Ethnomodeling as an Anthropological Research Concept

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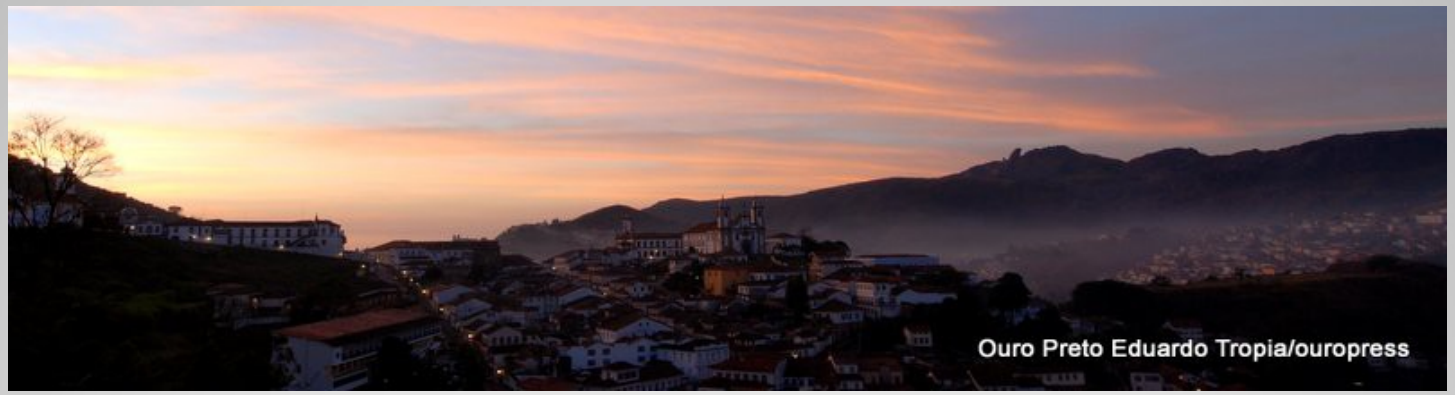
I can do nothing! I can do everything!

Government determines objectives
Experts assemble curriculum
Writers produce textbooks
Head teacher declares “the textbook”
Trainers prescribe teaching methods
Department head evaluates students’ achievement
I go to the classroom
I try to teach mathematics
But, I can do nothing!

I give meanings to the objectives
I can develop my own curriculum
I prepare contextual mathematical problems
I have choices among many teaching methods
I can see mathematics around us
I help students to learn mathematics
I continually assess students’ performance
So, I can do everything!

Binod Prasad Pant (2015)

Ouro Preto, Minas Gerais



Introduction

It is important to search for alternative methodological approaches to the many European mathematical practices which are universally accepted in order to record historical forms of mathematical ideas that occur in different cultural contexts before we loose them.

Introduction

One alternative methodological approach is ***ethnomodelling***, which I consider as the practical application of ethnomathematics that adds the important cultural perspective to mathematical modelling concepts.

Introduction

Sophisticated mathematical ideas and practices that include geometric principles in craft work, architectural concepts, and practices are found in the activities and artefacts of many local, and global cultures.

Introduction

These concepts are related to numeric relations found in *measuring*, *calculation*, *games and divination*, *navigation*, *astronomy*, *modelling*, and a wide variety of other mathematical procedures as well as cultural artefacts (D'Ambrosio, 1990).

- Do we want to loose the rich traditional and unique Nepali ways in which these are done here as Nepal "modernizes" or changes?

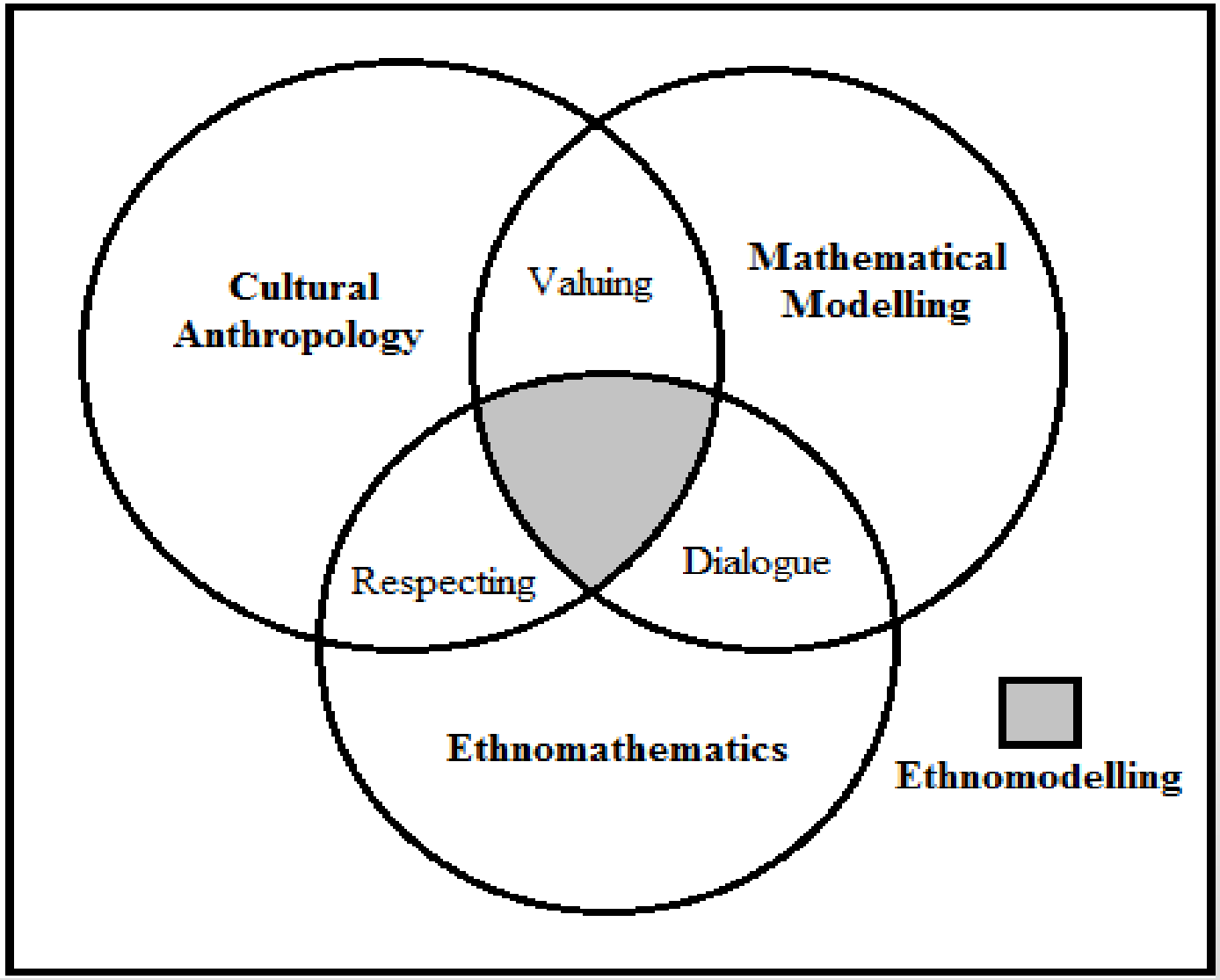
Ethnomodelling

Using ethnomodelling as a tool towards pedagogical action of an ethnomathematics program, students learn how to find and work with authentic situations and real-life problems. If mathematics is a language, then modeling is the act of writing a mathematical poem.

- What math poems have Nepalis written in the past?
- How can we create new ones that describe the current mathematical dilemmas you experience?

Ethnomodelling

Ethnomodelling is the essential element in the area of cultural anthropology, ethnomathematics, and mathematical modelling.


Cultural Anthropology
Valuing
Mathematical Modelling
Respecting
Dialogue
Ethnomathematics
Ethnomodelling

Ethnomodelling

Translation is the description of the process of modelling of local (cultural) systems, which may have a Western academic mathematical representation.

Ethnomodelling

Ethnomathematics makes use of modeling by using it in order to establish relations between the local conceptual framework and the mathematics embedded in relation to global designs.

And this is not unlike translating words, terms, ideas and concepts say from Portuguese to Nepali.

Emic Constructs

Emic constructs are the accounts, descriptions, and analyses expressed in terms of the conceptual schemes and categories that are regarded as meaningful and appropriate by the members of the cultural group under study. An emic construct is in accordance with perceptions and understandings deemed appropriate by the insider's culture.

Emic Constructs

- Mathematical knowledge can be seen as arising from emic rather than etic origins.
- This seems reasonable as ethnomathematics often applies modelling to establish relations between the indigenous conceptual framework and the mathematics embedded in related indigenous designs.

Emic Constructs

Any validation of the emic knowledge comes with a matter of consensus, which is the consensus of local people who must agree that these constructs match the shared perceptions that portray the characteristics of *their* culture.

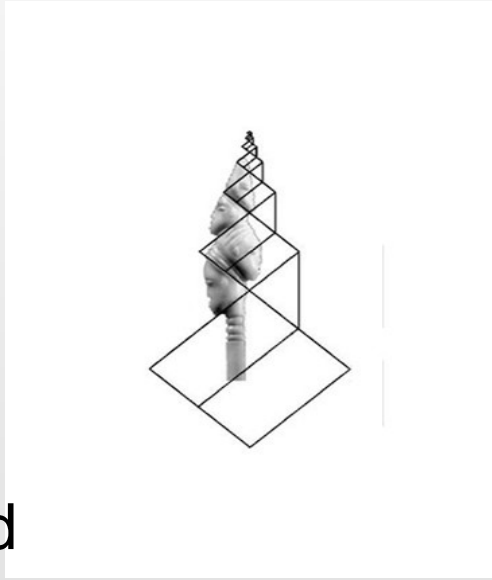
Emic Constructs - Mangbetu Ivory Sculpture - Zaire via Ron Eglash

Combining this 45 degree angle construction technique with the scaling properties of the ivory carving can reveal its underlying structure. The carving has three interesting geometric features.

- Each head is larger than the one above it, and faces in the opposite direction.
- Each head is framed by two lines, one formed by the jaw and one formed by the hair; these lines intersect at approximately 90 degrees.
- There is an asymmetry: the left side shows a distinct angle about 20 degrees from the vertical.

Emic Constructs - Mangbetu Ivory Sculpture – Zaire

This sequence of shrinking squares can be constructed by an iterative process, bisecting one square to create the length of the side for the next square. In this sculpture, the left side is about 20 degrees from the vertical. In the iterative squares structure, the left side is about 18 degrees from the vertical. The construction algorithm can be continued indefinitely, and the *resulting structure can be applied to a wide variety of* math teaching applications, from simple procedural construction to trigonometry.



Dialectal Ethnomodels

In this approach, the etic perspective claims that the knowledge of any given cultural group have no necessary priority over its competing emic claims.

The ***etics*** perspective may be a way of getting at ***emics*** of the members of cultural groups. This perspective may be useful for penetrating, discovering, and elucidating emic systems that were developed by members of distinct cultural groups.

Etic Constructs

Etic constructs are accounts, descriptions, and analyses of mathematical ideas, concepts, procedures, and practices expressed in terms of the conceptual schemes and categories that are regarded as meaningful and appropriate by the community of scientific observers and researchers. An etic construct must be precise, logical, comprehensive, replicable, falsifiable, and observer-researcher independent. The validation of etic knowledge is a matter of logical and empirical analysis, in particular, the logical analysis of whether the construct meets the standards of falsifiability, comprehensiveness, and logical consistency.

Modelling the Wall – Ouro Preto, Minas Gerais – Brasil

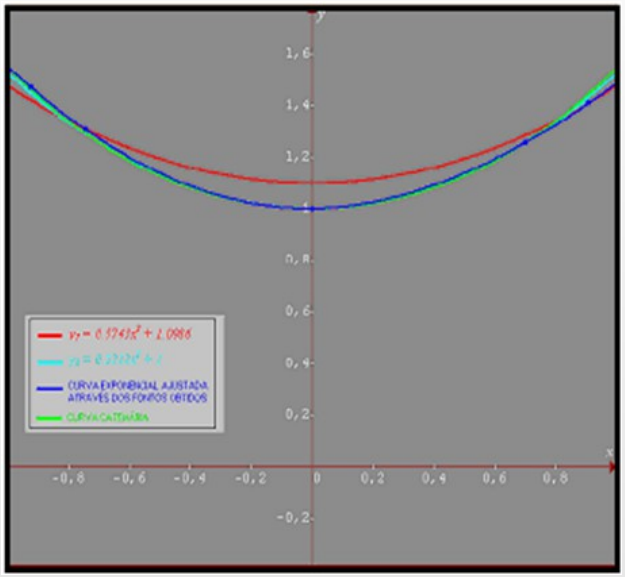
Parabolas, Exponentials or Catenaries?

We were interested in checking if we could prove that the shape found on the wall of the school was either a series of *exponential curves, parabolas or catenaries*.

What happened was something altogether surprising, and in the end, the final result, important as it was, was eclipsed by the opportunity to discuss and to debate about exponential curves, parabolas, and catenaries that happened between the professors and the students.

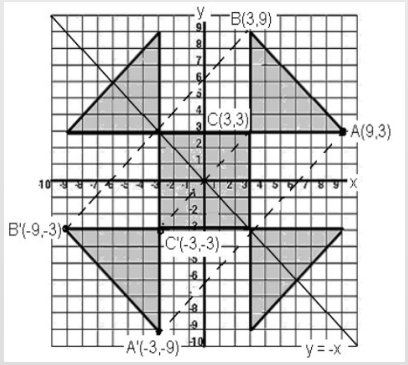
Modelling the Wall – Ouro Preto, Minas Gerais - Brasil

After examining the data collected when we measured various curves on the wall and trying to fit them to the exponential, quadratic, and catenary functions through mathematical models we came to the conclusion that the curves on the wall approximated a *catenary curve*.



Ethnomodels

The elaboration of models that represent these systems are representations that help the members of these groups to understand and comprehend reality by using small units of information, named ethnomodels, which link their cultural heritage with the development of their mathematical practices.



Ethnomodels

Emic ethnomodels are grounded in what mathematically matters by the community itself. These models represent the mathematical thinking of the people themselves who live in such communities and seeks to translate how they think mathematically using examples found in their own reality.

Ethnomodels

Etic ethnomodels are built on an outsider's view of about the reality being modelled. These models represent how the modeller thinks the world works through systems taken from reality.

The Emic-Etic Perspective

The etic perspective plays an important role in ethnomodeling research, yet the emic perspective should be taken into consideration in this process as well, because the emic characteristics sharpen the question of what an agent-based model should include to serve practical goals in modelling research.

The Emic-Etic Perspective

Mathematical ideas and procedures are *etic* if they can be compared across cultures using common definitions and metrics while the focus of the *emic* analysis of these aspects are emic if the mathematical concepts and practices are unique to a subset of cultures that are rooted on the diverse ways in which emic activities are carried out in a specific cultural setting.

The Dialectal Perspective

- There is need for “acts of “translation” between emic and etic perspectives (Eglash at al, 2006).

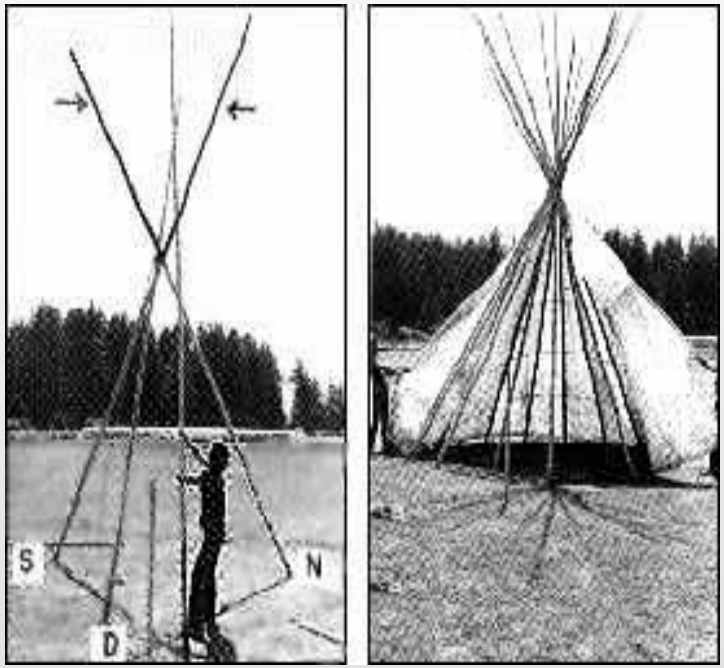
- Mathematical knowledge of the members of cultural groups that are combined with the Western mathematical knowledge system results in a dialectical perspectives in mathematics education (Rosa & Orey, 2010).

An Ethnomodeling Curriculum

Most curriculum developers have ignored the emic perspectives in the school curricular activities, and this is one of the primary reasons for the failure of many educational systems. An emic-etic perspective includes the recognition of other epistemologies, and of holistic and integrated natures of the mathematical knowledge of members of diverse cultural groups found in many urban centres.

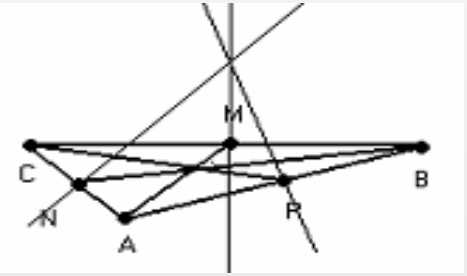
The Sioux Tipi - United States – Dialogical Ethnomodel of a Tripodal Foundation

- This foundation appears to be perfectly adapted for the harsh environment in which it was used.
- It has the advantage of providing a stable structure.
- It withstood the prevailing winds and extremely variable weather of this region.

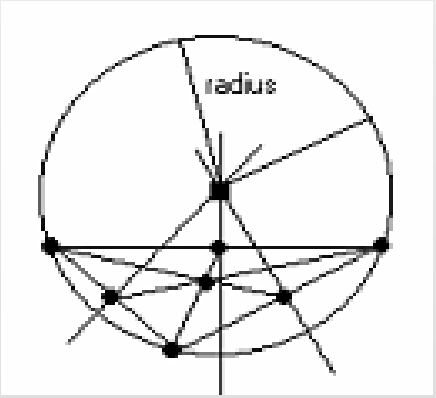


The Sioux Tipi - Dialogical Ethnomodel of a Tripodal Foundation (Orey, 2000)

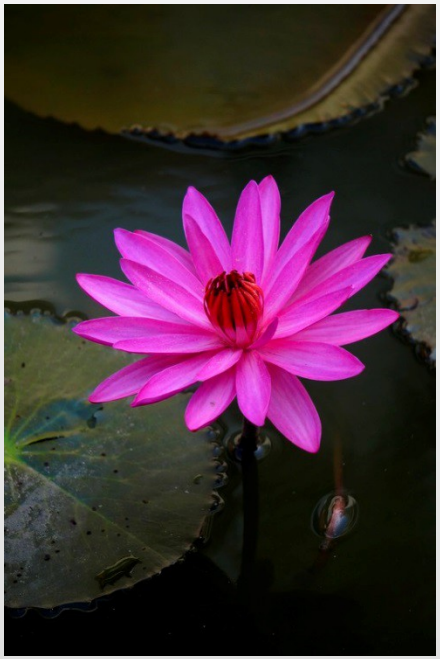
- The dwellers determined the center of the circular base of the Tipi by using the idea of the existing triangle formed by the tripod.



- The center of the Tipi holds a definite power and holiness, which is more than just necessity or aesthetics that went into finding the center of the Sioux home.



Further Research Questions



An alternative goal for research must be the acquisition of both emic and etic knowledge in ethnomodelling.

Further Research Questions

Not all ethnomodels of cultural ideas, concepts, procedures, and practice can or will be considered as ethnomathematics. The more evidence that a model provides the *emic* view, not *etic*, the better the case for ethnomathematics. The evidence that we suggest are:

- Explanatory narratives by informants.
- Variant uses of specific “design themes” (not rote memorization).
- Correlations across different domains such as cultural, linguistic, etc.

My 100m / Meu 100m / ¡Mi 100m / Mi 100m

1. Select your stretch of road or street
2. Measure and document how you know you have 100m
   a. Where is the middle?
   b. Your front door?
3. What kind of 100m?
   a. Rural? Suburban? Urban? City Center?
   b. What kind of Houses & Businesses?
4. What kind of, and how much pavement?
   a. Asphalt, cobble stones, dirt, gravel?
   b. How much of each is necessary to cover your 100m?
   c. How did you go about solving this problem?

My 100m / Meu 100m / [illegible]100m / Mi 100m

5. Details:
    a. Houses
    b. Stores
    c. Sidewalks
    d. Green space / trees
    e. Public art
    f. Transportation
    g. Access covers
    h. Utilities
    i. Litter / trash
    j. Graffiti

How did you calculate your 100m?
How did you measure your meter?
How do you know you have 100?
Where is your center?
Where is your 100m? What is its history?
Who is there with you?
What do people who live in or use your 100m do?
What are three of your favorite things about your 100m?
What are things that your 100m needs to do to improve (challenges?)
Litter, noise, trash, greenspace, crime…

Final Considerations

Because it is a culturally bound social construction, and an essential part of ethnomathematics; *ethnomodelling* studies mathematical phenomena within a cultural context.

Final Considerations

Emic knowledge is a valuable source of inspiration for etic hypotheses.

Etic knowledge is essential for cross-cultural comparison, the essential components of ethnology.

An "Ethno" Middle Way

1. Right View
2. Right Intention
3. Right Speech
4. Right Action
5. Right Livelihood
6. Right Effort
7. Right Mindfulness
8. Right Concentration

1. Right Math for our Community
2. Right Mathematical Intention
3. Right Math Vocabulary
4. Right Mathematical Actions
5. Right Teaching for our Community
6. Right Mathematical Effort
7. Right Mathematical Mindfulness
8. Right Mathematical Concentration

The most famous of all Nepalis once said:

*That this is the **middle way** discovered by a **Perfect One**, which gives **vision**, which gives **knowledge**, and which leads to **peace**, to **direct acquaintance**, to **discovery**... to **nibbanna**.*

the Dhammacakkappavattana Sutta

Thank you! Obrigado! Dhanyabad!

Where do we go from here?

Small Group activity

- Brainstorming
- Question & Answers