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Accepting the Other: Different Division Expression

Aceitando as diferenças algorítmicas dos outros

Pedro Paulo Scandiuzzi[1]

Abstract

This article describes some experiences in my work close to the forest indigenous people of Brazil and these descriptions are possible because ethnomathematics´s theory is based in Paulo Freire´s method and anthropology. Gathered at an indigenous people's meeting point, I gave some classes on mathematics teacher pre-service education to a group of 19 people with 13 different languages. I began the didactic work with drawings and observed different drawings associated with people of different languages. This article shows representational differences in the algorithm of division. The representations, combined with idiom, myth, and affect, combine to illustrate cultural influences in mathematical education. This demonstrates the need for teachers in classrooms to be aware of people of different languages and cultures. Teachers need to be sensitive and respectful of linguistic and cultural difference, and to demonstrate solidarity, cooperation, and respect towards different students. A new posture in mathematical teaching is implied.

Key words: ethnomathematics education, indigenous education, mathematics education

Resumo

Este artigo descreve algumas experiências no meu trabalho junto aos povos indígenas do Brasil e as descrições são possíveis porque a teoria da etnomatemática está baseada na metodologia freireana e antropologia. Durante a minha permanência junto aos indígenas , ao ministrar oficinas de matemática para um grupo de 19 indígenas com 13 diferentes línguas eu comecei meu trabalho didático desenhando e observei as diferentes associações ao desenhar com povos de diferentes linguagens. Este artigo mostra diferentes representações no algoritmo da divisão. Representações, combinadas com idiomas, mito e ao afeto, serve para ilustrar influências culturais na educação matemática. Isto demonstra a necessidade para professores em sala de aula estarem atentos aos alunos de diferentes linguagens e culturas. Professores e educadores precisam ser sensíveis e respeitadores das linguagens e diferenças culturais, e demonstrar solidariedade, cooperação e respeito para diferentes estudantes. Isto implica uma nova postura na educação matemática.

Palavras chaves: educação etnomatemática, educação indígena, educação matemática.

[1] Professor da UNESP – campus de Rio Claro- SP – Brasil - pepe@ibilce.unesp.br

This work was developed in one of the indigenous areas of the Brazilian center west, called the Xingu National Park (PQXin). This state-defined area is inhabited by seventeen indigenous groups belonging to four different linguistic roots: Tupi Guarani, Macro Ge, Aruak, Karib, and the isolated idiom group Trumai. Their rich idiomatic differences become more evident when perceived within another cultural space, for example, the geometric representations of myths and rituals. The cultural groups have intermittent contacts, but each has significant contact with Brazilian society.

Within PQXin there are educational institutions set up to help the indigenous groups to understand the world that each day approaches them in different ways as travellers, doctors, anthropologists, linguists, educators, land-grabbers, and so on. In this context, I had the opportunity of advising on the mathematics component of indigenous teacher education courses. These were organized by NGOs in partnership with the federal, state and municipal governments and were given from the second semester of 1995 to October, 1997. This paper describes my orientation to this work, and illustrates the multi-cultural and multi-lingual issues that arise within it. It concludes with some reflections about the role of teachers in such a situation.

A Freirian Approach

When I began the work many questions appeared, for example: What education will the participants have had? What education is appropriate? Should there be a uniform or differentiated national teacher curriculum? What are the consequences of the same curriculum and teaching strategy is given to different people? Is it possible to present a national curriculum for students with other experiences without having problems with different cultural representations?

My experience in public schools in urban environments, led me to the methods developed by Paulo Freire (Torres, 1981, 156-163). This Freirian method demands that first we know our pupils and that as this knowledge grows, the educational dialogue grows deeper, leading to a true knowledge exchange. Through the dialogue, knowledge change occurs. This way goes to until a symmetric dialogue. When the world vision of the educator

and the educated is different, the dialogue of differences leads to growth of both parts. Thus:

> ... the pedagogic space is a text to be constantly 'read', 'interpreted, 'written' and 'rewritten'. In this sense, the more solidarity that exists among the educator and educated in this space, so much more the possibilities of democratic learning open up in the school. (Freire, 1997, 109)

Such an orientation demands a lot from us as mathematics educators. It is not sufficient to only know the participants names, origins, work, ambitions, and the reasons for them being in the programme. Knowledge for dialogue means to be side by side, trying to understand gestures, symbols and signs, glances, silences, and language. It means to intertwine worlds in an equals-to-equals relationship, mutually giving and receiving information, growing together in the search for knowledge and in comprehending each others' worlds.

In this context, what does it mean to comprehend worlds? A person that is born in a city has an internal knowledge that they acquire when noticing what happens inside their house, in their city, in dialogue with their neighbors, and in the media. A person that is born in the center of the forest, will learn how to survive, (to deal with fire, to cut wood, and so on), and how to relate with those with whom they live. These two people, one from the city and one from the forest, each build signs, symbols, and specific languages to explain what happens around them. That production for understanding enables them to solve daily problems. This we can define as world understanding.

Notice that, in each period, new languages are created: computer languages, languages of the arts, languages of mathematics, juvenile and adult languages, languages of the rich and poor, languages of industry and agriculture. These may be expressed as French, English, Portuguese, Guarani, or Kuikuro. Those idioms involve the symbols needed to communicate, but they cannot themselves embody the gestures, the emotions, or the particular sounds of the speakers of the idiom.

Urton (2003, 26-28) defines the concept of writing as "the communication of specific ideas in a highly conventionalized, standardized manner by means of permanent, visible signs". This corresponds to what Santos, Barracco and Myazaki (1975, 15) called

horizontal communication. It appeared in the 21th century, and developed along with materials and linguistic transformations. There is another communication, named by them as vertical communication (p. 16)

> Vertical communication is the production of sound, of gesture and of movement. It is the world of universal communication and can neither be changed temporally nor spatially once it is in the world of meanings where it is found in the 'form-content' relation, and not in the conventional thought of the user.

Santos, Barracco and Myazaki (1975, 17) said "[vertical communications] don't possess anything in common in their codes, amongst readers the only community element is the human being".

Then, you can see, the teacher pay atentain, generally, in the horizontal communication and forget the vertical comunication

However, through this entanglement of languages that seem sometimes to separate rather than unite, to individualise rather than to group, the dialogue must be built, and a way found to allow different people to understand each other and themselves, thus reaching their full accomplishment as human beings.

In this way, the Freirian theory contributes to the ethnomathematics program proposed by Ubiratan D´Ambrósio (1991, 70). This programme makes us rethink the arts and techniques of counting, classifying, comparing, and measuring, used by different people to describe the information that they observe and come to understand. Techniques that, in dialogue with others, become knowledge from horizontal comuniation and the product of art from the vertical communication.

An Example

In this article I present data from a mathematics class which involves people of three ethnic groups: the *Panará,* the *Juruna*, and the *Kaiapó*. The *Panará* and the *Kaiapó* speak languages from the same linguistic root (Macro Ge), while the *Juruna* speak a language from a different root (Tupi Guarani).

But, before me to continue this paper is necessary to explain what I think about the difference between mathematics and ethnomathematics for my understanding. For me, mathematics is the name of the power science, the best science according economical and politically dominant, but the construction of science don't depends this position but only need creative and free men/women. In all people have creative persons. For me, the road of those that likes mathematics is very important but they teach what find only in the book, but ethnomathematics is educator and need understand what the other does and help them inside their science's constructions.

The same way, academic people ask about the preoccupation in inequality perpetuate. I don't have this preoccupation because Freirean´s education had the same problems and I know it's impossible to do comparison among two cultures because the more fort will always look at navel. The ethnocentrism is clear. Always, in the same space, where two people live, if don't have the dialogue with respect, solidarity and cooperation, one is more fort then other then the first one dictate the rules. In case of this paper, the national society says what the indigenous people it can and it should do. But the indigenous people walk differently than the national society orders. The people follow the same way that explains Certeau (1994, 97-102). He explains about the forces among the people and their governants. The people take another way and governants need change again their strategies. This is a life's game. Paulo Freire called guiles and tricks.

In this thought line, the following data were collected in 1996 when I taught the topic of division. I chose division because the indigenous people asked me about it. Freire spoke us is important for students they have curiosity about the content of the educator dialogue. But in different drawings or another situation about structure their thought is possible find data like these, but isn´t the subject here in this paper.

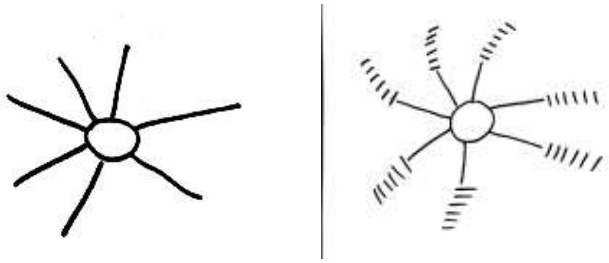
The indigenous people of this area have two conceptions of division. One is where everybody receives an amount proportional to the needs of each. Indigenous societies have specialists for making such divisions. The second conception is what they imagine happens in Brazilian society, where division means a lot for some and nothing for others.

I explained what I, as a mathematics educator, understood as division. Starting from the different conceptions, we created a third conception, an abstract one, that gives the

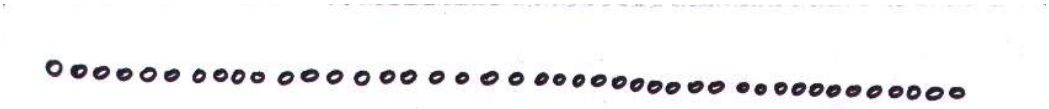
same amount equally to everyone, taking no account of needs, status or power. The division operation was then shown in a daily problem.

A fisherman went fishing. He caught 42 fish and had to divide them amongst 7 families. How many fish will each family receive?

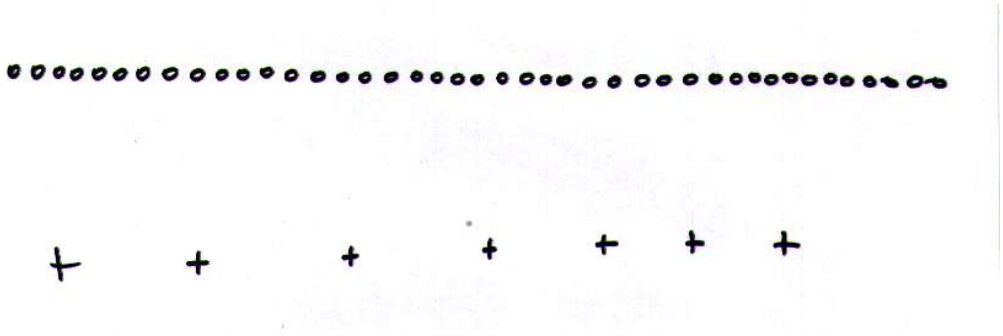
The *Juruna* teacher drew a circle and placed "whiskers" to represent each of the families. Then, the fish were distributed, one by one, to each family:



The *Panará* teacher placed the amount of fish in a horizontal line.



Underneath that, he placed crosses representing the number of families that would receive the fish:



Then he guessed how many fish each family would receive and made an adjustment at the end:

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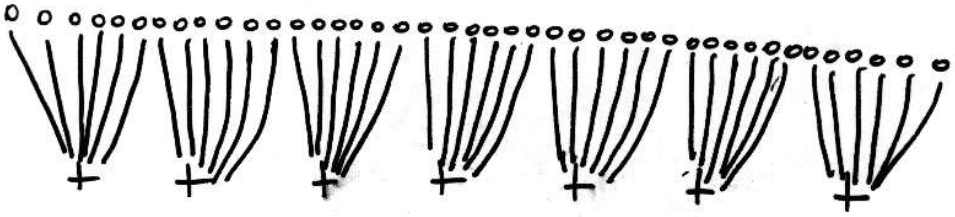
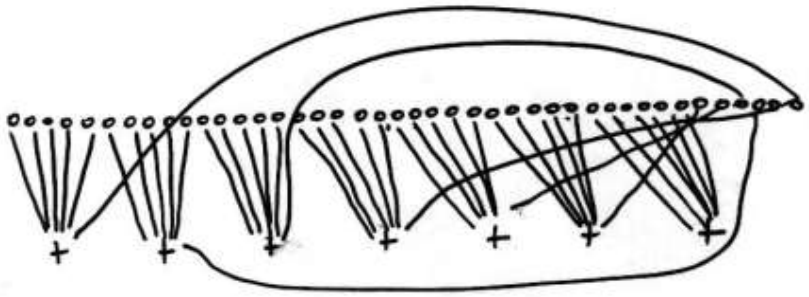
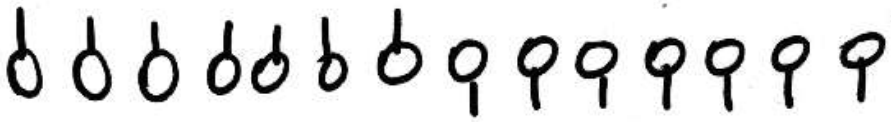


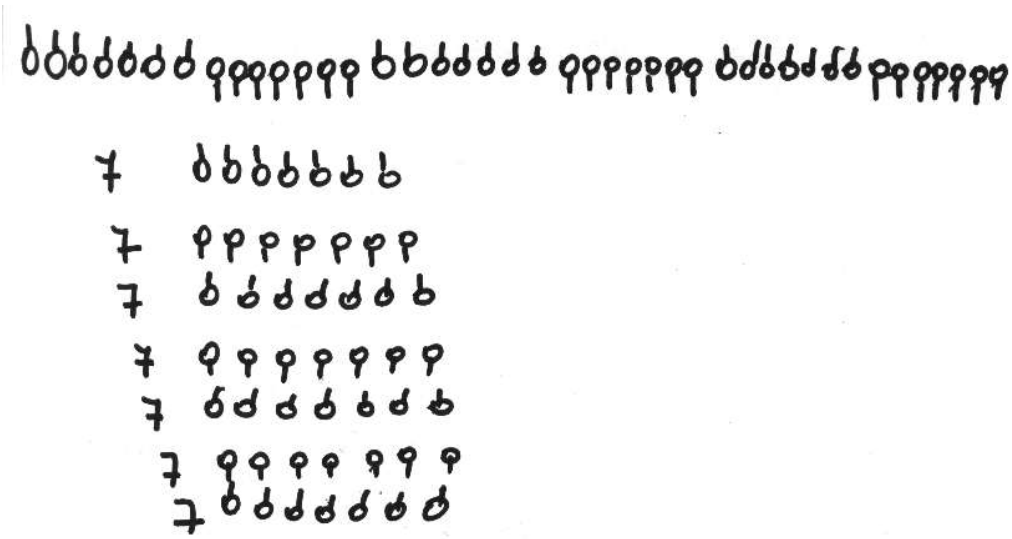


The *Kaiapó* teacher memorized the number of families in the problem and drew the first seven fish, one for each family.

After this, he distributed a second fish for each family:



and followed the distribution process using this rhythm till the end.



The method I taught was to draw tally marks representing the total number of fish, and then use horizontal marks to indicate one for each family who would receive fish. The result is the number of horizontal marks:

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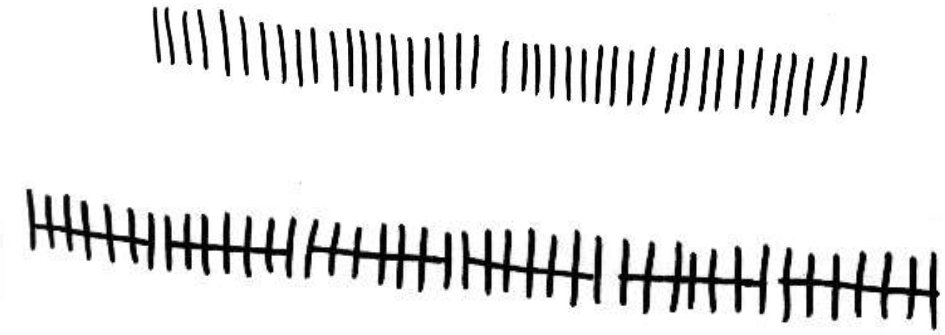
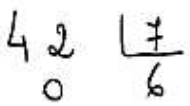
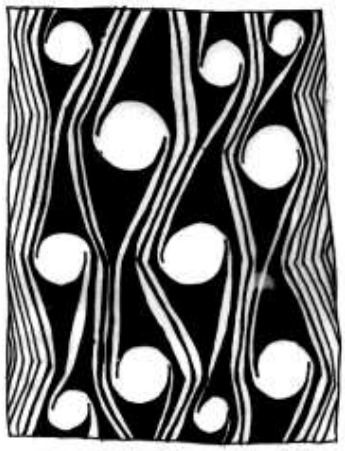




It was expected that the students would imitate the teacher, but the above data demanded from me as an educator some attitudes, thoughts, elaborated postures, and respect towards others in order to allow the school space to be culturally differentiated.

It was noted that in this indigenous space, the student-teachers were not concerned to imitate the teacher, but used the opportunity to explain how they understood the world that surrounds them and how this is manifest in the concept of division as it is processed within their group. They described how they learned from the elders and from the *shaman* of the indigenous settlement through its histories and myths. It is possible that the procedural differences between the *Panará*, the *Kaiapó,* and the *Juruna* may have to do with the way drawings are made: the shapes used the purposes to which drawings are put, and so on. Maybe they are similar to Kayabi (a neighbouring indigenous tribe who speak Guarini), about whose geometric education I have previously written (Scandiuzzi 1996a, 1996b).

For more explanation I put here Juruna´s draw and Kaiapó´s draw. The Kaiapó uses only right line. The Panará draw with right lines too.



Teaching Implications: specific conclusion between theory and data

I know is very important this part because all readers wait this moment. But, for me, is the most important when you show which theory you believe, show also the data found in the field and put together and the readers do connections. If, I show all connections and

discussions is not possible I to say: I believe in dialogue, in Freirean´s education, in ethnomathematics. However, I will do some remarks. These observations are my dialogue whit the readers, I wait.

An obvious observation is that mathematics teachers need to be attentive to such cultural details as are embodied in myths and drawing conventions and language. This is to avoid an ethnocide, and the possibility of discrediting the elders and *shamans*. Knowing the fragile dynamic of these cultures in particular, educators need to be careful not to inadvertently upset traditional balances. It is important observation because if you like mathematics you can to impose and don't respect and observe different science constructions. The data teach us the answer questions did before in this article.

A mathematics lesson produced evidence at a very basic level that people of different places understand the world starting from how they live and what they know. It should not surprise us that this builds different world views. Where different idioms or languages are used, the distances between world views are likely to be bigger, and more deeply embedded. Is it possible that our cultural disrespect is the reason that urban as well as indigenous students avoid school?

A natural conclusion is that we should demonstrate respect by using the idiom or language used by the people themselves. Every translation contributes to a loss of identity and a further separation between the student and the learning. The consequence of this conclusion is that if we force a national language of instruction (for mathematics in this case), then this may have drastic consequences for some of the people on whom it is being imposed.

However we know that is impossible to avoid change, and that linguistic dynamism enriches cultures. What emerges from this analysis, however, is that the dialogue must create changes of world views for both sides, and that the consequences should not make one group suffer more than another, for example by destroying the values in which they have believed from generation to generation.

Mathematics has a very special place in this situation because it is with it that we work with space, forms, and quantification, and those areas of knowledge are intimately linked to its myths and its rituals, and hence to its world view.

We conclude, therefore, that a special mathematics education needs to be taught to a culturally differentiated group of people. They deserve an adapted dialogue that is in agreement with their ethnicity. The strategies require that we understand their needs, their daily concerns, their myths, their rituals, their histories, and their language—as they understand ours in their own way. Each understanding has its own validity. As stated by D´Ambrósio (1994, 3):

> To speak of mathematics to indigenous people carries a message that comes from outside. For those more sensitized to the history of indigenous people, it is to speak of the conqueror, and to speak of something that was built by the ruler, that serves as an instrument to exercise its domain.

An educator's posture should exclude all self-sufficiency, to dialogue with equality, to accept the difference and the alteridade, to leave the other to define itself from a self-reading of its own identity. This posture is part of the ethnomathematics programme, and recognizes the social capacity of decision-making and participation in education, that is, the programme of the processes of formation of the indigenous people. We must recognise and accept cultural plurality and the right for people to handle, in an autonomous way, the resources of their own culture. They are the people that should decide their future, according to projects that come from their own interests and aspirations.

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