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An Ethnographic Lenses on Mathematical Activities in Kewrat Culture

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Abstract

A study explores the mathematical knowledge embedded in the daily practices of the Kewrat community of Nepal. Employing an ethnography research design, with aims to identify the traditional counting, measurement, and geometrical concepts used by the Kewrat people and their potential pedagogical applications. The information from respondents selected with purpose sampling of 5 - elderly community members, 2 - native school teachers, 10 – students from Kewrat family and their parents with interview, observation and photographs, shows that that mathematical practices in the Kewrat culture is based on counting, measuring, arithmetic operations and geometrical principles. The study found that "ganda," "vira," "vanja," and "skori" are used in counting, fingers and hands are used for arithmetic operations, indigenous measurement tools are "dandi" for weight, "lota" and "kat-tha" for volume, and "bitta" and "haat" for measuring length and calculating area. Kewrat people also demonstrate a practical understanding of geometrical concepts, such as cones, cylinders, and prisms, applied in crafting tools for daily uses. These findings highlight the richness of cultural mathematics and its relevance to formal education. This study suggests incorporating these traditional practices into mathematics classrooms to enhance student engagement, promote hands-on learning, and connect cultural knowledge with academic concepts.

Keywords: Culture, Ethnomathematics, Kewrat

Introduction

Culture is a set of shared beliefs, values, customs, and practices that evolve organically within a group of people (Fowler & Fowler, 2014). According to Geertz (1973), culture is “symbolically constructed,” meaning that it is expressed and communicated through various forms, such as rituals, art, and social practices. Every culture uses mathematics as a tool of communication and for the performance of their activities. Bishop (1988) describes mathematics as a pan-human phenomenon, emphasizing that all human cultures possess their own mathematical systems and practices and concludes counting common to all cultures are counting, locating, measuring, designing, playing and exploring are cultural products common to all cultures.

Identifiable cultural groups are known as ‘ethno’ and 'Mathema' means to explain, understand and manage reality specifically by counting, measuring, classifying, ordering, inferring and modeling patterns arising in the environment and the 'tics’ mean art or technique (Fowler & Fowler, 2014). Thus, ethno-mathematics is the study of mathematical techniques used by identifiable cultural groups in understanding, explaining, and managing problems and activities arising in their own environment. Nepal is a multilingual and multicultural country, as stated in the Constitution, with various ethnic groups, each possessing unique cultural traditions and practices. Among them, the Kewrat is an ethnic group living in Morang District, consisting of 8,809 people (Central Bureau of Statistics, 2022). We can observe the unique mathematical system in counting, measuring and classifying being practiced in Kewrat culture. So, this study focuses on the mathematical ideas and practices inherent in the Kewrat culture, aiming to bridge the gap between cultural heritage and mathematical understanding with the primary objective to investigate the mathematical practices inherent in Kewrat culture and to examine the pedagogical implications of mathematical practices in the Kewrat community for school mathematics. This raises important questions: Can the mathematical activities found in different cultures be recognized through various philosophical perspectives? Can the mathematical ideas of the Kewrat community be included in the local formal education curriculum? The discussion that follows addresses these questions.

The Absolute philosophy of mathematics views mathematics as a certain, objective, unchangeable body of knowledge founded on the firm base of deductive logic (Ernest, 1991, 1998). This view does not value the mathematics of culture. Next, fallibilism considers mathematics as the result of social processes (Ernest, 1991). In the past few decades, a fresh wave or movement of fallibilist philosophy of mathematics has been gaining ground. These perspectives propose a different and opposing image of mathematics as human, corrigible, historical, and changing (Davis & Hersh, 1980; Ernest, 1994b; Lakatos, 1976; Tymoczko, 1986).

The fallibilist philosophy of mathematics accepts and includes the practices of mathematicians, the history and application of mathematics, its position in human culture and behavior and issues of education and values as authorized philosophical concerns.

The different cultural practices and beliefs of people in the environment like mathematical practices of Kewrat culture, school mathematics and different mathematical philosophy are examined on the following framework and demonstrate the value of integrating traditional knowledge into contemporary education. This approach not only fills a research gap in connecting ancient mathematical principles with modern pedagogical practices but also promotes a richer, more inclusive mathematics education that acknowledges the contributions of diverse cultures.

Khanal (2008) has studied on 'Ethnographic study on mathematical concepts and pressure by Porter'. It is concluded that going of knowledge is the process of observing, reflection of thinking, performing, practicing and creating. To fulfil each and every mathematical need potter applies mathematical concepts in their daily potter mathematics. The conventional mathematical concepts were embedded in the work of potter. This shows mathematics is used in profession, now question comes whether mathematics is used in other ethnic activities?

Rai (2011) studied on 'Mathematical concept and process of practice by Dumi Rai at Khotang district and found the Dumi rai have two types (one counting number in the Dumi language and next place value system) of numeration system: They use The Dumi Rai have their own traditional system of measurement: length is measured with fingers, and hand, area of land is measured according to seeding and poaching time, volume is measured by 'muthi', pathi' and 'muri'. This literature shows that mathematics by ethnic group in their traditional system of measurement. Now question comes whether research related to mathematics used by different ethnic people are made?

UNESCO (1998) has conducted research on the topic 'Developing culturally contextualized mathematics resource materials: capturing local practice of Tamang and Gopali communities' and found that the parents, teachers and students were very positive towards culturally responsive teaching and curriculum materials.

This discussion shows mathematics is used in profession like potter and also in the activities of different ethnic groups and research in ethnographic study of mathematics are also being carried out. Nepalis one of the multicultural countries, where different ethnic group are living and they have practice mathematical activities of their own cultural system. We can observe mathematical activities being practiced in Kewrat culture also. From the literatures it can be argued that that culturally relevant mathematics teaching builds the mathematical bridge between students' home culture and school mathematics. of different ethnic groups.

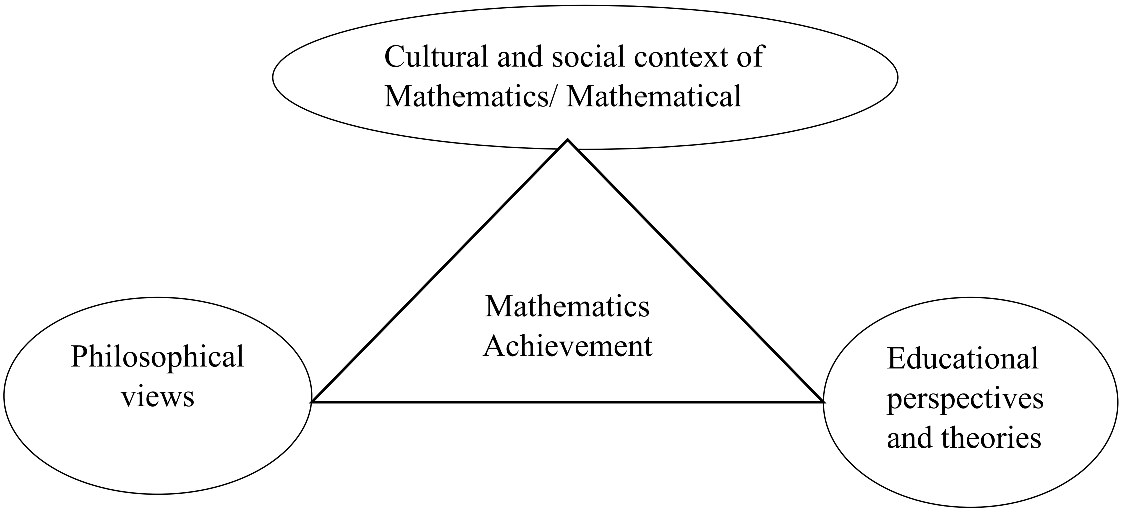
Now a days school mathematics is viewed from three different perspectives: cultural context of mathematics, philosophical views of mathematics and educational perspectives and learning theories. Cultural and social context of mathematics is driven by cultural act ivies with social aspects of mathematics like mathematical activities of

Kewrat culture and teaching learning activities in the school influenced by the social activities. on the other hand, mathematics has its own philosophy to, and the local mathematical knowledge and global understanding mathematical should be in the framework of philosophy of mathematics. Teaching learning activities of mathematics in the school are influenced by cultural activities and social aspects, humanistic view as well modern theories of pedagogies. So, the cultural context, philosophical perspectives and educational perspectives are connected to school mathematics curriculum.

This relation is presented in the following table.

Figure 1

Conceptual Framework of this study



Methods and Materials

Methodology refers to the overarching strategy of the research. It includes ontology, epistemology, research design, the area of the study, tools for data collection, and quality standards (Guba & Lincoln, 1994). The mathematical practiced activities of a Kewrat Community are studied so this study is in subjective reality. Epistemology involves knowledge and reflects a particular understanding of what it means to know representing how we know what we know (Crotty, 1998). Mathematical activities of Kewrat were explored through interaction with Kewrat people, by observing their behavior with participation in their society. So, this study is ethnographic in design and qualitative in nature. This ethnographic research aimed to find the mathematical concept and practice among the Kewrat community. Kewrat people were inhabitants of Sunwarshi Municipality of Morang district. Sunwarshi Municipality of Morang district was the study area taken with purposive sampling. The respondents of this study are 5- old people of age above 60years, 10- parents, 10- students, 2- mathematics Kewrat teachers from Kali Secondary School, Sunwarshi-4 and Bishnu Basic School of the study area. The primary data were taken with the tools like observation, interview and photography and the secondary data from different journal articles, books and other published and unpublished documents.

Quality Standard

Generally, a quality standard is a way of judging the quality of research. There are eight key markers of quality in qualitative research: worthy topic, rich rigor, transferability, credibility, praxis, resonance, ethics and meaningful coherence (Guba & Lincoln ,1994). Transferability, credibility, dependability, and conformability as quality standards is addressed in this study. Transferability is maintained by providing a rich description for the readers so that they can compare their own real-world situation, social context with the social setting of the research. One of the other of this study is the member of the Kewrat community, so the information provides thick and rich description and information for readers about the process of this research and its finding. This helps to mantained Conformability

Results and Discussion

The mathematical activities of Kewrat culture are discussed under the counting system, addition, subtraction, multiplication and division, measurement system and use of geometry in their daily lives.

Number Concepts and Counting System in Kewrat Culture

The concept of mathematics has ancient roots, starting with the basic idea of counting. In the early stages of human civilization, people likely used simple methods, such as one-to-one correspondence, to count their family members, livestock, or other objects. These methods, along with the development of numerical ideas and special languages for expression, represent important milestones in mathematical development. Mathematics serves as a crucial tool for solving daily life problems, and its application varies across different communities. The way mathematics is learned and used is often influenced by the culture and environment of each community. Although the older Kewrat people are illiterate, they have developed and applied mathematical concepts through practical use in their daily lives. Kewrat people predominantly use their native counting system, which has been in practice for generations. However, younger children who have received formal education tend to use the conventional counting system. The researchers did not find any indigenous script used by the Kewrat community for recording numbers, as the counting system is based on oral traditions. For example, when a researcher asked an elderly man feeding pigeons, "How many pigeons are in your farm?" the response was "pacha ganda ek-ta," meaning "twenty-one." This reflects how Kewrat people use their unique counting language. The counting system follows a pattern for numbers, with terms like:

ek-ta (one), dui-da (two), tin-da (three), chaar-da (four), pass-ta (five), chhau-da (six), saat-da (seven), aatha-da (eight), nau-da (nine), dass-ta (ten), saya-da (hundred)

This sequence continues as a means of quantifying objects, showing that the Kewrat people have developed their own practical system for counting based on their cultural and daily needs. Additionally, they employ a group counting system for larger quantities. This system reflects the cultural factors that shape how mathematics is used in different societies.

Kewrat peoples are habitual to use different group counting system such as 'ganda', 'vira', 'jori', 'solahi', ' darjan', kkori', etc. as mentioned in appendix- 1. When the researcher visited one of the 55- years- old sample kewrat People, he explained that 'ganda' is used to count crabs, eggs, ducks etc., 'vira' is specially used to count 'jute', 'jori' is used to count couple of different thing such as Pigeons, hen, bananas etc., 'solahi' is used to count paddy's bundle , 'darjan' is used to count bananas, gauva, etc., 'kori' is specially used to count money like ' ek-kori taka', 'dui- kori taka' it means 20 Rupees, 40

Rupees respectively, and so on. Counting System in Kewrat culture is mentioned on table in appendices – 1. When asked about knowledge transmission of counting, all the participants respond that they learned such counting system by their elders and society peoples. This shows that Kewrat people acquired knowledge through self-construction in their society. They have their own ethno-mathematics.

Counting parts in term of whole (Fractional number)

Kewrat peoples use of fractional numbers in daily life. They use fractions to tell work done, quantity of fruits, and area of lands etc. One day, a respondent of the age of 65 who was eating breads and asked him how many breads can you eat nowadays? He told me *adhai- 'kha ruti khawa sakechhi'*. It means, he can eat 2 full and one half of breads. He was asked other questions related to fraction but he could not respond in writing script but orally he explained using the terms such mentioned on the above table. He gave me some examples such as '*paune din kattha khet*' it means $2\frac{3}{4}$ *kattha* land, '*der din kaar kaam'* it means $1\frac{1}{2}$ day work done.

The Counting of Money

The counting system of money in Kewret community is based on base 20. They called "taka" for money. Also, they use "dallar" which is made as paisa, sukka, aathana, ek-taka and dui-taka. The money (taka) counting is expressed in terms of paisa, anni/aana, sukka, mohar and kori are as follows:

Table 1

Money Conversation Table

Money unit Devanagari	In Kewrat
1paisa	Ek -Paisi
25 paisa (1 suki)	1 Chaar aanni / Chaar aana
50 paisa (1 mohar)	1 Aathani/Aathana= 2 Chaar aanni
75 paisa (3 suki)	1 Bara-anna=3 Chaar anni
100 paisa (2 Mohar) = 1 Rupiya	1 Taka
20 Rupiya	1 Kori=20 Taka

Source: Field Survey, 2023

Addition, Subtraction, Multiplication and Division Practices in Kewrat People

The Kewrat culture demonstrated unique methods of using arithmetic operations-addition, subtraction, multiplication, and division-in various daily life activities, including trade, estimating crop quantities, and other routine practices. This is discussed in the following sections.

Addition and Subtraction. The Kewrat people traditionally use their hands, feet, fingers, and finger joints to perform addition and subtraction. In addition to physical tools, they employ mental strategies such as partitioning, gathering, and cancellation techniques to calculate numerical values.

Example 1

To add 40 and 20, they represent 20 using all fingers and toes-ten fingers and ten toes equaling twenty. To calculate 40, they repeat this full-body count twice. Then, to add an additional 20, they perform the count once more. This process leads them to state the result as "*tin kori*," which translates to 60.

Example 2

When they calculate large addition and subtraction between the number like 430 and 310 then they use finger nodes and get results of addition and Subtraction by partition, cancelation and gathering technique orally.

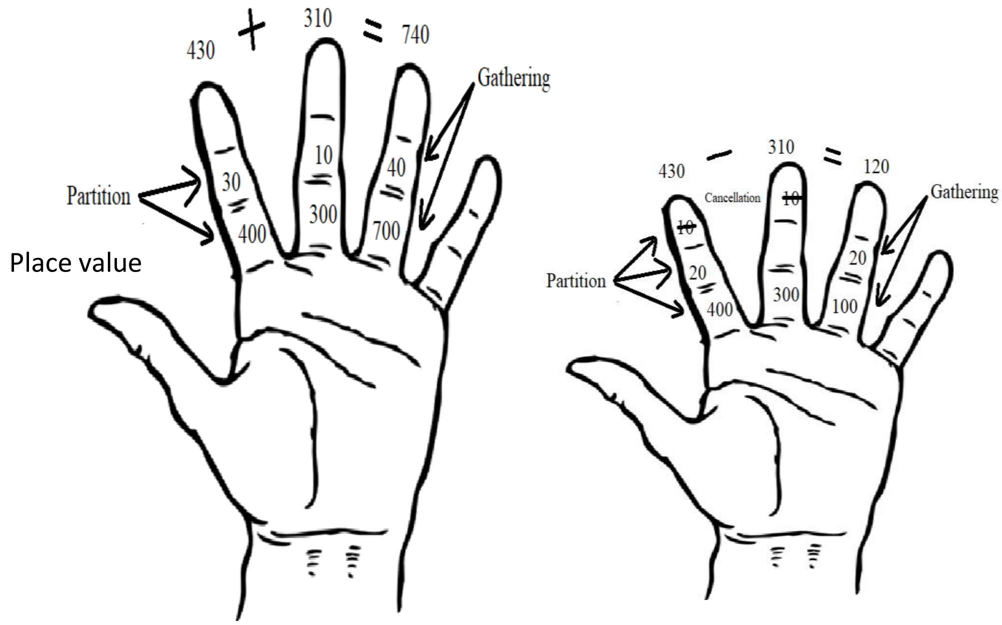
One of the sample people explained to me that they have to add some large number like 430 and 310, then they use finger nodes. They use partition and gathering technique as 430 breaks 400 and 30, which are keeping in the hundred place and ten place ,respectively, in nodes of any first finger as they feel easy and 310 breaks into 300 and 10, which are kept in the hundred place and ten place respectively in nodes of next finger, then they add the ten place number and hundred place number separately then keep it in nodes of next finger and finally they get the result by gathering the obtained hundred place number and ten place number of last finger as shown in the figure below.

Similarly, when they have to subtract the number s such as 310 from 430, they do not follow place value: They would break numbers like 430 into 400, 20, and 10, and

310 into 300 and 10, aiming to find common components between the two. This allowed them to simplify the numbers and apply cancellation more easily during calculations. They keep the above separated number as shown in the figure below, and then they perform cancelation and gathering techniques to obtained the final result orally.

Figure 2

Addition and Subtraction in Kewrat Culture Using Finger



Multiplication. Multiplication problem is solved orally by using following counting system known as "khaata" like:

ek-kang: ek-kang is the counting system as: 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10.

du-kang: du-kang is the counting system as: 2, 4, 6, 8, 10, 12, 14, 16, 18, and 20.

tin-kang: tin-kang is the counting system as: 3 ,6, 9, 12, 15, 18, 21, 24, 27, and 30.

Similarly, they use *sabaiya*, *derha*, *dunai* as shown in the table below:

Table 2

Sabaiya Multiple Table

Sabaiya	
ek-sabaiya	= saba Ek ($\mathbf{1}\frac{1}{4}$)
dui-sabai	= adhai ($2\frac{1}{2}$)
tin-Sabaiya	= paune chaar ($3\frac{3}{4}$)
chaar-sabaiya	= paacha (5)
pachasSabaiya	= saba chha ($6\frac{1}{4}$)
chha-sabaiya	= sadhe saat ($7\frac{1}{2}$)
saat-sabaiya	= paune Nau ($8\frac{3}{4}$)
aatha-sabaiya	= dass (10)
nau-sabaiya	= saba eghara ($\mathbf{11}\frac{1}{4}$)
dass-sabaiya	= sade barah ($\mathbf{12}\frac{1}{2}$)

Table 3

Deraha Multiple Table

Deraha	
ek-dere	= der($\mathbf{1}\frac{1}{2}$)
dui-dere	= tin **(**3)
tin-dere	= sadhe Chaar ($4\frac{1}{2}$)
chaar-dere	= chha(6)
pacha-dere	= sadhe saat($7\frac{1}{2}$)
chha-dere	= nau **(**9)
saat-dere	= sadhe Dass **(**$\mathbf{10}\frac{1}{2}$)
aatha-dere	= barah **(**12)
nau-dere	= sadhe Terah **(**$\mathbf{13}\frac{1}{2}$)
dass-dere	= pandra (**15**)

Table 4

Araihiya Multiple Table

Araihiya	
ek-areh	= arai ($2\frac{1}{2}$)
dui-areh	= pacha (5)
tin-areh	= Sadhe Saat ($7\frac{1}{2}$)
chaar-areh	= dass (10)
pacha-areh	= sade barah ($12\frac{1}{2}$)
chha-areh	= pandra (15)
saat-areh	= sadhe satra($17\frac{1}{2}$)
aatha-areh	= bis (20)
nau-areh	= sadhe baaish($22\frac{1}{2}$)
dass-areh	= pachis (25)

The Kewrat community traditionally uses oral 'Garang' multiplication tables for large number calculations. This indigenous system of counting is not part of formal school mathematics, and only a few individuals possess expertise in reciting and applying these tables.

Table 5

Eghaar Garang Table

Eghaar Garang	
eghaar Eghaaraang (11x11)	= ek-Sau Ekaish (121)
eghaar Barahaang (11x12)	= ek-Sau Battis (132)
eghaar Terahaang (11x13)	= ek-Sau Trichalis (143)
eghaar Chaudharaang (11x14)	= ek-Sau Chawann (154)
eghaar pandraang (11x15)	= ek-Sau paisathi (165)
eghaar soraang (11x16)	= ek-Sau Chayatar (176)
eghaar Sataraang (11x17)	= ek-Sau satasi (187)
eghaar Athaaraang (11x18)	= ek-Sau Anthanabbe (198)
eghaar Unaisaang (11x19)	= dui-Sau Nau (209)
eghaar Bisaang (11x20)	= dui-Sau Bish (220)

Table 6

Baar Garang Table

Baar Garang	
baar eghaaraang (12x11)	= ek-sau battis (132)
baar barahaang (12x12)	= ek-Sau Chauwalis (144)
baar terahaang (12x13)	= ek-Sau Chhapanna (156)
baar chaudharaang (12x14)	= ek-Sau Aarsathi (168)
baar pandraang (12x15)	= ek-Sau Assi (180)
baar soraang (12x16)	= ek-Sau Bayanabe (192)
baar sataraang (12x17)	= eui-Sau Chaar (204)
baar athaaraang (12x18)	= eui-Sau Sorah (216)
baar unaisaang (12x19)	= eui-Sau Athaish (228)
baar bisaang (12x20)	= eui-Sau chaalis (240)

Division. For division, the Kewrat people use a technique based on partitioning and halving. For example, to divide 50 by 4, they perform the calculation mentally using the following steps. If 50 divided by 4: they are doing the partition as 40+10, then half of it is 20+5 and again half of its 10+ adhai ($2\frac{1}{2}$)= sadhe baar ($12\frac{1}{2}$) and so on

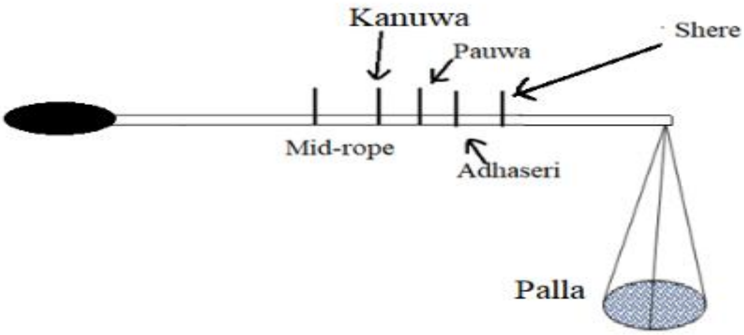
Measurement System

Weight Measurement

The Kewrat people also have traditional weight measurement systems. Units such as kanuwa, pauwa, aadha sher, shere, pasheri, daseri, bishi, chaalisa, and man are very commonly used in this culture. The most important tool used in the Kewrat community for measuring weight is "dandi”. which is traditionally made of bamboo or wood rood, with one side tie with "palla" i.e. plate-like structure of bamboo work tied with rope. Its other side is balanced by marking weight by hanging rope as in figure. and it is calibrated by comparing weight with other people’s " dandi".

Figure 3

Traditional Dandi



The Kewrat measurement weight system is much influenced by the modern measurement system. They also use “dak and palla”. "dhak and palla”, which are modern physical balances or beam balance. They used the following measurement units;

1 kanuwa = 62.5 gram approx.

4 kanuwa= 1 pauwa (250 gm)

2 pauwa= 1 aadh-Sheri

2 aadh-sheri= 1 aheri= 1 Kg

5 sheri= 1 pasheri

2 paseri= 1 daseri

2 dasheri= 1 bishi

2 bishi= 1 chaalisa

1 chaalisa= 1 man

Volume Measurement

In the Kewarat community, volumetric measurement is mainly used to measure paddy, wheat, oil, and milk etc. One of the sample people said that units of volume measurement widely used are: "kilo", " pauwa", " aadhseri”, " bishi”," Chalisa". The measurement of volume is used in daily life. Pots such as lota, glass, kath-tha, bottle, dhaki, kothi etc. are used for volume measurement. They use "bishi”, "chalisha" unit to measure paddy, wheat, Corn by using "kath-tha" They measure volume of liquid materials like milk by using "lota","glass" as "kilo" unit.

Measurement of Length, Distance and Time

Kewret has their own measurement system of length and distance and practice in their traditional measurement system. Kewret people and farmers used their traditional measurement system to measure the distance and length units such as aangul, thu-thu, bitta, muthan haat, haat, kosh. If they have to measure the very short length of anything they use fingers wideness distance as eK- aangul, dui- aangul. similarly, they use thu - thu to measure, which is the distance between the tip of the thumb and to tip of the pointer finger presented below.

Figure 4

Figure of 4 Aangul (3 inch approx.)

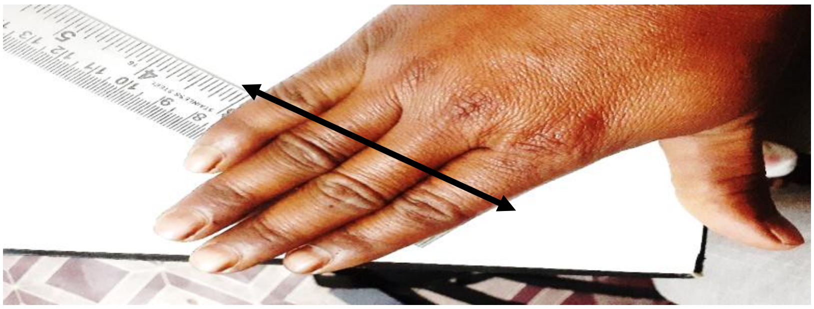


Figure 5

Figure of Ek- Thu-thu (6 inch approx.)

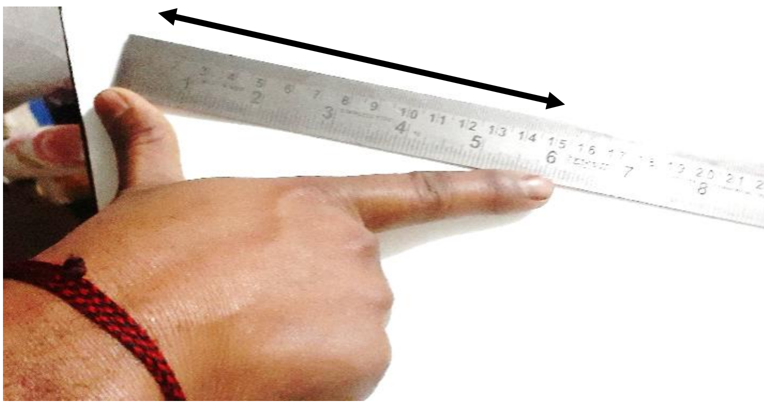
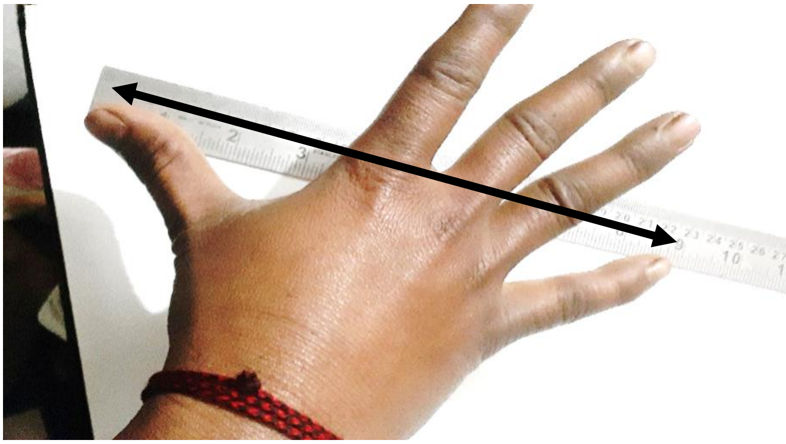


Figure 6

Figure of Ek-Bitta (9 Inch approx.)



They use bitta to measure the short distance between the tips of the thumb and the tip of the middle finger which is shown in the above figure. Moreover, their measurement unit is haat and it is determined by the distance from elbows tip to the middle finger tip, as shown in figure below.

Figure 7

Figure of One Haat

Length conversation

1 aangul= 0.75 inch (Approx.)

4 aangul= 1 giraha (3 inch Approx.)

8 aangul= 1 Thu-tha (6 inch approx.)

12 aangul= 1 Bitta (9 inch approx.)

2 aitta = 1 Haat (18 inch approx.)

3 thu-tha= 1 Haat

4 haat= 1 dega (6 feet approx.)

2000 dega= 1kosh (12000 feet or 3.66 km)

4 kosh= 1 jajan (9 mile or 14.48 km)

10 kosh = 1 din (One Day)

These measures are still in use to measure the length and breadth of houses, land, wood, and rope in farming. Elder Kewrat people still use kosh to measure the long distance. They believe that a man can travel approximately 10 kosh per day.

When there was no watch, they used the shadow to guess the time. When the shadow is approaching the object, they think time is closing to 12 o'clock and when the sun is just above the man, they also guess time is 12 o'clock. They divided 24 hours as baar pahar din and baar pahar raat.

They divide different parts of day and night as follows:

4 am to 6 am=varauwa

6 am to 9 am=bihana

Before 12 o'clock= epahare

12 o'clock= bar pahar din

2 o'clock= dafariya

after 12 o'clock= upahare

3 pm to 7 pm=sanjhuwa

time between 7 pm to 11 am=raat

mid night= bar pahar Raat also called,

yesterday= kaal

today = aaj

tomorrow =kaal

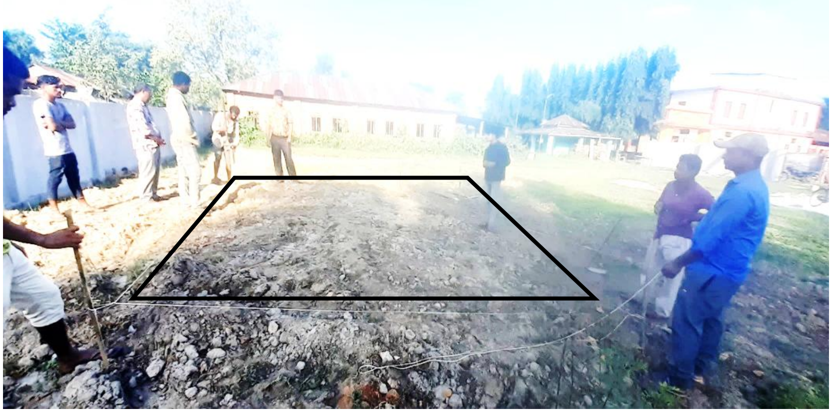
a day after tomorrow = parsu

Area Measurement

Measurement of an area is mostly used in estimating farmland and constructing houses. Measurement of area is used by Kewrat people in their daily lives is to measure the area of their house. The simplest method used by the Kewrat for measurement of area is one to one correspondence that has verification. When they start to construct houses, they measure by a rope in which different symbols are marked on the basis of the length measure in haat which is used to measure the required length of the ground. The researcher asked a to the elderly kewret people, how to make a house? He said, if we want to build a small house then we need 9 Haat breadth and 13 Haat length, if we build a medium size house then we need 9 haat breadths and 15 haat lengths. The houses, 9 by 15, has 3 medium size rooms. They were drawn on the right side by stretching-bending a rope to the required shape of the new house. The wooden nail is nailed to the ground hole in equal distance from the rope.

Figure 8

Area Measuring Using Rope for the Construction of House



Measurement of Land for Farming

The Kewrat people called 'amin' for the one who has knowledge of land measurement, they use hand measure of land for buying and selling for farm or fields. The units used by them are as follows:

9 haat=1 Laggi (i.e 13.5 feet approx.)

4.5 haat × 4.5 haat = (1/2 Laggi × 1/2 Laggi) =1 kanwa (45.5625 sq.feet)

1 laggi ×1 Laggi=1 dhur (182.25 Sq. feet)

4 kanwa= 1 dhur

20 dhur=1 kattha (3645 Sq. feet)

20 kattha=1 bigha, If the land is square then length of 1 dhur = 9 haat and breadth is also 9 haat

They used bigha-kattha-dhur-kanwa i.e. bik ka-dh-Ka unit system for measurement of crop land for example, 2-15-13-3 represents for 2 bigha, 15 kattha, 13 dhur and 3 kanwa area of land

Geometrical Knowledge Used in Kewarat Culture

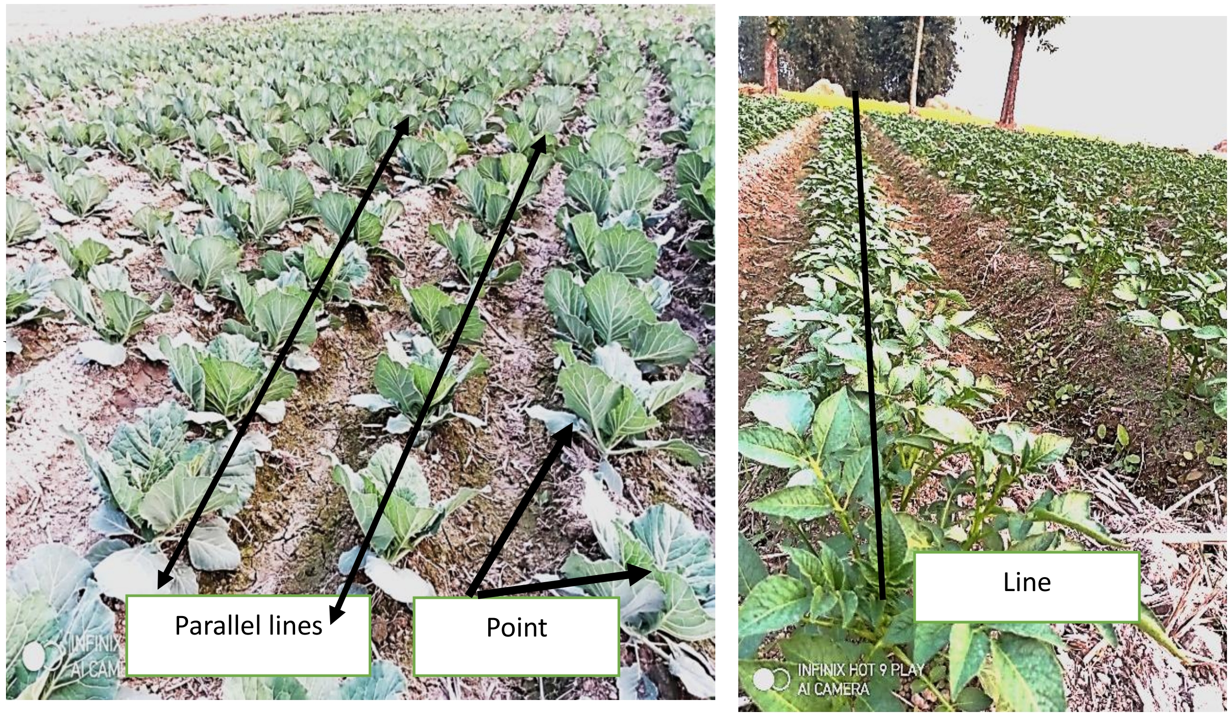
Kewrat people performed different geometrical activities in their farming. They are discussed as below:

Construction of Cabbage and Potato Field

Kewrat people used a rope and two sticks of the same size and the rope was mark in equal intervals with color. They made straight the rope straight and dug a small gaddha (hole in field) at every color mark, which represents the concept of a point for planting cabbage plants, then put the two sticks on both the ends of the rope and then changed the place of the rope to make the another dyang (i.e. line concept). Dyang is a line made for parallel lines, they barabar (equal) dyang.This shows that Kewrat culture hasmany artifacts for point, line and parallel lines as shown in figure below.

Figure 9

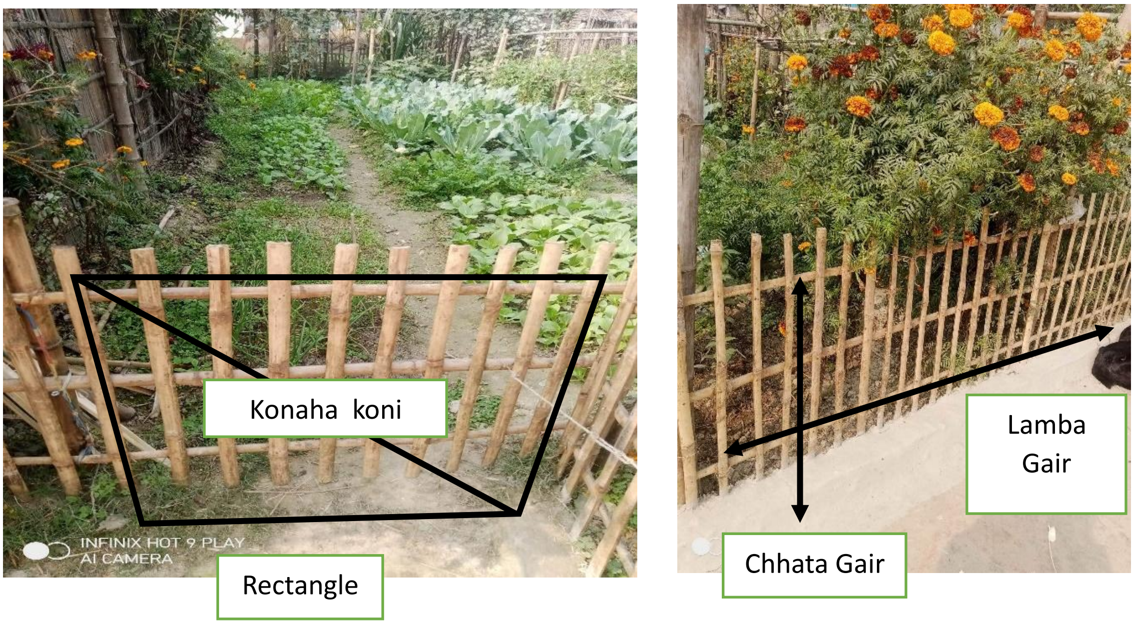
Figure of Cabbage and Potato Field



Kewrat people fenced-in their garden by using bamboo pegs which are in a rectangular shape. The researcher asked them to say the shape name. They called its name as " chaukhutia taati", which means "rectangular fence" as given below. They also explained that first they put horizontally " lamba gair", which means long bamboo stick, then they fix the lateral side by putting vertically "Chhata Gair "which means short bamboo stick. They also fix the corner properly by measuring " kona koni," which means equal diagonal using thin rope and finally they fix all the vertical bamboo sticks putting these at equal intervals.

Figure 10

Figure of Bamboo Fence



Mara and Kothi

The Kewrat community uses the concept of a cylinder in their daily activity, to make Mara and Kothi. An elder Kewrat people whose occupation is also agriculture is asked the concept of a cylinder but could not give the meaning of a cylinder but can construct and use Mara for keeping paddy and kothi for rice. Again, he was asked - how do you make Mara and Kothi goho (Cylindrical)? His response was personal practice. The following figure is the concept of cylinder in Kewrat communities:

Figure 11

Figure of Kothi and Mara in Shape of cylinder

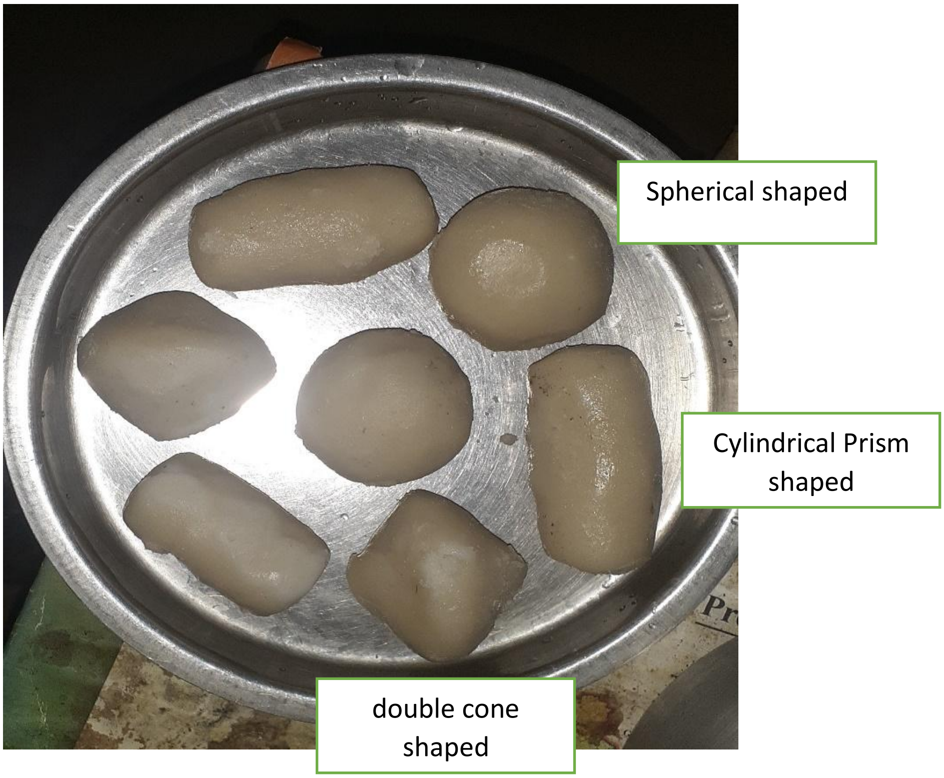
Kothi is made of mud and Mara is made of bamboo. It has a circular mouth.

Pit-tha

The researcher observed their Pit-tha is a special type of food or Sweet made on the occasion of Hukka (Tihar) Festival by the steaming process of Chaauler gunda (rice powder). It has different geometrical shapes like cylindrical prism, cone, and sphere as in the figure given below. Children of the Kewrat community mostly like this sweet and also enjoy cooking *pit-tha.*

Figure 12

Figure of Different Geometrical Shaped Pit-tha



Chulha, Kothi, Binda, Thali, Kath-tha

The Kewrat people follow a traditional process of making *Binda*, *Chulha*, and *Kothi* during the harvesting of paddy. They made binda using paddy straw in a circular shape by a coiling method starting from a point. They do not know the circle but say it is goho (circular in shape). The mouth plate (Dhakani) of kothi is circular shape it is made up of mud and also make chulha. They draw a circle on the ground where they make it. Then they give its cylindrical shape. Circle is also understood by thali, mouth of lata and kath - tha as given in the figure. Kewrat people say center as "bicha" they have no formal concept of diameter and radius but they use "bichaa bich"

Figure 13

Figure of Chulha, Kothi, Binda, Thali, Kath-tha

Kat-tha

Through the observation, it was found that Kewrat community used the concept of similarity, which they called "*ekke kisam*". This concept was found when the sample population was using different size.

Figure 14

Figure of Similar Kath-tha

Through observation and interview, the researchers found that Kewrat people have the concept of congruence.

Figure 15

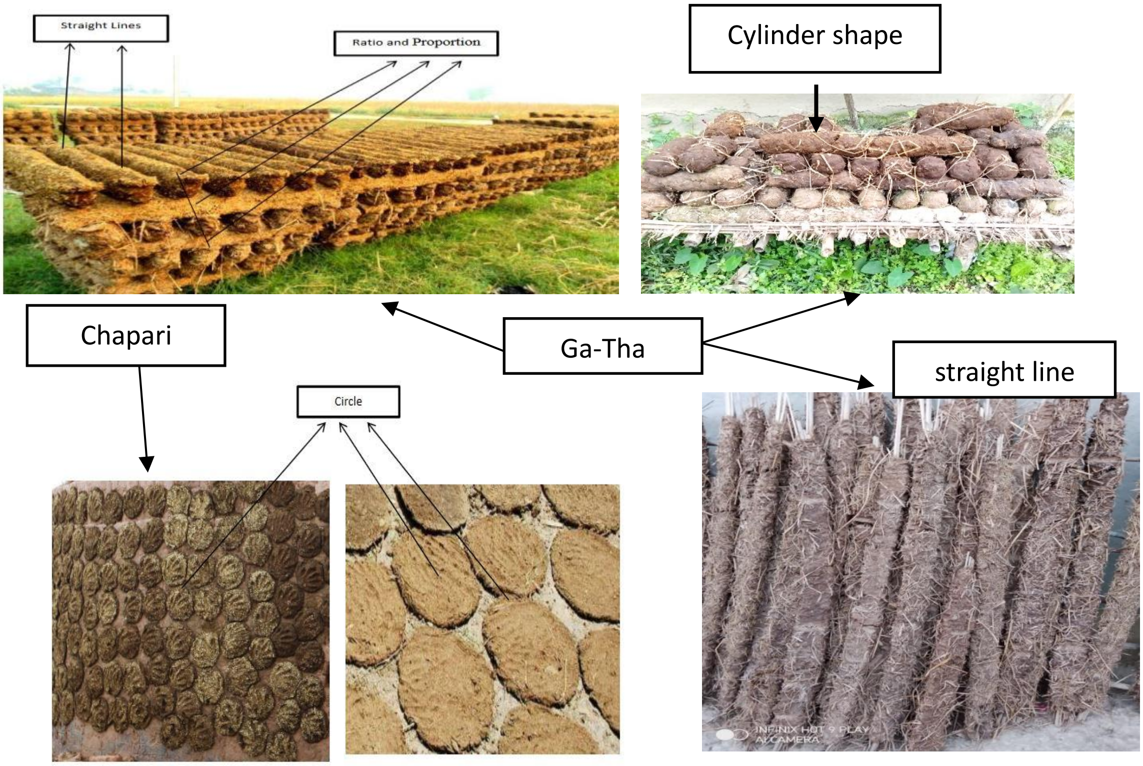
Figure of Two Congruence Mara

Ga-tha

Generally, ga-tha is the most useful firewood in the Kewrat community. Kewrat people specially used dung as an alternative to firewood. Around 70 to 80 percent of households in the Kewrat community have been using ga-tha for cooking. Women make it by using cow dung. Fresh dung stock on open ground, and women are mixing this fresh dung with dry grass. In the local language, there are different names and shapes of ga-tha, which is long in shape, and likewise chapari which is circular in shape; some are cylindrical.

Figure 16

Ga-tha and Chapari in Different Shape

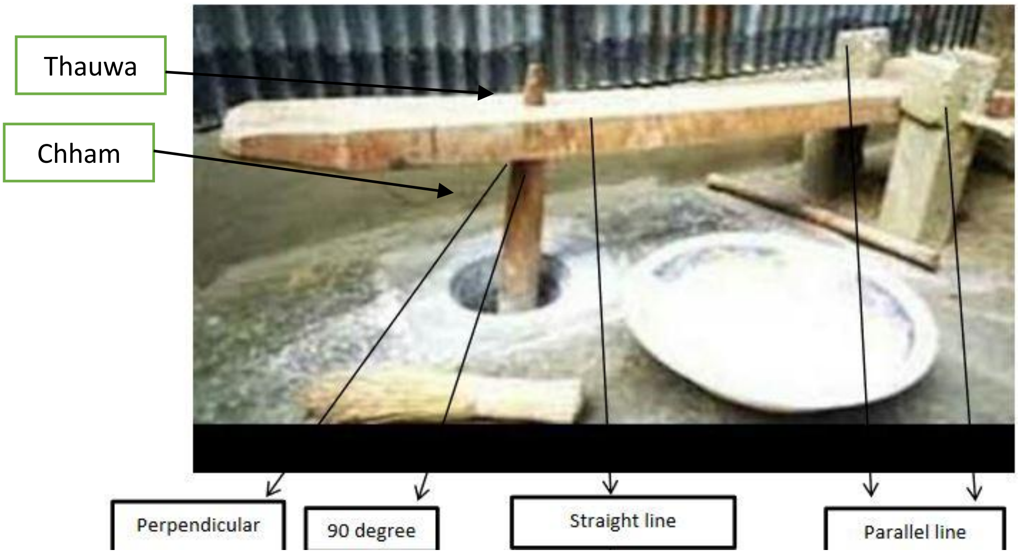


Dheki

Dheki is one of the most useful traditional materials which are made of wood. It is a kind of traditional machine which is used for beating paddy, maize, rice, and wheat etc. to construct this dheki; firstly, they buried the two poles called machiya in the land in such a way that they are mutually perpendicular and parallel. The manual wooden thresher dheki is made of wooden in a cuboid shape and works like a lever, but is instead used for grinding. The framework consists of a fulcrum (aaglo) having two pillars on each side, an effort area (where one person stands on the long, thick plank of wood, making an effort at every interval), and a long, and thick plank of horizontal wood, which has a small vertical extension called thauwa that fits into a wooden hole called chham made in the ground.

Figure 17

Figure of Dheki

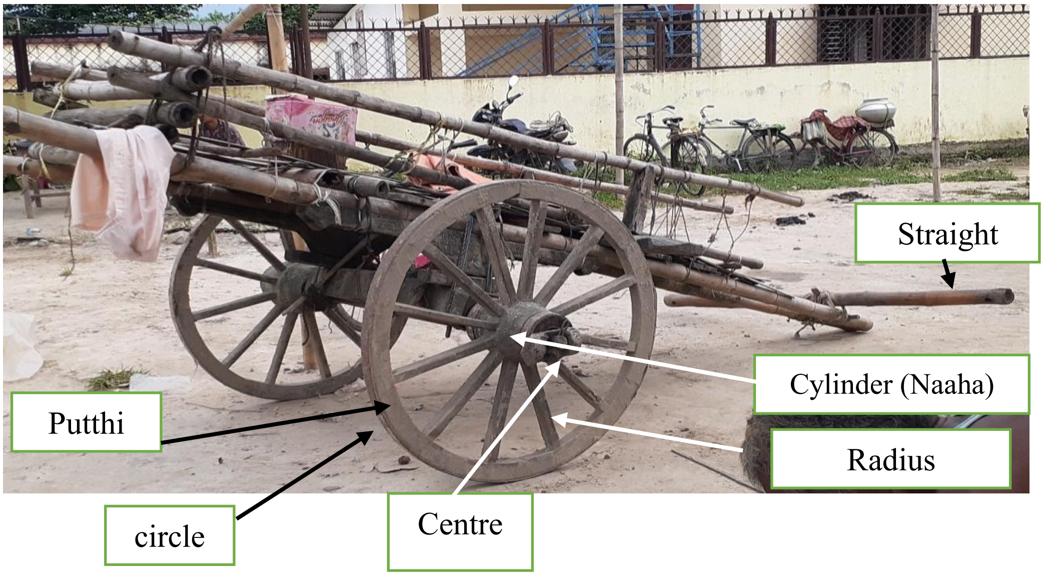


Bayal Gari

Kewrat people uses bayal gari for transportation purposes. They use bamboo, wood planks, and rope to make it. To make it, they use different geometrical ideas. But the Kewrat people explain this geometrical idea used in bayal gari in their traditional term 'gol' (circle), siddha (straight line), putthi (circumference of wheels), dariya (radius) and naaha (cylindrical shape of wheel), etc.

Figure 18

Figure of Bayal Gari



Patiya (Mat)

Patiya is the significant item made by the Kewrat using the basketry techniques. This is a mat made out of paddy stalk locally. The wrapped procedures are working for making the gundri. The wrapping strand of a rope in this case passes round the bundle of paddy stalk, 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 short distances, 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 winter for sleeping because it provides heat.

Figure 19

Figure of Making Patiya

Figure 20

Figure of Patiya role

Chhitki Jaal and Tapi

The researcher observed that Kewrat people use chhitki jaal for fishing purpose. when asked about the shape of chhitki jaal responsed to the researcher chaukhuniya (square) and also it is same in length on both sides. The researcher visited a man making tapi which is conical in shape and is used to save and control chickens, hens and ducks also sometimes used for fishing. which is illustrated in the figure.

To make chhitki jaal, they use two bamboo sticks which are tied crossing as given in the figure below, then a square shaped piece of jaal is fixed.

Figure 21

Figure of Chhitki Jaal

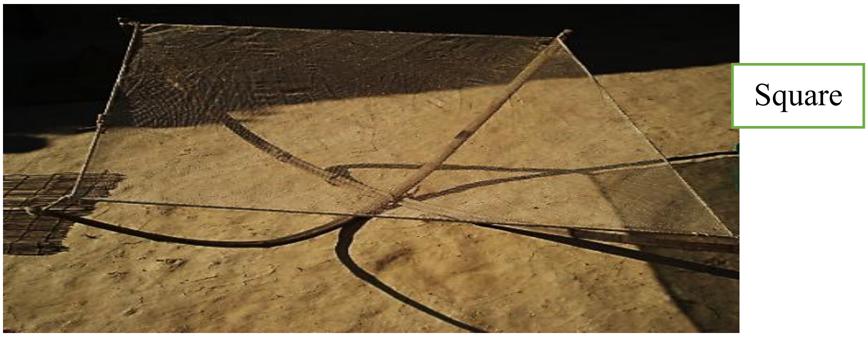


Figure 22

Man Making Tapi

Puwaler Tal

Kewrat people stock their paddy straws known as puwal in a combined shape of cylinder and cone shape,which is called puwaler tal as in the figure.

Figure 23

Puwaler Tal

Ghar

Most of the Kewrat' house (ghar) is structured as in the figure below, made up of clay, bamboo, paddy straw, wood with so many geometric shapes such as triangle, trapezoid, congruence.

Figure 24

Kewarat People's House (Ghar)

Kewrat people use mathematical activities as tool of performance in their lives. They have their own system of counting, numeration system and use of geometrical concepts in practice although these practices have not been in recorded form. The geometrical concepts like circle form in oven (chulha), perpendicular, parallel form in dheki, rectangular form in tati, cone form in tapi, spherical form in mara and rectangular, cubical, truncated, and triangle, from many household goods can be found in Kewrat culture. The geometrical shapes practiced in this culture reflects the practical application of school geometry in real life contexts. Now a days, however, a child does not know the local measurements like volume of one 'pawa' milk poured from a jog by milk man, volume of oil contained in a packet of oil and its consumption of a family in a day and not get discussed in his classroom, too. Though, local governments have implemented local curriculum at the basic level of education, focused such cultural activities. If such applied mathematics of lived cultures are discussed in the school curriculum, students would have greater opportunities to solve mathematical problem using hands on methods. Hence, it is recommended that the concerned local governments include mathematical ideas used by Kewrat people in their local curriculum, so that these hands- on techniques can enhance be used to pedagogical implication of modern mathematics in schools.

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Appendices

Appendix-I

Table of Group Counting System in Kewarat

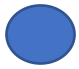
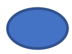
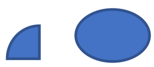
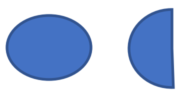
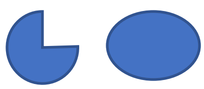
Group	Its Value	Example, Use, quantity	Remarks
ganda	four objects	2 ganda gakhara (i.e 2x4=8 no. of crab) 3 ganda Dimma (i.e 3x4=12 no. of egg) 2 ganda tin-da Haas (i.e 2x4+3=11 no. of duck) etc. aadha ganda=1/2x4= 2 object	count like: ek-ta (i.e 1), dui-da (i.e 2), tin-da (i.e 3), then ek-ganda (i.e 4), ek-ganda ek ta (i.e. 4 + 1 = 5) and so on
Vira	four objects	Vira is used specially count to jute ek-vira= 4 muth-thi (1 muth-thi jute is a small bunch of jute) ek-vira Patuwa= 4 small bunch of jute	4 based counting system
jori	two object (one pair)	1 jori Kela (2 piece of Banana) 4 jori Kab-tar (4x2=8 no. of Pigeon) aadha jori =1/2x2= 1 object	2 based counting system
Solahi	16 objects	Solahi is specially used by Kewarat Farmer to count Paddy, wheat, etc crop (i.e 1 Bajha= a bunch of paddy or other crops use full part cutting) 1 solahi= 16 bajha ek Sosahi dhan= 16 bunch of paddies aadha dolahi= 1/2x16=8 bajha	16 Based counting system
Darjan	12 pieces of object	1 darjan Kela= 12 piece of Banana aadha darjan= 1/2x12=6 piece ex-pauwa darjan=1/4 x 12= 3 piece	12 based counting system

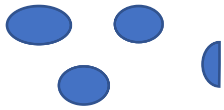
Group	Its Value	Example, Use, quantity	Remarks
Kori	20 objects	specially used in counting money 1,2,3,4,5..........19, 1 Kori, 1 Kori 1, 1 Kori 2, ..., 1 Kori 19, 2 Kori so on i.e. 5 kori taka= 5x20=100 rupees 4 kori 15 taka= 4x20+15=95 rupees arahai kori taka=$2\frac{1}{2} \times 20 = 50$ Rupees	20 based system of counting which is in practice from long period of time by Kewrat
Panja	it is used for 8, 3 according to situational use	i.e for paddy (Dhan) planting worker 1 Muth-thi Bihan= 1 bunch of paddy seedling 8 muth-thi Bihan= 1 panja bihan 4 panja bihan = 1 Jan (1 worker) i.e forp paddy (Dhan) cutter worker 1 muth-thi dhan= 1 small bunch of paddy plant cutting 3 muth-thi dhan= 1 panja dhan 4 panja dhan= 1 bajha dhan 16 bajha dhan = 1 solahi dhan	
Bishi	20 objects	specially used to count rice,wheat, corn volumetric quantity comparing weight i.e 1 Kath-tha = 1 unit volume (1 full vessel) or 1 unit Mass 20 Kath-tha=1 Bishi 10 Kath-tha= 1/2 Bishi 2 Bishi= 1 Chalisaa	20 based counting
Chalisaa	40 objects	1 chalisaa= 2 Bishi	40 based counting
Sekara	100 objects	1 sekara Aam= 100 piece of mango 2 sekara kagaj thali= 200 Piece of paper plate	100 based counting

Source: field Survey, 2023

Appendix -II

Table of Counting Parts in terms of Whole (Fractional Number)

Unit of part	Pictorial presentation	Unit Value
ek-ta /Gata-da		1 unit or 1 part
ek-pauwa		1/4 part
eadha		1/2 part
tin-pauwa		3/4 part
gata		1 part
sawa ek		$1\frac{1}{4}$ parts
der		$1\frac{1}{2}$ parts
paune dui		$1\frac{3}{4}$ parts
sawa dui		$2\frac{1}{4}$ parts

Unit of part	Pictorial presentation	Unit Value
adhai		$2\frac{1}{2}$ parts
paune tin		$2\frac{3}{4}$ parts
sadhe tin		$3\frac{1}{2}$ parts

Source: Field Survey, 2023