Baira*, and *Durchandi Deo*. Wooden stumps are embedded in the earth along the roadside to represent the form of *Dhorchandi*. The *Banaspati* deity is found in the center of the forest. *Deuba* is *Kul Devta*, which is worshipped and kept in side of their houses. The *Chvhavar Dhrchandi's* shrine is made out of the carved wood and there will be five wooden pegs fixed the earth near the deity. These five pegs are fixed to the earth near the deity. These five pegs represent the five *Pandav* brothers and people pray to those gods whenever sickness occurs in the village. The shamans perform the *Chinta* ritual and the priest performs social function.

Tharus believe that when the gods are angry with them, they cause various diseases to attack them, they also believe in ghosts and evil spirits. Thrus, who, mostly poor and illiterate believe that witch and evil spirits, which are, exist among them. Therefore, if they fall ill, they blame angry deities, mischievous and wicked spirits, witched and warlocks. To eradicate these sicknesses, they employ their tribal priests, who cast spell and mantras to attempt to remove effect of the deities and evil spirits. Tharu worship female deities like *Kali*, *Bhagawati*, *Maya* and *Gauri*. Female goddesses' deities are offered animal sacrifices like chickens along with alcohol. Tharus bury half of the plough into the earth and make it a *Jkhin* which represents the *Vakshini* demon which is then worshipped. For male deities, they worship *Shiva* in the form of *Bhairav*, *Narayan*, *Ram* and *Krishna*. *Krishna* is given the highest status in their pantheon. They also worship *Bhimsen* and consider it as a village deity. *Madhu* is the god of alcohol and

Dharmaraj or *Nagrahi* are their protectors of their cattle and other domesticated animals. There are also other deities like *Rathinath, Garnerbir, and Bhagheswari* etc.

Every Tharu has a household deity, which is called *Gun*. The deity is offered milk, silk clothes and sacrifices of chicken and white pigeon. Their tutelary deity is a house or image of a horse. The sticks held by the priests during the festivals and *pujas* and the *barchhi* in the groom's hand during marriage ceremonies are kept in the room of the *Deurahar* deity. The *Dharmaraj* deity, who is the protector of cattle and other domestic animals, is pleased outside the house. *Bgar* is a deity, who looks after the animals, is kept in the bushes. A *Rakshasa* (demon) shrine is placed outside their compound if they rear cattle. They consider animals like monkey, snakes and cows to be sacred so they do not kill them. They also worship the *Pipal* tree during the *Banaspati Puja* and worshiping takes place at crossroads, jungle edges and riverbanks.

The Tharus performing arts including songs, dances, music and drama are regarded as truly representatives of their culture. Tharu are expressing their innermost feeling, their emotion of joy and sorrow, fear and jubilance throught this activities. Whatever touches them in their daily life and whatever changes occurring in it are reflected in their songs? Tharus' performing arts play an important role in their lisuring life by their burdens, encouraging them and imparting entertainment and pleasure. Thus apart from providing a healthy activity to them, they also allow them to give and find expression for their unexpressed feelings.

Song:

The Tharus have numerous indigenous songs popular amongst themselves because of their love for singing and dancing. They are always accompanied by singing is both men and women love to sing even if there is no dancing. Tharu song truly represents the entire philosophy of their life. Singing is often accompanied by musical instruments. However, both men and women frequently sing without using any musical instruments at all. A unique feature among the Tharus is that men and women never sing together. Even during the mixed dances, they sing separately in chorus one after another. Thus, there is no duet sung by them. There are no restrictions on any person for singing. Men, women, the old, the young, the married, the unmarried, and widow, all can sing. The composers of song are anonymous and there is no single poet as their writer. The Tharus have large and rich collection of songs. They do not have any formal categorization. However they can catagoriesed into devotional/ religious songs, life cycle ritual song, and festival songs and others.

Religious song: These songs known as *Sakhi* are meant to call upon the deities for their blessings before beginning any work i. e. Oh lord *Nager Bhuiya* you are great. We fall at your feet. Life cycle ritual song: Several Tharus songs are related to the main lifecycle rituals of birth, marriage and death. Among the Tharus *Badhai* (greeting) songs are sung during the *satti* (purification) ceremony generally held on the sixth or seventh day after the child birth as this is a joyous occasion. Similarly the feeling of joy and excitement during the marriage ceremonies call for the

singing of *Manghar* or marriages song. Songs sung during the *Roti-Pani* or *Barshi* ceremony are very philosophical and represent the mysteries of life and death.

Festival songs: Among the festival songs, *Holi* songs are the most important and popular. There are few *Dusshera* songs too, which pertain to lord *Ram* and his life. But these are mainly included as the result of cultural contract. There is no song particular to *Diwali*. *Holi* songs or *Holi geet* are not necessary songs only during the *Holi*, but sung throughout the year. These songs are called the dance songs, since dancing takes place mainly during this festival. *Holi* songs revolve around the few main themes – stories of *Radha* and *Krishna*, love and separation from beloved and devotion.

Other songs: There are several other songs among the Tharus that is dealt with day to day problems, suggestions about how to deal with wife and woman complaining about the ill treatment of her in-laws, and remembrances of one's carefree childhood days. All situations of daily life are expressed through these songs. This is usually practised to mould the body. It is done in accordance with some predetermined idea of beauty, or for ritual purpose, or by some surgical operation, to provide for the connection of some decoration. It may change the normal shape of the body. Among the Tharus piercing of ears and nose of girls is done for beautification. Rationally two to three or even more holes were made on ears from the lobe going up the upper part. This trend has been changed and now only one hole is pierced in each ear lobe. Men, who take part in dances regularly, usually pierce their earlobes or upper part of the helix, and sometimes even their nose if they desire. Tharu women may pierce the ear of a child with a

common sewing needle. The needle is pushed through in the centre of the ear lobe; a white thread allowed to pass through it and then tied up. Mustard oil and turmeric are regularly applied to the holes so that it heals fast and does not form pus. Most of the women aging 35 years and above have huge holes in their earlobe that elongate them considerably. This is done by gradually increasing the thickness of the twig put into the hole. After sometimes, in place of twigs of *neem*, mango leaves are put through the hole. Each time the hole enlarges, thicker rolls of leaves are is put in and this helps in the formation of a large hole. This is done to enable the entrance of the thick earplugs of the ear help in the carrying of the heavy weight of the ornaments. In modern time Tharu girls do not enlarge the hole pierced in her ear lobe, since they have started considering it ugly to deform the shape of the ear. Ears and nose of the male child are not pierced by the parents if the child is not expected to live long. A white thread is inserted in these holes and when the thread brakes off, on its own, it is believed that the *totka* has been successful in warding off all evil effects from the child.

Body Paints: Body paints are washed off easily and weaken. This advantage inspires the birth of a means of making the stable chosen design. The result is tattoo, a custom of world wide sharing. Thus, the practice of tattooing is as old as painting and common among the primitive as well as in modern societies. Tattooing consists of pricking color into the skin, leaving a smooth and even surface. Different motives are ascribed to the practice of tattooing, such as enrichment of beauty and sexual attraction, health, sign of recognition, to ward evil spirits. Except the pupil of the eyes, tattooing may be done on almost any part of the body, but the most favored parts are the

forehead, nose, arms and chest. Considerably, tattooing is the more fashionable among the fair skinned people where it looks more well-defined.

Tattoing, known to the Tharu as *leela*, is widely adopted by both men and woman, although it is more usually noted among the women. Tharu women are greatly tattooed. Though the practice of tattooing is very painful, people enthusiastically joyfully and cheerfully use it. The main unussible drive behind this is to enhance one's beauty and attraction. This is also one of the motives for tattooing among the Tharus. Another motive of having a tattooing is the desire to get a place in heaven. There a belief among the Tharus that unless one is tattooed, one will not get a place in heaven; rather he/she would be lashed with thorny branches of the *simra* and *maini* tree and sent to hell. It has medical reasons too. According to the Tharus, if pain persists in any part of the body, a tattoo should be made on it. This would cause the dirty blood of the area to flow out, thus to get relieve of the pain is main reason.

House painting

Tharu houses take the form of one-storey huts with bamboo walls and thatched roofs. They do not keep their houses and environment clean and healthy from inside and outside. The houses are not strongly built and can catch fire easily. They believe that the *Bhutuwa* god does not permit them to live in houses that have more than one storey. Tharus build houses in a group or in a village, or along the both sides of the village streets. The length and size of each house may differ according to the size of the families. Houses are thirty and forty feet in length. The walls of their houses have the paintings of different animals like elephants, horses, birds mostly parrots,

flowers and other nature motifs. The women and girls do this work. For building the hut, both men and women equally put their labour. While men construct the entire framework and roof, it is the responsibility of women to plaster, colour and decorate the house. Much land is needed for the construction of the Tharu huts as there should be enough space to include not only the main house, i.e., *ghar*, but also the *saar* (cattle byre) a plan or bangle, a *bari* (kitchen garden) and so on. There is little architecture skilled involved in the construction of a Tharu huts, though their shape and form are made as attractive as possible. The plans of all Tharus houses are nearly similar. The main house is built facing its length toward north south and breadth to the East to West. Huts are rectangular in shape and have the roof slanting both in front and backwards. The size of house depends on the need and size of the family. Thus the larger the family, the bigger the house is. An important point to note here is that the houses of the Dang Tharu always have two doors. The doors are situated in front of each other.

CHAPTER V

MATHEMATIZING THARU MATHEMATICS

In this chapter the resercher have focused on ethnomathematical perspective for mathematizing Tharus mathematics in modern society. He has also drawn the implication of Tharu' mathematics for the current curriculum.

Genesis of Mathematics

Seeking beauty is of an aesthetic desire of mathematics, as the tradition of people. Mathematics as an art is close to life as it is on tribal cultures (Maiti, 2004, p.287). In addition, in many non-tribal societies too, the technical talent of the conceptual mathematical artists is spent on object of everyday use. It is the expression of the desire for beauty and fulfillment of technical skill through accepted form (ibid). In term of pattern perceptions and creative resource of the artistically able member of every society needs mathematical dealing. Based on intensive fieldwork carried out on the Tharus of Dang, It reveals that the mathematics and art are interwoven into nearly every phase of the Tharu life. Most of their objects of daily use are self-made. Looking at those objects it is obvious that the Tharu are guided by their own well defined aesthetic awareness. The Tharu are living in harmony with nature. They try to use all the existing raw materials of their surroundings, without disturbing the nature and ecosystem for fulfillment of majority of their necessities.

The mathematical artistic preference among the Tharus is developed and shaped right from the childhood. Children imitate their elders in artistic activities and gradually acquire the skill required for particular art with reference to mathematics. In the attempt they are always

encouraged and supported by their elders even there does not specialization of any mathematical knowledge. Every Tharu has the necessary knowledge and skill to make artistic objects. Several individuals are skillful in one or the other art or craft. Some individual is skillful in several artistic activities of mathematical pattern. Such individuals are more accepted and respected for their activities. Their help and guidance is taken in the community without much hesitation whenever needed. Although there are several outstandingly artistic skill and craftspersons among the Tharu, they are hardly professional and as such everyone takes a part in artistic pursuits for their own pleasure and satisfaction by decorating articles of daily use. These articles are made of wood, reed, bamboo and soft clay acquired from the ponds. Hutments are large and cover areas large enough to accommodate a main and secondary hut, a cattle shed, an open courtyard and kitchen garden. Huts are rectangular having a sloping roof both in front and back. The requirement of labor for construction of hut is provides by family members and close relatives or friends. Men being construct the frameworks of hut and make roof, where as women plaster the entire house. While plastering, shelves of various shape are made on inner walls and on the pillars to provide safe space to keep small article of different kinds. On the wall both inner and outer, are beautified by making different designs in either low relief work engraving or painting or combination of any or all of those. Colours used are in accordance to one's own experience. The most common designs are geometric, but flowers, animals, birds, and human figures.

Another important use of the clay is make vessels of various shapes, sizes and designs. All clay works are mainly made by women without the help of potter's wheel, but are using any three techniques, modeling, moulding and coiling. These are baked in the Sun instead of being in fire. Cow dung and paddy husk are added to clay for clay works to prevent them from creaking. Article product are various, e.g., huge grain bins, small basins used as containers, receptacles,

shed for housing, poultry, hearths, beautiful stand of different shapes and sizes. The confidence with which these articles are shaped by the Tharus, make them not only functional but also aesthetical as well as mathematically valuable. The household goods they make need mathematical ideas and knowledge. The Tharus are skillful in basketwork. Several basket containers and other items are made by utilizing both the major basketry techniques namely, plaiting and coiling. All coiled baskets are made by women. The ceremonial and ritual baskets made by women are widely beautified by coiling colorful patterns on to them. Patterns are habitually geometric even when zoomorphic (animal figure) and anthropomorphic (men and women) figures are made, they are mostly line drawings. Some of those baskets are extra-decorated with accessories such as beads and shells. Apart from containers, the basketry techniques are used for making fishing traps and few other utility items such as mats and winnowing plates. Making of rope by using various materials, weaving of fishing nets, carpentry and various kinds of crafts use mathematical ideas.

It is mentioned here that it is possible to have two different mental responses to them. Such objects may merely be considered effective in fulfilling some requirement and thus considered simply utilitarian. On the other hand they may be accepted in aesthetic way as a thing of beauty. They appeal to their aesthetic feelings and therefore on the dominion of mathematical creative art and design. There are no hesitations that the Tharu huts, clay objects, basketry items, or clothes are primary in utilitarian in nature, but they are also work of arts leading to the mathematical design.

The performances of arts of Tharu include mainly dancing and singing. Use of musical instrument exist only accompaniments to dancing and singing. The musical instruments found here are mainly used for beating instruments that provide rhythm. As in most primitive societies,

among the Tharus too, melody rhythm is given more importance. Tharu sings even without achievement of musical instruments.

The studies of ethnomathematical ideas can be accomplished from several perspectives. The Tharu societies have a rich cultural heritage. Tharu artistic objects such simplicity, style and beauty. Art and art objects found in Tharu society is the way indicative of their artistic bend of mathematical mind. It encourages them to decorate articles of daily use to make them more attractive than mere functional. However, the fact is that the products through which these people reflect their artistic temperament are first functional and utilitarian cannot be denied. Although Tharu art and crafts are of artistic mathematical manifestation of the creative design, they are not always guided by the ideas of art for art's sake. In general, Tharu artistic nature is to satisfy the motive for art for utility. Thus, various artistic objects cater to the various need of the Tharu society. The Tharu are a self-sufficient and every household attempts to fulfill its requirement on its own. Thus, primary importance of huts, which acts as a painter's canvas, is to provide shelter and protection, clay vessels and baskets serve as containers and receptacles. Fishing net, traps, and clothing similarly have their utility. Woodwork is practise mainly for fulfilling some basic needs. Ornaments and other adornments serve to enhance one's personal appearance and for beautification. The performing arts have two fold objectives, as stated by Tharus themselves; to provide healthy entertainment and to act as a means to put into the open their personal feeling. Tharu manage to express their creativity in satisfying way. Thus the Tharu have devised means not only fulfilling their daily necessities, by skillfully utilizing row material available conveniently from the surrounding areas, but also intelligently using those very objects as their canvas to bring forth their love for beauty, colour and everything taken in the sense of aesthetic inclination. The resercher observation has been reiterated by Ray’s analysis

> Art play a vital role in primitive societies. Primitive art consider as belonging to the categories of traditional art form. Traditional art is the expression of conceptual art; it is the mental summary of the visual perception. An artist is conceptualizes the form through observation of the object (living and non-living) based on the social norms and rules. It is mental summary of visual perception, which inspires an artistic to create images (Ray, 2001, p.19).

To explain this, art is mental summary of perception which has mathematical rule and regulation deals about symmetry and beauty. Two basic trends of expression are normally represented in graphic and plastic arts of the primitive society i.e. decorative and the representative arts. A common feature of primitive art is that it has symbolic character. The symbolism may be said to survive when some components of the mind's experience obtain activity and values ordinarily associated with other component of experience. Almost all languages and almost all arts would be symbolic. However, symbolism is considered in a narrower and purposive way. A symbol is an object or action that represents another thing. It is part of made to stand for whole. Art becomes significant to society through its representative characteristic like mathematics. Symbol represents ideology and philosophy of the mental concept of society, which is mathematical. However, gradually over the time the symbol becomes the pattern or decorative design. Some of those patterns use in daily life through decorative motifs, and textile, utensils, household items and weapons are commonly decorated with those.

Mathematizing Tharus' aesthetic design

As already noted, most patterns and designs found among the Tharu are geometric or a combination of different geometrical forms. Apart from these, flower-patterned, zoomorphic and anthropomorphic patterns are also common. Among the geometric pattern, triangle and zigzag lines are the most common and considered auspicious. Besides those, vertical, horizontal and diagonal bends and parallel lines close together, squares, rectangles, dots or circular punch

marks, detached circle, elliptical punch-marks, rectangular cross-hatiching, chequer and star are found by the intersection of three or more lines noted. These patterns are common to all artistically decorated objects on the walls of the huts, clay vessels, baskets, leharia work, and even tattoos. Most flower-patterned, zoomorphic and anthropomorphic patterns are line drawing. Animals commonly noted were elephants, horse and deer, birds such as peacocks, hens, duck, pigeons and parrots. Figures made were generally of men riding animals, with bows and arrows in their hands or standing close in a group. Such designs are common on the wall of the hut, baskets, appliqué and tattoos. Flowers are many times merely a few square or lozenges joint together differently and foundon all kind of objects. Since most patterns and motifs found on the various Tharu art objects assumed that, there lies some meaning behind these. Most of the artistic designs, however, are not understood easily what those motifs symbolize. Only some old women and men could give the interpretation of a few symbols, which according to them have traditional meaning, for others these motifs are merely decorative and made since they were pleasant and attractive to look at. The Tharus dependence on nature has created a nature understanding and demonstrative relationship with the environment, which they depict through their patterns. Thus, most of the symbols found here are related to the environment and surroundings. No one among the Tharu tribes of Dang district could enlighten the researcher as to why triangles and zigzag lines represent river and pounds. Both of those being a part of the immediate surrounding, its importance in the Tharu life is understandable. The interpretation of the symbols is not one given by the Tharu, who consider these symbols auspicious, but they are unaware for the reason of their belief, the meaning of the symbol or rationale behind it. According to the Tharus, a square with a dot is symbol of a flower. Two triangles with their apex opposite and touching each other stand for a butterfly, a circle surrounded with lines on four sides suggests a low seats, a circle

suggest a hearth, several disjoint dots or punch marks stand for a sieve, two vertical lines covered with a single horizontal line or an inverted "v" suggest a hut. Thus, all symbols are related either to the nature and natural surroundings or to the objects of daily use. Although some motifs are symbolic, it must not presume that all designs or patterns represent something else. Thus flowers, anthropomorphic and zoomorphic figures and in many cases even geometric patterns do not carry any specific significance. These are merely used for the sake of design and decorative purposes.

The possibility of certain relationships between the arts of a society the other aspects of its culture have recognized. It was due to this very assumption that some anthropologists have used artistic data to address questions of cross cultural variation or universals. The cross-cultural approach to art, thus attempts to establish board correlations between art styles or forms and social or socio- psychological factors. Fischer (1961) in this regard has examined the stylish features of art with the aim of discovering "some sort of regular connection between some artistic feature and some social situation" (p 361). Using statistical evidence, he states that egalitarian societies characterized by graphic designs, which repeat simple elements, while hierarchical societies produce designs integrating a number of dissimilar elements. Fischer argues that the artist expresses a form of social fantasy. In other words, in a stable society artists will response to those social conditions in the society that bring them, and the society, security or pleasure. Assuming that is "pictorial elements in design are on one psychological level, abstract, mainly unconscious representations of persons in the society. Fischer reasoned that egalitarian societies are generally composed of small, self-sufficient communities that are structurally similar and have little differentiation between persons. Stratified societies on the other hand generally have larger and interdependent (dissimilar) communities and great difference among

the persons in prestige, power and access to economic resource. Fischer hypothesized and found in a cross-cultural study that certain elements of designs are strongly related to the presence of social hierarchy. This finding is summarized egalitarian society- Repetition of simple elements, much empty or "irrelevant" space, Symmetrical design, unenclosed figures. Stratified Society- integration of unlike elements, little empty space, asymmetrical design, enclosed figure.

Repetitions of single element represent the art of egalitarian society, which has little political organization and few authority positions. If each element unconsciously represents an individual within the society, the relative similarities of people seem to be reflected in the repetitiveness of design elements. Conversely the combining of different elements in a complex pattern that tends to be found in the art of stratified society seems to reflect the high degree of social differentiation that exists in such societies. Symmetry, the third stylistic feature related to the type of society, is similar to the first. Symmetry may suggest likeness or egalitarian society while asymmetry suggests difference and perhaps stratification of hierarchical society. Application of these two hypotheses on the Tharu art conform Fishers conclusion to the great extent. Patterns are found on Tharus baskets. Embroidery, most clay objects, and few wall decorations are repetitive and symmetrical. Similar arguments can advance for the group dance steps, which are synchronized and repetitive. While singing too a line of song is repeated by a group after it has been uttered once. All these indicate the self-sufficiency and egalitarian structure of the Tharu society. They are, however, a few examples that question the complete validity of these hypotheses. Most of the wall decorations are made on grain containers and appliqué.

Fischer’s second hypothesis suggests that the egalitarian society's empty space in a design represents the society's relative isolation. Because egalitarian societies are usually small and self-

sufficient, they tend to shy away form aliens, preferring the security within their own group. On the other hand, the art of stratified societies is generally crowed. The hierarchal society does not seek to isolate individuals or communities within the group since they must be interdependent. Among the Tharus this hypothesis in decorations and clay vessels have a lot of empty and irrelevant space? Then again, they are many wall paintings that do not have any empty space at all. The Tharus are also unable to inform about any ethnic categories, related to mathematics. No abstract principles whatsoever used by them to account for the beautification and decoration of their objects of utility render them as mathematics. However, the Tharus do not ignore the importance of their mathematical activities. According to them, beauty and beautiful things arises feeling of happiness and contentment among the onlookers. In addition, the easiest way to derive this feeling is by beautifying things in and around one's house, since this is the place where one spends most of his/her time. This is one of the major reasons, why the Tharus beautify most of their utility items. They say that the feeling of satisfaction and fulfillment derived from creating something beautiful is another important factor. This combined with the admiration, praise and recognition received from members of the community proves a vital motivating factor in the creative pursuit.

Today, all over the world, one can observe the dying of old artisanship and true handicraft, which are more mathematical. Even the Tharu are no longer an isolated lot as they have been living for centuries. A causal observer can easily take notice of the impact of urbanization and fast developing cosmopolitan culture in every sphere of their life includes the attitudes towards arts and artistic pursuits. Today, the beautiful Tharu huts being replace fast by those made of bricks and cement which lack the earlier mentioned beautiful mural art of the traditional Tharus huts lose mathematical tessellation, design, and pattern as well as mathematical ideas. In place of

the clay vessels, neatly woven and decorated baskets are loosing, more and more plastic and metal containers are being used. The use of electric and plastic- hand fans brought from the market is fast replacing the painstakingly coiled or woven traditional ones. The change over the urban style of dressing and decorating is being adopted in place of the beautiful Tharu attire. A materialistic attitude is fast replacing the simple and leisurely life of these tribal. Because of the desire to acquire more and more wealth and economic prosperity, preference is being given to activities that helped in generating wealth. But creative force is suppressed to great extent. Many of the Tharu today consider artistic activities such as coiling beautiful baskets or doing the exclusive embroidery a waste of their precious time and energy that can instead be put to some economically gainful work. This change, though occurring at a fast pace, is in its initial stage. Even today, skilled craftspersons and artists are respected and admired by the members of the Tharu community. Until date, objects of beauty are considered price possessions and much free time is spent in deriving aesthetic pleasure by using their hands at creating something innovative and artistic. However, the market declined in the quality of work is easily noticeable. It is a pity that the exceptional and unique Tharu arts and crafts are on a decline trend because the young generation do not perform and give an interest in it. Attempts should be made to preserve and nurture one of the most fascinating and beautiful aspects of Tharu life which is more mathematically insignificant.

The skill of joining plants fiber into the ordinary pattern and making household goods is known as basketry works. It needs mathematical functions. The mathematical ideas of rotating, twisting, banding together, combining together, separating and interlacing together contribute to make a basket. On the other hand Tharus love for beauty generates mathematical patterns and use of colors shows its pioneering designs and ideas. Rough texture is made soft and smooth for

bending and twisting and for tightness. For making design they use furcated and lazy squaw methods. For making basket the base has a snail or rosette pattern. They use transformational geometry to design pattern. For example, Lauka; it looks like a squash container. The rope is tied to obtain required shape where the shape is modifed naturally by using mathematical ideas. For making some baskets, some kind of flexible weft passes alternately over and under on the thicker rap rods. Tharus make various types of beautiful baskets some of them are:

Jhabia/Dabki: It is a flexible weft that passes alternatively over and under the wrap matter. They are similar but vary in size. It is almost 1/4 part of sphere shape. The greatest diameter is on of its mouth. *Chitwa:* It is like a truncated cone, a smaller base is in bottom making the check pattern, which is circular. *Doko*: The plaited work is in base, and vertical weft is in the direction of truncated cone and wrapped weft is in horizontal direction following circular paths. The vertical weft follows same direction and in other cases it makes 60-degree angles and finally, produces hexagonal opened shape. *Chhaparia*: It is cylindrical in shape having a base as a rim. *Pitra*: Basket has check pattern of the plaiting technique. It is nearly globular in shape with flat base and narrow mouth. *Bhaunka:* - It is made by spiral coil technique and in globular shape. Its greatest width is at the middle and decreases uniformly. *Dalwa:* - It is half globular in shape. Its greatest diameter is in mouth, the foundation is in desire shape. *Tokri:* - Its outline is seen like triangular shape but it is truncated conical in opposite direction. The base is 1.5 inch. It has big circular mouth compared to bottom. Dhimri: It is in rectangular base of conical shape made of bamboo splints. *Hiluka:* it has semi circular shape. *Pitara:* it is in globular shape but base and mouth are usually small in diameter and middle is large. *Tukna*: it is conical but big mouth and small base and base has another truncated conical stand. *Udia:* It is combined shape of cylindrical and truncated half circle. *Khaincha:* It is combined shape of cone and cylinder. *Supo*:

It is combined shape of flat circular plane and short cylindrical and base has twined pattern in diagonal. *Mithaura*: It is combined shape of circular conical and spherical sector. It has open and hexagonal patterns. The direction of bamboo splint is in 60 degree instead of horizontal and vertical. *Gadri:* It is a combined shape of two circular conical shapes. One cone is gradually tapered down never point and another is tapered down in far point. It is made by parallel spirit of bamboo wrapped by rope. *Krorg:* It is circular conical in shape. The bamboo splint is raped by rope. *Tupi*: It is square base of parallelepiped shape. *Nuiya*: It is globular in shape and different colorful patterns coiled on it. *Dalwa*: It is a semi conical basket, it has gradually tapered outline but internally flat base. It has a stand and circular mouth. *Dalai*: It is semi globular or basin shape the widest diameter is in the mouth and gradually tempering downwards. The colorful patterns are coiled on it. *Kanjola:* It is a globular basket with flat base and uniformly similar from big diameter. The maximum diameter is at the middle. *Dalia*: It has circular mouth open not more than 5 inches which tapers down from all the sides up to 3-4 inches to form a constricted neck and the again starts increasing in diameter gradually as one goes downward towards the base. Sara: It is a square or rectangular based parallelepiped shaped basket. The involvement of mathematical concepts uses in the constructional process, their geometrical shapes are mention in table 5.1 below.

Table 5.1 Mathematizing Basketry Work Items

Items	Constructional process	Geometric shape	Involvements of mathematical concepts
Jhabra/ Dabki	Wrap, Weft pass over and under	1/4 part of spherical shape	Sector of sphere, radius, surface area, volume, inner and outer diameter, circular (rim of Jhabra), elliptical curve (cross section of Jhabra).

Chitwa/ Dalo	plaited, bee-skip technique	truncated cone	Plane, line, edge, base, radius, surface, volume, circle, bigger and smaller diameter, plane and round surface, vertical and horizontal line and angle
Doko	Plaited, wrap and coil work, Wrap weft in horizontal, open Hexagonal	truncated cone	Division of angle 360 in to 60s, Plane, line, edge, base, radius, surface, volume, circle, bigger and smaller diameter, plane and round surface, slant and horizontal line and angle, slope, open and closed
Chhapa ria:	plaited, check pattern	cylindrical	Line, edge, base, radius, surface, volume, circle, diameter, plane and round surface, horizontal and vertical line and angle 90 degree.
Pitara	plaited, check pattern	Nearly globular with flat base with narrow mouth	line, edge, base, radius, surface, volume, circle, diameter, plane and round surface, horizontal and vertical line and angle 90 degree, globe, flat surface, tessellation, pattern, parallel line, triangular design, greatest diameter, smallest diameter etc.
Bhaunk a	spiral coil	globular	greatest width is at the middle and decreases uniformly, line, edge, base, radius, surface area, volume, diameter, flat surface, tessellation, pattern, parallel line, triangular design,
Dalwa	spiral coil	half globular	greatest width is at the middle and decreases uniformly, line, edge, base, radius, surface area, volume, diameter, spiral,
Tokri	coil and	outline is triangular truncated conical,	Direction in straight line, slope, line, circle, diameter, radius, surface area, volume, handle is in curve, base with opposite truncated cone, spiral
Dhimri	Bee-skip	Like truncated paramedical	Point, line segment, direction, parallel line, plane, rectangle, trapezoid, volume, area, angle, slope
Gadri	Bee-skip	double truncated conical but in opposite direction	combined shape of two circular truncated conical shapes, direction, slope, change in diameter, circular, curve line, gradually trapper down never point

Udia	check pattern	cylindrical combine with truncated cone	circle, vertical & horizontal line, volume, area, slope, diameter, radius,
Khandra	check	combined cylindrical with circular conical	Rhombus, points, pattern, tessellation line, point, diameter, radius, surface area, volume
Pine	coil	truncated conical	spiral, conical surface, area, volume, circular rim,
Khong	Bee-skip	conical	Intersections of line, symmetrical concept, parabolic concert, line point, plan,

The table 5.1 reveles that the Tharus of Dang are skillful in basketry work. They construct basketry works items such as *Jhebra, Chittwa, Bhaunka, Pine, Khong. Dhinri,* and others. The mathematical making processes used are plaited and coil. On the construction of basket wefts are operated differently i.e. vertical, horizontal, and slant position and pass over and under producing different mathematical patterns. The netting process is also mathematical. Different kinds of hollow shapes solid and plain plate are produced. Designs on basket with symmetrical categories are seen. The mathematical idea of transformation is used. Tharu construct geometrical shape such as spherical, globular, height globular, truncated globular, cylindrical, cubical, and combined of these shapes. They also make triangular, hexagonal, check, wrap, square, parallel and coil pattern. For this they use estimation, counting, fingers measuring, and making equal size of weft, rapping equal number of weft, and taking equal amount of coil material.

The clay commonly available in nature is very plastic and can be model into the great variety of shapes. Tharus have classified the clay on the basis of soft and smooth in three categories, viz; *paror mitti, chitkar mitti,* and *sheth mitti*. They mix cow dung and paddy husk to reduce weight and to save from cracking and for longitivity. Tharus believe that if the clay pot is completed in

the same month it will remain free from insects throughout the period of their storage. Sunday is believed the auspicious day to start work. Bulding up, moulding, and molding are main fundamental processes of making clay pots. Once the prepared clay has been moulded, then it is air-dried. When pot reaches in lather-hard stage, policing and brushing is done to reduce porosity. *Dehari:* There are different kinds of deharis with different shape and size. They are rectangular, cubical and truncated triangular. *Jhabra*: It is basin shape. *Mohakar:* It is a circular disk with rising edge. *Bhamra*: It is globular in shape with circular stand at the bottom. *Bhkri*: It is sperical shape of height is more then breathe. *Lohra:* It is a globular shape but bottom and mouth are more flat. There are rounded or elongated holes for air passing. *Darba:* It has square, rectangular, semicircular and trapezoid shape. Combine of those shapes are used. *Aukharan*: It is cylindrical object with narrow in middle lock like outline as hyperbolic. The table 5.2 shows the clay works of Tharus on their making process, mathematical shape and the involvements of mathematical concepts.

Table 5.2 Mathematizing Clay Items

Goods	Process	Geometric Shape	Involvement of Mathematical Concepts
Dehari	coiling	Rectangular, cubical, truncated triangular, combined cubical	length, breath, height, vertical & horizontal plane, side of triangle, parallel line, circular rim, radius, diameter, area, volume
Jhabra	Moulding	Basin	circular rim, rise rim, diameter, radius, center , surface area etc.
Bhamra	Moulding	Half globular	circular rim, diameter, radius, volume, surface area, circle, height, proportionate wide, greater & lesser diameter, inner and outer diameter

Dhakkna	Moulding	square, circular, rectangular	circular rim, diameter, radius, volume, surface area, circle, height, length, breath, edge, convex, hole, leather hard, steady heat
Bhakri	Building up	height globular	circular rim, change of diameter and radius, volume, area etc.
Laiya/ Lei	Building up	Globe cut into half, rectangular	radius, diameter, length, breath, line segment, point, parallel line, elliptical or circular hole
Darba	Building up	square, rectangular, semicircular, etc.	sector of circle, length, breath, parallel line, angle 90 degree, opposite side, diagonal, vertical and horizontal line, radius , area, circular, elliptical etc.
Khabra	Building up	Parallelepiped	length, breath, parallel line, angle 90 degree, opposite side, diagonal, vertical and horizontal line
Aukharan	Building up	cylindrical, hyperbolized	radius, diameter, center, circumference, section of circle, area, volume

The table 5.2 shows that the Tharus clay works have main three mathematical operations they are coiling, moulding, and modeling. Today's house building process is advance form of coiling and moulding process. The clay work involve rectangular, cubical, truncated cubical, half globular, elliptical, basin and parallelepiped shapes. The involvements of mathematical concepts are points, line, plane, length, breadth, height, line parallel line, diameter, radius, volume, area, angle, horizontal line, vertical line and rim. For this they use estimation, making same size of coil material, counting coil number, measuring inner diameter, diagonal, sides and moulding.

The Tharu have numerous indigenous dancing systems. A unique feature among the Tharu is that men and women never sing together. Even during the mixed dance, they sing separately in chores one after another. *Barka* dance: Two rows of boys and girls, dance in circle and in half circle but in slow motion, rotate in 90, 180, clockwise and anticlockwise direction. *Kathghori*

dance: Madales bit the madal standing in row and dancers stand in two rows one row of female dancers, make a horse and dance in the row follow semi circle and circle path. *Lathauwa* dance: Dancers stand in row, go forward and backward, rotate in 90, 180, 270, and 360, in clockwise and anticlockwise, move in curve line and follow circles' circumference path. They take two stick and dance changing the position of rectangular arrangement in row and row arrangement into circumference curve line. *Sorathi* dance: Dancers and madales dance together and singers stand in a line makeing rectangular arrangement, dance in same pattern and dress in similar pattern. *Sakhiya* dance: Dancers stand on three columns, girl's columns is between the boy's columns and dance in symmetrical pattern and action followed by dancers is similar. *Huradunga* dance: Ladies dance in two or in-group, rotate clockwise and anticlockwise and follow symmetrical pattern. *Mugroura* dance: Dancers go forward and come backward standing in two-row madales and one dancer in between, boys and girls are in parallel lines and interchange position. The starting point or reference point and co ordinate axis and other many mathematical ideas or concept can be dealt in performing art of Tharu. The table below depicts their dancing characteristics.

Table 5.3 Mathamatizing Tharus' Dance

	Position	Transformation	Involvement of Mathematical Concepts
Barka	Stand in two row and Colum	Row change into Circle, circle change into half circle or in line	Rotation: clockwise and anticlockwise in 90, 180, and 270 degree, motion, speed, shearing
Kathghori	Madale middle row, dancer in two row	Row into circle; circle into semi circle and again in row.	Line, point, parallel line, circle, half circle, motion, rotation, transformation

Lathauwa	Dancer stand in row,	Go forward and backward, move in circle, circumference	Changing position, transformation, rotation in 90, 180, 270, and 360, change rectangular arrangement into row and row into circle, linear arrangement,
Sorathi	Dancer, madale are dance together singer stand in a line	Make rectangular arrangement, dance in same, dress are in similar pattern.	Changing position, reflection, reduction, rotation in 90, 180, 270, and 360, change rectangular arrangement into row and row into circle, linear arrangement,
Sakhiya	Dancers in 3 columns, girl's is between the boy's	Dance is in symmetrical pattern, action followed by dancer is similar.	symmetrical pattern, order, linear transform, betweens, orientation, similar, repetition
Mugroura	in two-rows madale and one dancer in between	Dancers go forward and come backward	Parallel line, reference point, co-ordinate, horizontal & vertical line, point, line segment, circle, circumference, angles, rectangle, radius, diameter, rotation

As can be seen from the table 4.3 that Tharus dance *Baraka, Kathghori, Lathaura, Sorathi, Sankheya, Mugrauwa*. In dancing position sometimes they arrange row, sometimes in columns, sometimes in circles and half circles, and then they move in row, line, rectangular shape, circular shape. They move forward and backward and do action repeatedly following symmetrical patterns. The involvements of mathematical concepts are point, line, ray, row, column, motion, rotation, reflection, reduction, enlargement, circle, radius and diameter. Repetition and orientation action are repeated. Pattern of co ordinate geometry i.e. reference point, axis, vertical line, horizontal line, clockwise and anticlockwise, rotation are used while dancing. For the knowledge generation they use estimation, counting, walking steps counting, seeing others action, and guess.

Tharus artistic inclination and love for beauty is reflected on the designing and decoration of wall of their houses. They plaster their houses with mixture of clay, paddy husk, and cow dung to save from the creaking. The table 5.4 mentions the picture of Tharus on their houses with their theme and involvement of mathematical concepts.

Table 5.4 Mathematizing House painting work

Picture type	Theme	Involvement of Mathematical Concepts
Flower	Natural and unnatural design occur	Point, line segment, curve line, dot line, parallel line, circular, half circular, zigzag line, cylindrical stream, symmetrical pattern, closed region, edge, reformation, rotation, reduction, enlargement, similar, congruent, slope
Zoomorphic	elephant, peacock, hen, snake, horse, Tiger, dear, duck, bird	Position, point, line segment, curve line, elliptical curve, parabolic curve, direction, slope, zigzag line, circular, ratio, proportion etc.
Anthropomorphic	Man, women, *Pandav,* Krishna, armies, *Parbati*, line of women, man riding horse, elephant	Dot, line segment, position, angle, direction, curve, edge, closed figure, parabolic curve, zigzag line, circular, cylindrical etc.
Astemaki	zoomorphic, flower, anthropomorphic, geometric (triangular, circular, square, tessellation) moon, sun, boat, and other	Square, triangular, circular pattern, tessellation, point, parallel line, line, Coolum, row, circular, crosscant, sun, ray, concave, convex, angle. direction, etc.
Geometric	triangular, circular, square, Pentagon, hexagon, check pattern, point, line	Dot, line segment, position, angle, direction, curve, edge, closed figure, parabolic curve, zigzag line, circular, cylindrical, Square, triangular, circular pattern, tessellation, point, parallel line, line, Coolum, row, circular, crosscant, sun, ray, concave, convex, angle. direction,

The table 5.4 above indicates that Tharus decorate their wall with flower art. Different kinds of flowers are depicted differently. The bud of the flower, the petal of the flower, and the leaves of the flower are all seen in symmetrical pattern. The Tharus' artistic inclination in designing is unique. The house plastering with the mixture of clay, paddy husk with cow dung in the ratio of 2: 1: 1 with respect to mass both inside and outside. There are many mathematical concepts, which are very important and practicable. Combinations of horizontal, vertical and diagonal lines are used to make checks design. Square, rectangle and triangular patterns are most used patterns. Zigzag lines, parallel lines, group of men and women, flowers art, geomorphic and anthropomorphic patterns are seen in wall decoration. The symmetrical patterns are most used in Tharu society. The Astemaki (the figure of biography of lord Krishna) paintings have contained sun, moon, five Pandav, as boats, and animals. The figures are arranged in row and column systematically. The border has depicted with parallel lines which provide the massage of auspicious. Other auspicious massage providing figures are triangle and zigzag lines. To make snake picture they make parallel curve line with respect to natural pattern design. Others pictures are gods, demons, men riding horses with taking arrow and bow are depicted on the wall. In house painting, Tharus use so many flowers, zoomorphic, anthropomorphic, Astemaki, and geometrical patterns which have natural and unnatural design. The aesthetic design has direct impact on their activities. They use utility base mathematics rather then theoretical. Symmetrical patterns are seen between the figures where there are many spaces. For house painting they use rectangle, square, parallel line, triangle pattern, ratio and proportion, position, location, gap between figure, flower, zoomorphic, and anthropomorphic figures. For this they use counting, measuring, estimating, gusting, trial and error, practicing. The other Tharu works are given on table 5.5 below.

Table 5.5 Mathematizing miscellaneous work

Item	Features	Involvement of Mathematical Concepts
Tattooing	Symmetrical shape, Temple: triangular, elliptical, pentagonal, cylindrical, boat shape, Flower, zoomorphic, anthropomorphic, eye shape, pigeon, snake etc.	Symbol, dot, dot line, line segment, line, curve point, triangle, rectangle, pentagon, circular, angle, slope, position, co-ordinate, reduction, rotation, reflection, translation, enlargement.
land registration *Begaari* (corvees)	Does not want to register free work tradition like *Kammaya*	currency, Money exchange, Principal, amount, interest, devaluation,
Mixing clay for making and plastering house	Paddy husk, cow dung, clay (1 : 1 : 2)	horizontal, vertical line graph, cell, 3X4 grid, Elasticity, steady heat, porosity, ratio, proportion,
Ghanghariya *Nahanga* (dress)	Rectangular division	horizontal, vertical line, rectangle, column, row, parallel line, angle, grid, opposite side, diagonal etc.
Workshop Room	Northeast room of house where god live	Season measure from northeast, Direction, bearing, angle, rotation (clockwise, anticlockwise)
Wood work arts	body proportion does not match, obviously	ratio, proportion, uneven, relative measurement
Work term	*Adhiya, trikur, panchakur*	fraction, ratio, percentage

Table 5.5 shows that tattooing is the tradition and culture of Tharus'. The motives behind this tradition are for protection against mosquitoes and insects, for adornment and attraction, for frighting with enemy, for remembrance or for religious purpose. The tattooing is usually practiced by all Tharu communities. The Tharu tattoos in their body are used to have with plant series of figure tree, different kinds of temple, flower, horse, deer, peacock, hen, pigeon, bird,

snake, hearth, wood so on. The concept of symmetry is observed in this tradition. The beautiful geometrical patterns are designed on the body. The mathematical ideas of point, line, line segment, parallel lines, curve line, square, rectangle, triangle, reflection, rotation, translation are imsolved in the tattoos by the Tharus. *Ghangaria:* It is trapezium or quadrilateral in shape. The unique feature of this garment is that it is not stitched on the side to make it cylindrical. The vertical and horizontal stitch linens make 4 X 3 grids where ideas of row and column can be conveyed. *Angia:* It is made of several colorful pieces of cloth, which may even be of different materials, cuts in the small strips and pieces after which they are systematically arranged and stitched together to give it desire shape. Symmetrical pattern are seen in these cloths.

CHAPTER VI

DISCUSSION AND IMPLICATION OF THARUS GOODS FOR MATHEMATICS TEACHING

The following household things are used in daily lives, which give ethnomathematical ideas used by Tharu community can be dealt in mathematics classroom. The implication of Tharus' goods for teaching mathematics is mentioned in the following discussion.

Atwa: A kind of wooden balcony used for storing maize, peeper, onion, garlic and so on. The parallel line, point, rectangle, slope, angle, horizontal, vertical, plane can be dealt with help of *atwa. Fig 6.1.*

Fig.6.1

Fig. 6.2

A kind of tall wooden hut Fig 6.2 used for watching wild animal to protect maize crops especially in Tharu community. They erect the pillar of bamboo fixing in triangular. These pillars make hut rigid and strong in structure. In modern mathematical science, the triangular fitness is used for strength the structure of any things. The flexibility is removed by triangular tightness.

Akarin: A bamboo's hooked wooden stick is used to shake or carry out straw during paddy threshing. Straight line, angle and distance can be mentioned by these sticks.

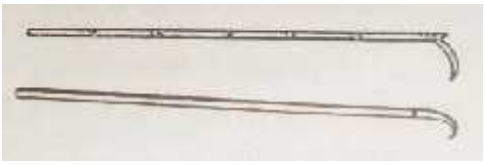


Figure:6.3 Akarin : A beautiful Bamboo Stick

Kul Diuta: Traditional deity of the Tharus established in the north eastern deity room, the home deity or family deity. Mathematical ideas angles, line, point, vertical and horizontal line, set can be dealt. The direction, bearing, slope and volume and area can be discussed by the help of this *Kul Diuta.*

Fig.6.4

Kolh: A wooden oil crusher handled by the people, especially Tharus women. It was used after the mid Stone Age to the starting of Bronze Age and was in practice in Tharus community 5-7 years ago. The rotation, change of direction, load, pressure and force, point of rotation, motion, speed and acceleration and force of gravitation can be dealt with help of this *kolh.* Clockwise and anticlockwise rotation, slope of line, circle, radius, and angle can be mentioned.

Fig.6.5

Chaadol: It is bridegroom's riding means carried by men during marriage ceremony. The beautiful design is seen on the top of the *chaadal*. It has flower design. Triangular as well as parallel patterns are seen in the edge of its roof. The symmetrical patterns are made.

Fig.6.6

Chatwa: A wooden ladle, a server made of wood. The concept of convex and concave can be dealt.

Fig.6.7.

Delwa: A basket made of *Kushan* grass and all round hanged clysters shell and fringe. It is used in marriage ceremony to carry the dress of bridegroom. Rhombus design with sides' decoration by joining two truncated conical shape are seen in different geometrical patterns. Tessellation is used in its design.

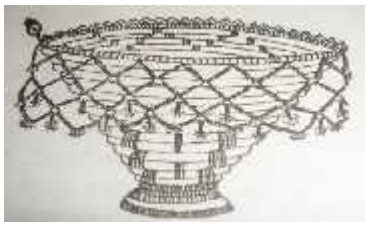
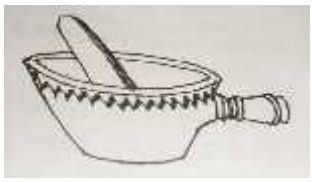


Fig.6.8

Dokana: A slab of wood grinding spices; grinder. It contains circular and triangular design, the truncated conical shape and other like different cylindrical shape are combined in it.

Fig.6.9 

Dhake: A wooden husking equipment or ponder which is in practice since the mid stone age and still in practice in Tharus tradition. The floral art and cuboids, parallel line, rotation, parallel line, point; angle can be mentioned with help of this simple machine.

Fig.6.10 

Nonblkne: A special designed salt and chilly carrier made of wood. It has zigzag line, which is known as auspicious and it has symmetrical pattern. The circle, radius, circumference, diameter, rotation, reflection, translation, curve, and point can be dealt with the help of these devices. Rectangular pattern with symmetrical shape makes it beautiful.

Fig.6.11

Pataha Deahare: The biggest earthen grain storage. *Pataha* is established between kitchen and home deity room in the northern portion. It is named *'Pataha"* because of the connection with the seat of deities so it has great importance according to folk belief paddy or rice stored in this *dehari* is forbidden to consume by own family except married or unmarried daughters. Their leather mark or the premier Tharu *Guruba* and bag e.g. *Parvati* is hung on the *dehari.* This earthen grain storage is a symbol of place of godness (Maya) *Parvati* where she lives with her son *saura* (Ganesh). Parallel line, rectangular arrangement, row, Column, addition, multiplication, and symmetrical pattern can be mentioned.

Fig.6.11

Bhauaka: A colorful three dimensional big basket is a coil woven by a kind of *Kusha* grass, which is hung in the antler of deer. The design of *Bhauaka* is beautiful with mathematical flower and geometrical pattern.

Fig.6.12

Marwa: A small wooden temple, which is built in the eastern yard in front of the main door or hut. The temple *Demandaura* Tharus established their deities. The temple of the village deities is

praganna of *Jaganattya* god. Mathematical ideas such as parallel line, horizontal, vertical line, angle, slope etc can be mentioned with help of this *Marwa.*

Fig.6.14

Laharu: A small bull cart used by local landlords. Circular, rectangles, parallel line, points, angles, rotation, transformation, reduction, reflection and other so many mathematical concepts can be dealt with help of this *laharu.*

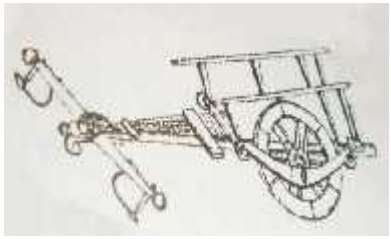


Fig.6.15

Har: A wooden plough is used to plough land. It is pulled by the pair of bulls. Angle parallel line, rectangle, pressure, distance, slope, and other mathematical ideas can be dealt.

Fig.6.16 a,

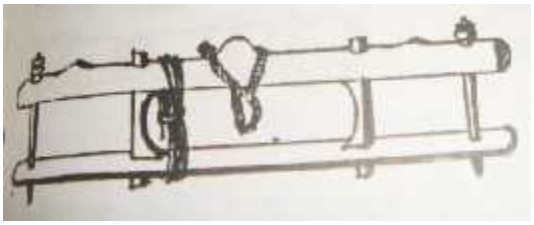


Fig.6.16 b,

Discussion and Implication of basketry, clay, dancing and house painting work

Globular Shapes: These articles have beautiful designs. *Pitera* contains triangular designs, which is auspicious for Tharu culture. In modern mathematics, the triangular design is known as rigid and tight construction. It is used in bridge construction as well as house and other purposes. Moreover, it has parallel lines and so many other designs. Tessellation of different shapes and sizes can be dealt easily. The rim is the example of circle, different size of radius and diameter can be discussed. *Dalia* goes up in spiral form. *Pitara* and *Conjalo* have vertical and horizontal lines crossing of bamboo splints in 90 degree made by twilled procedure.

Fig 6.17 Pitara

Fig 6.18 Dalia

Fig 6.19 Pitara

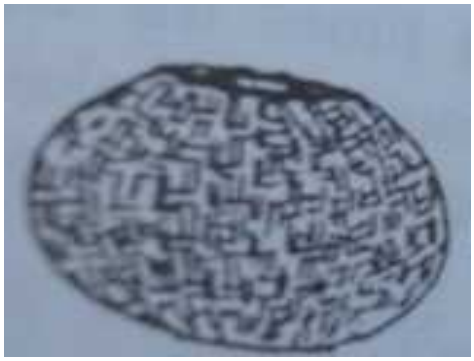


Fig 6.20 Kanjolo

Half globular shapes: *Dalai* has so many mathematical designs of hyperbolic curve and elliptical curve patterns. *Bhunka is* made by coiling technique on in spiral form. *Dabri* is made by twilled procedure. *Bhamra* is made by using modeling procedure. Moreover, surface is made smooth by using painting technique to make it for unbreakable. It is painted by smooth mitti. The elasticity concept is known by Tharu. The rim and bottom of the base of the basket are circular; the discourse of oblique section produces different types of elliptical curves.

Fig 6.21 Dalai

Fig 6.22 *Dabri*

Fig 6.21 *Dabri*

Fig 6.22 *Bhunka*

Fig.6.23 Bhamra

Cuboid Shape: The base is in square. The check patterns are in surface and coil technique is used in its rim. The vertical and horizontal line can be seen. It is three-dimensional which can be used to deal two or three dimensional co-ordinate system. The rim is transformed in circular shape instead of square.

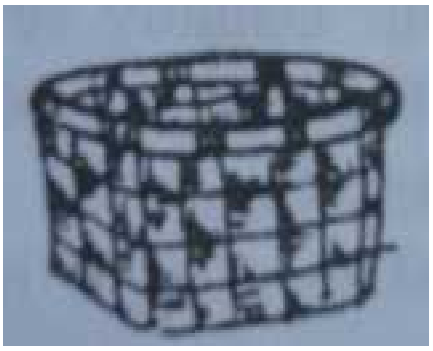


Fig.6.24 *Tupli*

Cylindrical shapes: *Daf* has star in the middle. *Mandra* has bountiful cloth design of rhombus shape. Ninety and different angles can be dealt with help of these articles. *Dhariya* is made by be-skip technique. *Chhapria* has check patterns. Circular line, rectangular shape, round cylindrical surface and pyramidal surface can be dealt with help of those articles.

Fig.6.25 Chhapria

Fig.6.26 *Dhariya*

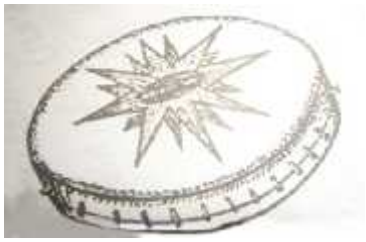


Fig.6.27 *Daf*

Fig.6.28 *Mandra*

Fig.6.29 *Cow dung arrangement*

Fig.6.30 *Filter*

Fig.6.31 *Innar (Well)*

Conical Shape: It has conical shape made by bamboo splint.

Fig.6.32 *Khonghya*

Truncated conical (Semi conical): *Pine, Panjhapna and Tukna* are in truncated conical shape made by spiral coiling technique.

Fig.6.33 *Pine*

Fig.6.34 *Panjhapna*

Fig.6.35 *Tukna*

Double Semi-Conical: *Dalwa* has beautiful mathematical design of triangular and rhombus shape. *Dhakya* has parabolic line design. These are made by coiling technique. The bottom of conical shape is short in comparison to upper part.

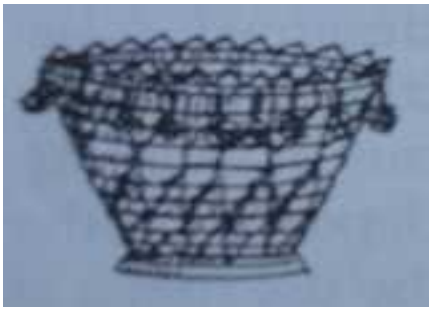


Fig.6.36 *Dalwa*

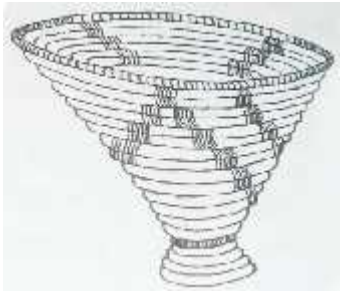


Fig.6.37 *Dhakya*

Fig.6.38 *Bhauka*

Cylindrical shape combined with conical: *Khandra and khandre* have rhombus design on it made by bamboo splints. In conical parts of them has rope design of different kinds. *Udia* has Vertical and horizontal lines and check design. Rim is made by coiling technique.

Fig.6.39 *Khandra*

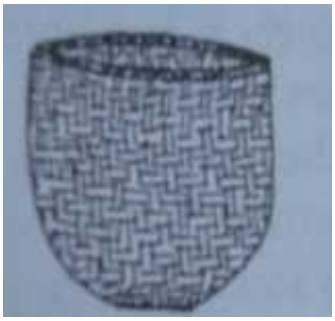


Fig.6.40 *Udia*

Fig.6.41 *Khandre*

Circular (Ring/ Dish) Shape: *Berra* has ring shape with triangular pattern and parallel lines. Flower pattern is coiled on it. *Pahiya* is in tube shape with radius stand. The center of circle, circumference, radius and sector of circle can be dealt with help of this article.

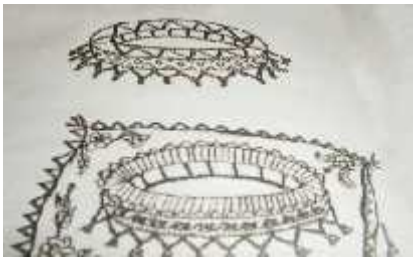


Fig.6.42 *Berra*

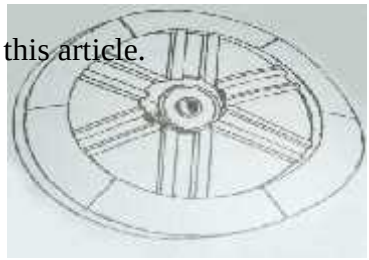


Fig.6.43 *Pahiya*

Truncated conical with parallelepiped: *Dabla* is made by wood that has engraved design near to it's' rim. They are floral designs.

Fig.6.44 Dabla

Square base and spherical pyramid like: It looks like spherical pyramid shape with beautiful floral design. The curve line, parallel line, circular line, rectangular shape and point can be dealt with help of this article.

Fig.6.45 Chandol 

Hexagonal shape: The *doko* (truncated conical shape) is in two types by making procedure. One type has vertical and horizontal weft made by wrapped procedure where one weft is above and another is below. Another has hexagonal work by dividing 360 degree with three-bamboo strips nearly each of 60-degree into six partition angle and bending in different directions trapped in each other like the one mentioned below in figure. One bamboo splint is in position of horizontal and other two are in slant position. These techniques make open hexagonal shape. Moreover, rim is made by coil technique. The object is made by crossing of two or more sets of elements, analogically called with Weaving, Warps and Wefts. The series of strings on vertical/ horizontal or rushes stretched in parallel known as wrap. In addition, another oven through is weft. When the wraps are interchangeable by inflexibility or direction, call both set of elements wefts, and make hexagonal work. They are open and closed hexagonal work.

Fig.6.46 Open

Fig.6.47 Closed

Circular, rectangular, and parallel lines, cycloid and symmetrical shapes are given below.

Fig.6.48 Lazy screw

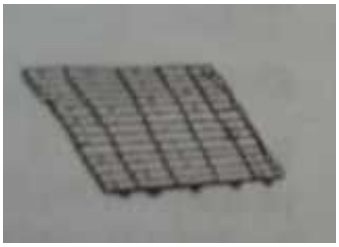


Fig.6.49 Bee-skip

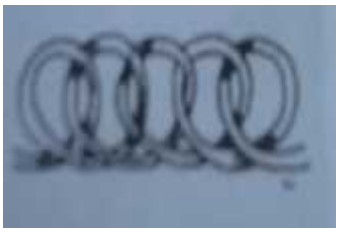


Fig.6.50 Cycloid

House wall decoration and paint: There are floral art in wall. Peacock is in front of each house. The most of the designs are seen symmetrical. Zigzag lines, parallels lines, rectangular and triangular shape are seen obviously. The zoomorphic and anthropomorphic figures are engraved on the wall for decoration well.

Fig.6.51, Houses' longitudinal faces are in north south. All of the houses are made in such a way.



Fig.6.52a, Man rid animals Fig.6.53 b, Fig.6.54c, Man

Fig.6.55, Snake picture on hut wall

The Astimaki painting: Here we can see sun and moon on the top of the corner and between them, there are five Pandaves. Armies are seen below it. They are seen in a row. The triangular designs are seen for auspicious. Moreover, other designs such as check pattern, boat and zoomorphic and anthropomorphic figures are depicted. Different kinds of circular symmetrical pattern can be observed.


Fig.6.56 a, Astimaki painting on walls Fig.6.57 b

Fig.6.58 a, Anthropomorphic and zoomorphic walls decoration & Floral arts

Fig.6.58 b,

Fig.6.58 c,

Fig.6.58 d,

Fig.6.58 e,

Fig.6.58 f,

Fig 6.58 g,

Fig.6.58 h Peacock

Fig.6.58 i,

Fig.6.58 j Sun

Tattoo (Made in the human body): It looks all in symmetric pattern. Tattooing: The tattoo designs are in different patterns of different shapes. The design are triangular, zigzag line, parallel lines, point, circular, semi circular, horse, deer, picklock, hen, bird, snake, square, rectangle, half circular, cross line, pentagonal and so on. The different kind of flowers and patterns are all in symmetrical in shape even *mandir* (temple) is made in symmetrical way.

Fig.6.59 a,

Fig.6.59 b,

Fig.6.59 c,

Fig.6.59 d,

Fig.6.60, Sun made in stone

Fig.6.61, Puja room

Fig.6.62, plough

Fig.6.63, Bhurayar god

Fig.6.63, Innar

Fig.6.64, roof tiles of house

Fig.6.65 Cow dung for fire

Fig.6.66 Carry load on head by Berra*

**Berra* - A ring used to hold pot or luggage on the head. The design of triangular, parallel line pattern, vertical line pattern and flower design are made to make it beautiful. The different colours is also used. For balancing the load Tharu use it to put on head.

Discussion and implication of Fishing Net: They are in various shapessuch as closed parabolic, and circular. The rope making process is mathematical. The changing of direction in one bundles of thread and producing pressure among them, for manufacturig the rope. Net making is also planted work like basket weaving. The trap pockets are made in the net and iron ball are hung on the ends which are helpful to capture the fish.

Fig.6.67 Heluka

Fig.6.68 Making Heluka

Fig.6.69 Rope

Fig.6.70 Fishing net

Artistic Woodwork (boy proportion looks different): The mathematical ideas about ratio and proportion have less performance in woodwork art. But their cultural and anthropological fashion is seen clearly. The volume, area, reduction, enlargement, position, rotation and sheared, plane, round surface and cylindrical can be manifested with the help of these objects.

Fig.6.71 a,

Fig.6.71 b,

Fig.6.71 c,

Fig.6.71 d,

Fig.6.71 e,

Fig.6.71 f,

Fig.6.71 g,

Fig.6.71 h,

Fig.6.71 i,

Fig.6.71 j,

Findings

The findings of the study are based on observation of real data and field study. These finding are taken out from Tharus' information and the literature of their practices and ethnomathematical perspectives.

Pedagogical

1 Braiding and interlacing are two of the oldest skills known to be operated by Tharus to use the simple plant fibers designing regular/irregular mathematical patterns to contribute

too many household containers. The most important braided or the interwoven objects are of many kinds Tharu make baskets container to keep their belonging. The combination of different stretch, check pattern and coil are used to produce network and pattern. The process of tessellation is dealt with the objects.

2 Tharu culture holds innumerable mathematical ideas in their daily life used in baskest, clay, house painting and dance. But children receive limited responses to questions asked about mathematics they are therefore less informed and less curious about the wider world of mathematics. They only see and do non-cognitive way of practice.

3 The concept of check pattern, twilled, painted, stretching, and coiled technique are found.

Spiral stretching technique is adapted to make different objects.

Arithmetical

1 Basketwork is never done during the summer since the material to be used becomes very dry and hard and brittle; breaking as the highest attempt to manipulate it. The month of *Sawan and Bhadra* are considered the most appropriate time for basket making because of the moisture in the air and material used for making baskets. *Muj* and *rangwa laar* get soft and unbreakable (pliable) facilitating manipulation. So the moisture in objects and air is considered correctly.

2 The ratio of clay (*mitti)*, cowdog and paddy husk in 2: 1: 1 is in practice in making clay pot as well as plastering the walls. The concept of elasticity and compact compound of object is used. The weight reducing process and non-tearing technique is found and practised.

3 Most of Tharus are tenant farmers and they cultivate land belonging to land owner (mostly Pahadi). The usual agreements are *adhiya* and some cases *Trikur* with the landlord taking half or one-third of the crops, respectively. The *panchkure* is also practised.

Geometrical

1 The concept of rectangular and square shape is in common practice among the Tharus. The parallel line and triangular (Trikuli*)* are also dealt. They assume *Trikuli* is auspicious. The zigzag (Khadruku) lines are also auspicious.

2 Tharus have concept of constructing circular, globular, cuboids, truncated frustum, cylindrical and parallelepiped and spherical objects to facilitate the daily life.

3 The concepts of different measurement of angles are found in different directions. The arrangements of angles are seen when making different objects, i.e., *doko* (a kind of basket) 360 angles is divided equally into six parts. The crosses of the bamboo splint in different direction create hexagonal shape in which the making object is rigid and increases its strength. The 90 degree vertical and horizontal connections as well as 45 degree and diagonal bend are used.

4 The Puja (worship) room is in the Northeast corner of the house that is most complex ritual room all of the Tharu houses. It is the auspicious direction where goodness maya (Parviti: spouse of lord Shiva) and lord Shiva lived.

5 The tradition of the *Astimaki* a beautiful design is still in use in traditional way. In village women are particularly skilled artists. Skills women are called to paint *astimaki* in other houses as well as their own house walls. The design includes many mathematical ideas such as points, lines, circular and cylindrical patterns.

6 The Tharu artistic inclinations and love for beauty is reflected in several ways, one of them is the design and decoration of the wall of their houses. The Tharu house is decorated in several ways. These designs might be the various types to suit one's taste. The commonly found designs are crises-cross, i. e., combination of horizontal and vertical and diagonal lines. The other designs are square, rectangular and checks. The common noted designs are geometric i. e. *Kundrukhu* is known as zigzag lines, *trikuli* is triangle and *leharia* two or more parallel lines.

7 Other commonly noted designs are *Phula and Phulwa.* They are flowers or florals designs of various kinds that include animals, birds, elephant, horse, deer, peacock, duck and hen. The human and temple figures are also found.

8 The classifications of *mitti* are seen in Tharu culture. *Paror mitti, chitkar mitti* and *seethe mitti* are found. *Mitti* which is clay mixed with paddy husk and cow dung in the proportion of 2: 1: 1 (in mass) are used to make different goods. When they prepare clay has been moulded, and drie in air. Steady heat is better for dryig. It is necessary to avoid creaking. Drying should proceed at a steady temperature uniformly through out the pot. When the clay has reached a lather-hard stage, polishing is undertaken to reduce porosity.

9 The plastering framework or goods with a mixture of clay, paddy husk and cow dung reduce the weight of the article. There are large numbers of *Deharies* of different shapes and sizes, i. e., rectangular, cubical and truncated triangles for storing their products.

10 Different techniques are used to form the different kind of baskets such as coiling and plaiting. The foundation is with spiral coil where the sewing strips are used. Baskets have different shapes and sizes some of them are globular, tetrahedron, cylindrical, truncated globular, truncated conical, cylindrical, flat globular, heighted globular and curved cylindrical, semi globular, semi spherical, flat spherical and height spherical.

11 When spread out complexity the *Nahage* is trapezium or quadrangle in a shape. The unique feature of this garment is that it is not stitched on the side to make it cylindrical like usual skirts. Thus, it can be considered as the wrap around. For the sake of description, the *Nahage* may be divided horizontally into four parts which are made of different colored cloth pieces stitched together and may even be of different materials. *Toi, ghangaria, mangji and ghuta* are its horizontal divisions. The three vertical divisions are made. It is like 4 X 3 grids.

12 In *Sadi Hori* dance girl's stands height wise and form two rows of at least eight each forming semi-circular facing each other. While dancing member of arc semi-circular one sing the line of the song and the others repeat it. The transformational ideas are practised on action.

13 The different motives are attributed to the practice of tattooing, such as enhancement of beauty and sexual attraction, health, sign of identification, the ward of evil spirits.

Tattooing is known to the Tharus as leela. It is widely practised both men and women while tattooing, the *Gudhni* repeatedly sings a couplet.

Mare ke sangi, jiya ki rangi

leela ke daag, janam sang jaae.

'The colour of life go away with death, however, a tattoo mark will remain with soul even after death. Different mathematical symmetrical pattern are preferred when tattooing the body.

Relations to School Mathematics Curriculum

The school mathematics curriculum deals with numbers and their applications. Tharu community uses same number system as Hindu people have used it. Some of numbers' pronunciations are different, i.e., *Unansatari* they called *unanhater*. For the time measure they do seasonal work. The time period or interval of same month to make *Dahari* is auspicious. Making basket is a seasonal activity not performed in the whole year. *Chaumasa* or the month of *Sawan Bhadou* are considered the most appropriate time for making basket because of the moisture in air and the soft materials and playble facilitating manipulation. Many of the rituals are meant to propitiate the supernatural powers before each agricultural pursuit so that they will be healthy throughout the year. In *Phalgun, Chait and Baisakh* they repair and construct house and do clay works and fishing. The rituals are done in leisure time. For distance measurement they use non-stendared unite, i. e., Angul (breath of finger) *Bitta* (distance between thumb and little finger), *Mudihat, Kose* and so on. For measurement of land they use *Hal*, *Thresaring field*, *Mauja*, *Praganna* and

Rajya. For the measurement of volume they use *Muthi, Mana, Pathi, Muri*, *Dehari,and Bhakari*. To get the weight of materials, they use *Chhati, Pau, and Dharni*. They use weight reduction technique for making clay work by mixing cow dong and paddy husk for non-tearing also. The steady heat is used for not creaking. For the exchange of work they do *Begaari*. It is currency for their usual work. *Adhiya, Trikur, and Panchkur* is practiced as their life activites. The concept of fraction is also practised in their life. The ratio and proportions are used when plastering the house by mixing mud, paddy husk and cow dung. The idea of set, so many geometrical concepts and designs, patterns, symmetrical ideas, tessellations and transformations are ethnomathematical ideas of Tharu community. Mostly geometrical flower, anthropomorphic, zoomorphic, parallel, triangular, zigzag patterns are seen in their designs.

Suggestion for Further Study

One the basis of the finding of this research the following suggestions have been made for further research.

- For the wider application of the research findings the similar study with more Tharu villages from different ecological zones can be conducted.
- Similar study should be conducted on different fields such as house making, village planning, and making cannel, and household goods arrangement.
- It is interesting to replicate this type of study in different socio-cultural contexts of Tharus villages.
- It is interesting to replicate this study in only one field of basketry work, dancing system, clay works, and house panting for in-depth mathematical formulization.

Researchers' Reflection

Nowadays, the concept of local knowledge implementation in schools is governments' major priority. This research study focuses on local mathematical knowledge of Tharu community and their day-to-day practices of mathematical activities that are dealt with functional basis. Ethnomathematical knowledge and their uses depend on contemporary technology, pedagogy and cultural heritage. Children acquire knowledge and develope skills and understand ethnomathematics from their cultural practice and experience. It is meaningful when it is rooted in real life contexts. In addition to, these children are given the opportunity to become actively involved in learning. Therefore there should be opportunity to share the ethnomathematics in school as well as in campus. Mathematical concepts cannot be preserved in isolation of community. If they are isolated philosophical, ideological, and discursive view will be disappeared. The priority of education should meet the needs of nation. There is gap between them. This research meets the relation between ethnomathematical concept and modern mathematical ideas.

Tharus have maintained and tried to balance among nature, its resources, and their own needs. Material for building houses, making tools for daily works, i.e., utility items like baskets, rope, herbs' for medicine, pastoral, plaguing, harvesting and planting are acquired from nearby forest area. Only dead trees are used and dried bushes and branches are collected for fuel. So much damage is not done from their side. It is concerned with the theory of ecology, economy, and utility.

Housing and shelter are one of the prime needs of men. Tharus' settle down in closer which ensure their social cohesion and progress toward beneficial economy. It helps to assist to use

continuous evolving technology. Tharus villages represent a closely-knit society; the unit has developed a bound of fellowship and co-operative life through mutual undersigning responsibility and co-operation.

Mathematics is learned from knowing, willing, and doing. When it concerned with activity, process of learning embedded on it. Constructivism deals 'making connection' but ethnomathematics emphasizes 'being connected' with activities. Personal attachment on actions, keep within self-realization and development of technique enhances creative learning. The manifestations of local technology enhance personal productive thinking. Technology not only indicates electronics mass media but also all equipments or goods that are concerned on mathematical knowledge. When mathematics concept is utilized in daily life, its approach is obviously communicative. The way of being, the way of seeing and the way of talking develop creativity and alternative thinking. In lively classroom situation and in concretize dealing, students like to discuss on their own words this promotes opportunity to concretize their thoughts and actions and gain insight to learning topics. Student can be involved in conversations where they offer their understandings of ideas, and discuss each others' views and identify the alternative mathematical opinions and contextualize it with their actions.

Tharu people like to live in the nuclear family is social organization. However, essential economic means of Tharus life are fishing, collecting wood, forest fruits and roots, and doing agriculture activities in groups. They like to have common settlement and perform certain functions together. An important responsibility of every village community among the Tharu is to maintain law and order. Tharus have sustained much of their self-sufficiency as far as their economic needs are concerned.

Tharus' ethnomathematical ideas are important for school mathematics teaching and learning that are listed in findings and implications. The context, process of learning and their experiences are applicable to local technology which can be beneficial to them. Creative mathematics learning depends on the local concepts. Lines, points, rays, closed figures, open figures, hexagonal shapes, triangular, parallelograms, quadrilaterals, cones, truncated cones, elliptical curves, hyperbolic curves and shapes, line segments, circles, spherical curves and shapes, globular shapes, half globular, trapeziums, parallel lines, and symmetrical lines are the foundations of modern mathematics that are rooted in Tharus' community. In addition, to this so many other hidden mathematical ideas are embedded on Tharus' community. They need to be manifested to developed alternative approach to teaching and investigation.

We have a pride to have traditional forms of mathematics. It would lead to their continuation of traditional mathematics with further progress and developments. The current commercial recognition of tribal mathematics like arts and crafts should not be oppressed, because it is a guiding force to encourage the indigenous mathematic. If the Tharus find their traditional mathematical arts economically viable and beneficial then they would be more ready to practice them. The traditional forms of house decoration through painting and design works should be encouraged. The excellent potential of Tharu in modeling and moulding, and coiling procedure clay into various shapes and design should be encouraged. They can easily be oriented in the art of making attractive, decorative and other utilitarian objects that are in enormous demand all over the world. The Tharus give the impression mainly in basket weaving. This craft explores large mathematical ideas, design, and arts which have a large scope for baskets with commercial use. It also helps to link universal mathematics as well as to explore local pedagogical mathematical ideas. The demand of baskets with colorful designs and patterns also exist in

Nepal even today, particularly used during religious and cultural ceremonial. The ritual basket has mathematical innovation. This craft can further be developed to create articles of both utility and decoration such as flower vases, fruit holders, and wall decorations. The conventional Thars' mathematical arts should be encouraged by organizing special performances. This would not only popularize the Tharus' indigenous mathematics among non-tribal, but also help the younger generations and others to get innovations that how new modern mathematics is generate from. Tharus community need remain in touch with this rich custom of theirs mathematical ideas that would be an alternative to practise for future generation to develop their identity.

Fig.6.72, Sakauras' balcony

Fig.6.73 a, Tharu villages

Fig.6.73 b,

GLOSSARY

Aghran : Female dress

Atwa : A kind of wooden balcony used for storing maize

Baery : Dinner

Bas : Bamboo

Bataiya : An act of the sharing agriculture product between landlord and land tiller, fixed share of the production

Begaari : Involuntary work without payment for landlord due to the unconsciousness, exploitation of poorer labour

Berra : A special kind of ring made of grass and woven with colorful threads which is used to put earthen water pot or bamboo basket on the head

Beth : Act of the demanding of unpaid labor on usual basis

Beth beggari : Free labor given to the landowner by their tenants

Bhadau : According to Bikram era, the fifth month and according to A.D era,

Bhutuwa : Evil watches

Birta : The freehold land, which was granted by the Baise /Chaubise king on the great contribution to the king, kingdom of nation

Bulliyat : Female dress

Dahar chande : A goddess who was incarnated in Dang valley to serve people and domestic animals from misfortunate

Dapha (Daf) : A kind of small drum, which is played on the occasion of Holy festival

Daru : Spirituous liquor, wine

Darwa : A big spoon to serve pulse and vegetable

Dehre : Earthen grain storage

Desbandhya : The wise chief of religious controller for religious deeds

Dhai : Midwife

Dhakle : A small basket woven by the *Kush* grass

Dhakya : An open plane or colorful basket made up of special grass

Dheke : A wooden husking equipment or pounder, which is in practice since the mid stone age and still in Tharu tradition

Dhikre : A kind of vaporized bread made of the rice flour

Dhoti : male dress

Diurhar : The sacred deity room, which is the east north side of the house

Dole : A kind of the palanquins of the bridge in the marriage procession

Gauri : One of the names of the goddess Parbati

Ghanghria : Female dress

Ghardhurnia : A women head of the house

Ghardhurya : A chief of the house or family

Gharguruwa : Heredity priest

Guitha : Cow dung used for fuel

Gurbaba : A protector of Tharus religion

Guruba : Tharu sorcerer or wizard priest who perform all the rituals

Kalewa : A breakfast food

Kamaiya : Labor used to work as being agricultural labor for one year

Kamlarhiya : A female servant

Kathghorek Nach : A kind of Tharu dance riding artificial horse

Khandhra : A big cage

Khandhre : A cage made of bamboo

Kul diuta : A presiding and traditional deity of the Tharu established in the north western deity room, the houses deity home deity or family deity

Kush : A sacred grass according to Tharu myth

Lungi : Female dress

Maghe Dewana : An act of the determination of the annual plan around 18th of January

Majhpatia : Middleman

Mana : Ten muthi

Manghar : A marriage song

Mangni : Engagement

Matawa : According to ancient tradition of human race, a chief of the Tharu villages that is selected by his own community to handle social work

Mauja : Administrative union of a village

Migo : Lunch

Mundan : Head shaving

Muthi : Measurement of one handful rice

Nogata : male dress

Pathe : The measuring pot in which contain eight-mana or 1/20th share of muri

Pharya : A special kind of white dress which is own below the wrist and the feet during the Sakhaya in Dashain festival the period of 15th August to 15th September.

Phatuhi : male dress

Praganna : Division of tharus region to set social and religious administration

Raksa : A kind of ghost who wanders here and there

Rakshana : Demon

Rath : A carriage, which was pulled by horse

Roti- pani, Barshi : Ceremony where the philosophical discussion about life and death

Sajana : A Tharu folk song which narrate about biography, eternal feeling happiness and sorrow

Sakhe : Female friend

Sakhia : A Tharu folk song based on the biography of the Krishna

Saluka : male dress

Satti : Purification day

Supa : Winnowing tray made of bamboo

REFERENCES

Ascher, M. (1998).*Ethno mathematics: A multicultural view of Mathematics Ideas.* Chapman & Hall: New York.

Ascher, M. (2000). *Mathematics elsewhere: An explanation of ideas across cultures.* Princeton, a NJ: Princeton University Press.

Barton, B. (1996). *Ethno mathematics: Exploring Cultural Diversity in Mathematics*. The University of Auckland, New Zealand

Bishop, A. (1994). *Mathematical Enculturation: A Cultural Perspective on Mathematics Education.* Norwell, kluwer Academic Publisher.

Bista, D. B. (1967). *People of Nepal.* Ratna Pustak Bhander, Kathmandu, Nepal

Bloor, D. (1978). *Knowledge and social Imagery*. Londan.

Bourdieu, p. (1977). Cultural reproduction and social reproduction. In J. Karabel & A. H. Hasely (eds), *Power and ideology in education* (pp. 487 – 511). New York: Oxford University Press.

Bourdieu. P. (1986). Forms of Capitals. In J.G. Richderson (Ed), *Handbook of theory and research for sociology of education* (pp. 241 – 258). New York: Greenwood.

Bourdieu. P. & Coleman, J.S. (1991). *Theory for changing society*. Blulder, CO: Westview.

Charmaz, K. (19002). *Constructivist and Objectivist Grounded Theory*. Thousand Oaks, Sage Publication.

Chaudhari, M. (2007). *Nepalko Terai Tatha Yasaka Vhumiputraharu.* Kathmandu, Heidel Press Dillibajar, Kathmandu.

Chaudhary, Shankar Lal. (1999). *Socio-Economic Status of Dangaura Tharus.* Publisher Shila Chaudhary.

Chaudhary, S. (2003) *Tharus the Pioneer of Civilization of Nepal,* Publisher Shila Chaudhary.

Crooke, W. (1896). *The Tribes and Castes of the North-Wistern Provinces and Oudh*. Office of Superintendent of Government Printing of India, Calcutta.

Dahal, R. C. (2007). *Indiginious Mathematical Concepts of Gopali Community from their Cultural Perspective.* M. Phil. Thesis submitted to the Tribhun University, Kathmandu.

Dahit, G. (2005). *Tharu Sanskritiko Sankshipta Parichaya.*

D'Ambrosio, U. (1979). *Multiculturalism and Mathematics Education,* International. Journal on Mathematics Science, Technology Education.

D'Ambrosio, U. (1985). *Ethnomathematics and its Place in the and Padagogy of mathematics*.

D'Ambrosio, U. (1987). *Impact of science on Society*. Science and Technology in Latin America.

D'Ambrosio, U. (1988). *A Research Program in the History of Ideas and Cognition*. ISGEm Newsletter Vol. 4 No. 1

D'Ambrosio, U. (2000).*Etnomathematics E Modelagem* [Ethonomathematics and modeling] Domite,M.C. (ED.). Anais do Primerio Congresso Brasileiro de Etnomatematic CBEm-1. Sao Paulo.

D'Ambrosio,U.(2001). Ethnomatematic. Elo Entre as Modernidade [Etnomathematics: A link between traditions and modernity]. Sao Paulo,S.P Editora Autentica.

D' Ambrosio U. (2002). *Prefacio* [Forward]. In Bassanezi, R.C. Ensinoaprendizagem com Modelagem Mathematic [Teaching and learning with mathematical modeling] Sao Paulo: Editora Contexto.

Danish, J. (1994). *Tharu Potters of Nepal.* Ceramic Monthly, 9.

Denzing N.K. & Lincoln Y.S. (2005). (Eds), *the sage Handbook of Qualitative Research*, (3rd Ed.). Delhi: sage publication

Dowling, P. (1993 Pp. 35-52). *Mathematics Theoretical"Totems":* a sociological language for educational practice. Johannesberg: Maskew.

Eglash, R. (2003). *Culturally–Situated Design Tools*. Retrieved on 01/04/ 2009 from http://www.rpi.edu/-eglash/csdt.html.

English, L. D. and Halford, G. S. (1995). *Mathematics education models and process*. Lewrence Erlbaum Association, New Jersy, UK.

Gautam, T. (2044). *Tharu Jatiko Etihash tatha Sanscriti*. Banaras: Prakash Printing Press.

Gerdes, P. (1982). *Mathematics for the Benefit of the People*. Paramarido: Carimath.

Griersion, G.A.(1903). *Linguistic Survey of India.* Vol.IV Part 1, Government of India Press.

Gutstein, E. (2003).*Teaching and Learning mathematics in Social Justicein an urban Latino School* Journal for research in mathematics education 34(1).

Fairclough. N. (1995). *Critical Discourse Analysis: The Critical Study of language.* Longman. London.

Fistcher, J. L. (1961). *Art Style as a Cultural Cognitive Map.* American Anthropologist: Vol. 63

Fischer, J.L. (1982). *The meaning of Art, Review in Anthropology:* Vol. 9 No. 2

Flick, U. Kardorff, E.V. and Steinke, I. (2004). *A Companion to Qualitative Research* (eds), Delhi, sage Publication.

Florida, R. (2002). *The Rise of the Creative Class: And how its Transforming work, leisure, community and everyday life*. New York, Basic Book.

Florida, R. (2005*). The flight of the Creative Class: the New Global competition for Talent*. New York, Harper Collins Publishers.

Funeratne, A. (1994). *The Tharus of Chitwan: Ethnicity, Class and the State in Nepal*, an unpublished Ph. D. thesis, Chicago University, Chicago.

Hamilton, F.B. (1971). *An Account of the Kingdom of Nepal.* Delhi, Manjurisri Publishing House.

Hamilton, A.B. (1997). *Ethnomathematics: Why and What Else*. New Zealand, University of Waikato.

Hammod, T. (2000). *Ethnomathematics: concept defination and research Perspective*. A thesis submitted to Columbia University. New York

Hansan, A. (1993), *Affairs of an Indian Tribe. The Story of my Tharus Relatives.* Lucknow, New Royal Book.

Hersh, Reuben. (1997). *What is Mathematics, Really*. New York: Oxford University Press

http: //www.cultural and the postmodern thinking

http: //web.nmsu.edu/-pscott/isgem.html(15-08-2007,5pm)

http: //www.cinvestav.mx/clame/(07-07-2007,7:45pm)

http://www.cohums.ohio-state.edu/comp/isgem.htm (17-04-2008; 9am)

Keline, M (1952). *Mathematics in western culture*. New York: Oxford University Press.

Keyser, C.J. (1947). *Mathematics as cultural clue.* New York; Oxford University Press.

Kieren, T. (1995). *Teaching in the Middle: Enactivist view Teaching and Learning Mathematics*. Queens University, Canada.

Krauskopff, G. (1987). *Naissance d'un village Tharu:A propos des rites de claustration villageoise.* L'Ethnographie, LXXXIII

Krauskopff, G. (1987). *De la maison sur pilotis a la grande maison.* In Architecture, Milieuet Societe en Himalays, Blamont, D. et. G. Toffin (eds.)'Etudes Himalayennes',

No. 1:15-39.

Krauskopff, G. (1989). *Maitres it Possedes, Les rites et l'ordre social chez les Tharu (Nepal).*Paris: CNRS, collection 'Cahiers Nepalais'.

Krauskopff, G. (1989). *Prtres du terroir et ma"tres de la f™ret. La centralization politique et le syst me pr trise Tharu a Dand et Deokheri.* Purusarth 12:79-100.

Krauskopff, G. (1990). *Les Tharus et le royaume hindou de Dang (Nepal).*l'Homme 116, Oct.- Dec, XXX (4):30-54.

Krishan, N. (1992). *Art and Crafts of Tamil Nadu.* Middletown: Granth Corp.

Lancy, D. (1976). *The Indigenous Mathematics Project*. Papua New Guuinea Jurnal of Educatio, 14,1-217

Maddy, P. (1990). *Realism in Mathematics* Oxford: Claredon press

Maheswari, J. K. (1981). *The Ethnobotany of the Tharus of Kheri District Utter Pradesh.* Lucknow: Economic Botany Information Service, NBRI.

Maiti, S. (1999). *Changing Status of Tharu Women.* The Estern Anthropologist: Vol. 52, No. 1.

Maiti. S. (2001).*Trible Art and Craft: A study among the Tharu of Utter Pradesh*, India Anthropological: Vol. 31. No two.

Maiti, S. (2004). *Singing their hearts out: Folksongs among the Tharu*. Bulletin of S.C. and S.T. Research and Training Institute : Vol. 4.

Majundar, D.N. (1937). *Some Aspecht of the Economic Life of the Bhoksas and Tharus of Nainital Tarai.* Jubilee Volume of the Anthropology Society of Bengal: Vol.VII, No .1.

Majundar, D.N. (1942). *The Tharus and their Blood Group Journal of Royal Asiatic Society of Bengal.* Vol. VIII, No. 1, p. 33.

Manjudar, R.C. ; Raya, H.C. and Chaudhary; Datta, K. (1996). *An Advanced History of India,*

4th edition, Madras MacMillan, India.

McDonaugh, C. (1984). *The Tharu of Dang: a study of Social Organization, Myth and Ritual in West Nepal.* PHD Dissertation, Oxford: University of Oxford.

McDonaugh, C. (1984). *The Tharu of Dang: a study of Social Organization, Myth and Ritual in West Nepal.* Ph. D. thesis presented at C.E.J.S., St. Edmund Hall, Oxford University.

McDonaugh, C. (1989). *The Mythology of the Tharu: Aspects of Cultural Identity in Dang, West Nepal.* Kailash, Vol. 15, No. 3-4 : 191-206.

McDonough, C. (1984). *The Tharu of Dang : A study of social organization , Myth and Ritual in West Nepal*, Ph. D. Desertation, Oxford: University of Oxford.

McDonough, C. (1989). *The methodology of the Tharu: Aspect of Cultural identity in Dang, West Nepal*, Kailash Vol. 15 .No. 3-4, 191-206.

Misra, C. (1984). *Political Economy of Population Redistribution: A case study of Dang Village* Vol 11 No 3, Dang.

Nesfield, J.C. (1885). *Description of the Manners, Industries, Religion of the Thuru and Bhokas Tribe of Upper India*. Calcutta Review: vol XXX, No 1.

Nevil, H. R. (1901). *Bararich, a Gazatteers* of United provinces and Oudh, vol.XLV. Government Press, Allahabad.

Paudyal, A. R. (1986). *Nation building of in Nepal:* Case study of the post revolution period 1950-80. Kathmandu, an Unpublished Ph. D. Dissertation, Tribhuvan University.

Posner, J. (1982). *The Development of Mathematical Knowledge in West African Societies.* Africa.

Powll, (1997). Arthur B. & Frankenstein, Marilyn (Eds), *Ethnomathematical Knowledge*. in Ethnomathematics: Challanging Eurocenrism in mathematics education. Albeny:

state university, New York.

Powell, A. (2002). *Ethnomathematics and the challenge of racism in mathematics Education* Proceeding of the Third International Mathematics Education and Society conference, 2-7 Aprill (2002). Helsingor, Denmark.

Rajaure, D. P. (1981a). *Tharu of Dang: The people and social context.* Kailash, No. 3-4. 155-185.

Rajaure, D.P. (1981b). *The Tharu of Dang: the people and the social Context*. Kailash, Vol 8: 155- 187.

Regmi, M.C. (1978*). Land Tenure and Taxation in Nepal*. Kathmandu: Ratna Pustak Bhander.

Rosa,M. (2000). *Mathematics Sequence and Progression*. San Paulo: Editora Erica.

Saksen, H.S. (1991). *Traditional Arts And Crafts among the Tharus of U. P.* A report prepared for the Crafts Museum, Government of India.

Scott, L. (1954). 'Pottery', in *A History of Technology* (ed.) C. Singer et. al. London: Oxford University Press. Vol. 1.

Singh, R.P. (1988 and 1991). *The real story of the Tharu*. Tharu Sanscriti , Lalitpur; Indu Press.

Singh,R. P. (1998). *The Real Stories of the Tharus.* Presented at the Press Conference in Patana,India.

Singh, S. K. (2006). *The Great Sons of the Tharus: Sakyamuni Buddha an Asoka The Great,* New Nepal ress, Kathmandu.

Skovmose, O. & Vithal (1997). *The end of Innocence: a Critique of Ethnomthematics*. Copenhagen, Department of Mathematics.

Srivastava, S.K. (1948). *Spring Festivals Among the Tharus.* The Estern anthropologist: Vol. 2, No. 1.

Srivastava, S.K. (1949). *Some Problems of Culture Contact among Tharus.* The Estern Anthropologist : Vol. 3, No. 1.

Srivastava, S.K. (1949). *Diwali Festival Among the Tharus.* Agra : Agra University Press.

Srivastava, S.K. (1958). *The Tharu: A Study in Cultural Dynamics, Agra*: Agra University Press.

Tharu, A. and Dahit G. (2000), *Gurbaba: Tharu-Nepali- English Dictionary.* Backward society education, Tulshipur, Dang.

Tharu, A. (2007). *Tharu Loksahityama Etihasa, Kala Ra Dersan*. Nabajoti Ofeset Press Tulsipur Dang.

The American Heritage College Dictionary, (1993). Oxford University Press. London.

Tymoczko, T. (1986). *New Direction in the Philosophy of Mathematics: An Anthopology*. Boston.

Verma, K.M. (1970). *The Indian Technique of Clay Modelling.* Calcutta : Calcutta Press. Watts, G. and Brown P. (1979). *Arts and Crafts of India :A Descriptive Study.* N, Delhi, Cosmo.

Yogi, N. N. (V. S. 2022). *Itihasa Prakashana Sandhi Patra Sagraha*. Dang.

Zaslavsky, C. (1973). *Africa Counts: Number and Pattern in Africa Culture*, Boston; Prindel,Weber, and scamidt.

APPENDIX A

Plaited Work

Fig.4.1 a Dabri

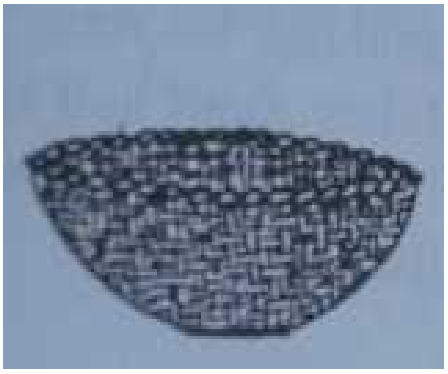


Fig.4.1 b

Fig.4.2 Chhapria

Fig.4.3 Pitra

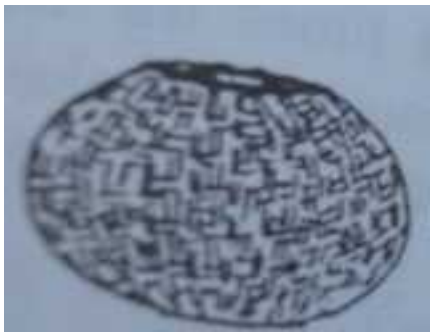


Fig.4.4 Kanjolo

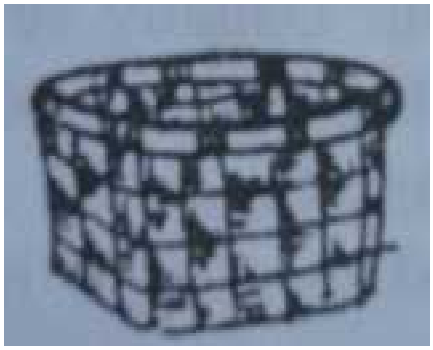


Fig.4.5 Lauka/Dalia

Fig.4.6 Tupli

Fig.4.7 Udia

Fig.4.8 Dalwa

Fig.4.9 Mithaura

Oversewn Coil

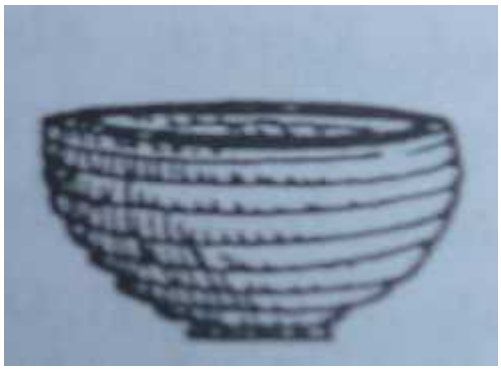


Fig.4.10 Pitara

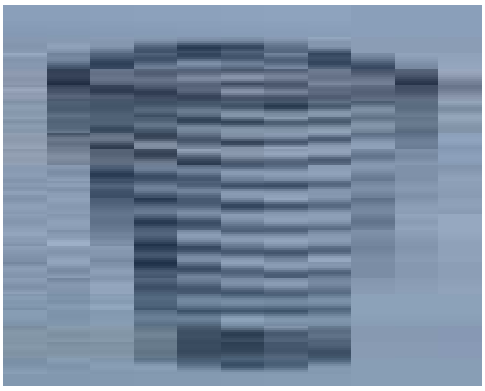


Fig.4.11 Bhunka

Fig.4.12 Tupna/ Tokri

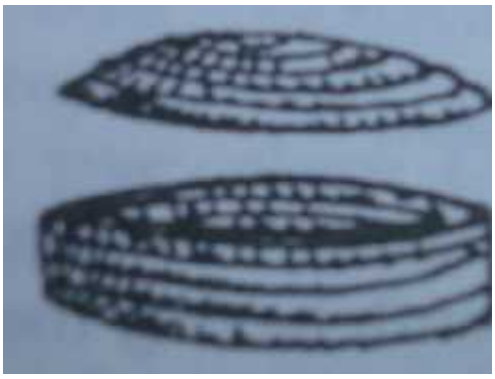


Fig.4.13 Dalia

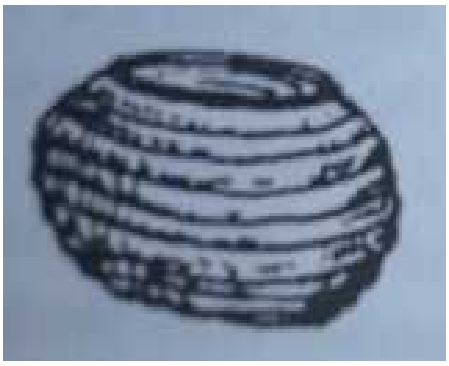


Fig.4.14 Pitara

Fig.4.16 Nuiya

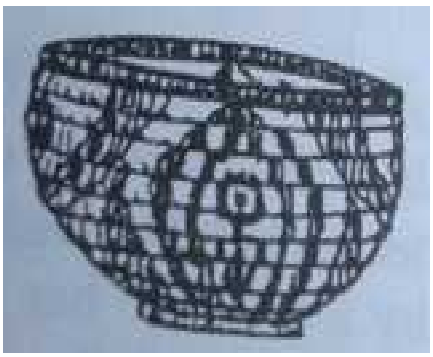


Fig.4.17 Dalwa

Fig.4.18 Dalai

Fig.4.19 Tukna

Fig.4.20 Tokri

Fig.4.21 Tukni

Fig.4.22 Pine

Bee skeip coil

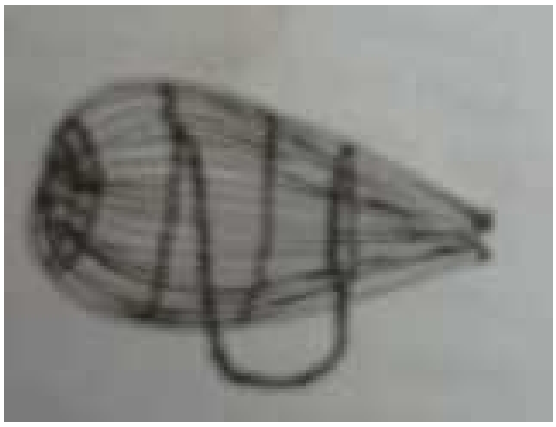


Fig.4.23 Gadri

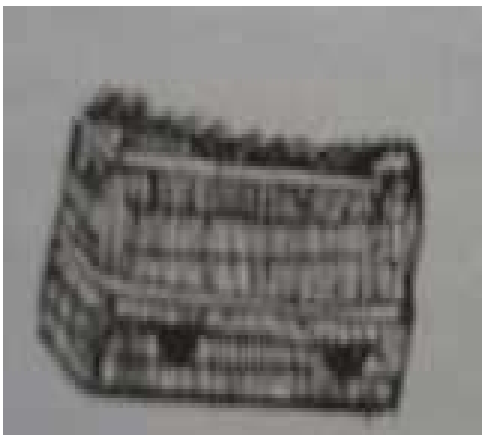


Fig.4.24 Dhimri

Fig.4.25 Gundra

Fig.4.26 Khandra

APPENDIX B

Basketry: Plaited work

Fig. 4.1, Check

Fig. 4.2, Twilled

Fig. 4.3 a, Hexagonal

Fig.4.3 b, Open Hexagonal

Fig.4.3 c,Closed hexagonal

Fig.4.3 d,Open hexagoanl

Fig.4.4, Twined

Fig.4.5, Wrapped

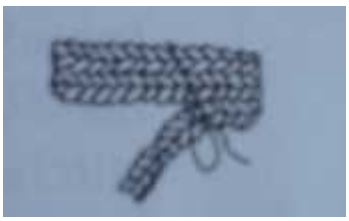


Fig.4.6, Plaited

Coiled work

Fig.4.7(a), Tukna

Fig.4.7 (b), Bhaunka

Fig.4.7 (c), Tupna/tokri

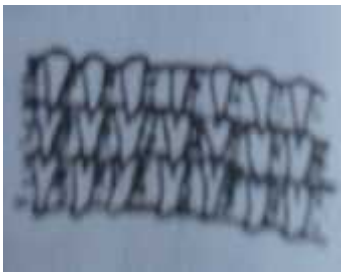


Fig.4.8, Furcate coil

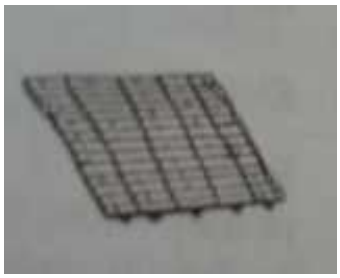


Fig.4.9, Bee-skep

Fig.4.10, Lazy- squaw

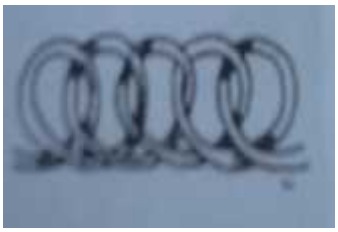


Fig.4.11, Cycloid

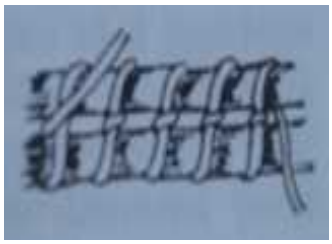


Fig.4.12, Knot stich

Clay Works: Handmade pottery is prepared in three ways over the Tharu village. They are coiling, moulding and modeling, and mix of them.

Coiling (Building Up)

Fig.4.13 a, Dehari

Fig.4.13 b, Broken Dehari

Moulding

Fig.4.14 a,

Bhamra Fig.4.14 b,

Modeling work

Fig.4.15, Pot

Fig.4.16, Filter

Fig.4.17, pot & Elephant

Fig.4.18, Ritual pot

Fig.4.19, Mug