How is a Mayan Ethnomathematics Perspective Actualized Through Intercultural Dialogue?

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ABSTRACT This paper looks at the role of ethnomathematics in mathematics education through the lens of intercultural dialogue, mutual conscientization and challenging Eurocentric conceptions of mathematics in a research and collaborative teaching setting at an autonomous Mayan educational community in Chiapas, Mexico. The focus is on the intersection of indigenous knowledge and an ethnomathematics perspective, which allowed Mayan teachers to develop their own constructions of Mayan-based mathematics over time. The author argues that a culturally sensitive approach to this kind of work can offer broader implications for research and practice in ethnomathematics generally.

> *It is important to recuperate the knowledge of our ancestors. In the autonomous schools we are achieving this goal step by step. In general, the teaching of mathematics is based in European culture.*
>
> - promoters from Mayan autonomous school (my translation)

Introduction

I had the opportunity and honor to work with a Mayan autonomous secondary school in the Highlands of Chiapas, Mexico from July 2000 to July 2003. Autonomous education has been developed in Mayan communities in Chiapas as part of a resistance movement confronting the homogenization and ongoing colonial policies of the Mexican government toward indigenous peoples. Our collaborative teaching/learning and my ethnographic-style investigation allowed us to uncover the hidden role of Mayan ethnomathematics that was present in the community yet not visible. Part of our work involved coming to terms with an argument for ethnomathematics as a cultural way of doing mathematics, made even more powerful by ancient Mayan concepts and practices as well as those carried out by contemporary Mayans in Chiapas. This did not mean, however, that a pervasive Eurocentric approach to mathematics, commonplace in government schools in Mexico, did not have a foothold in the autonomous school as well.

During our periods of work together, a process of "mutual conscientization" based in Freire (Freire, 1970, 1985) and "intercultural dialogue" (Apffel-Marglin, 1998; Rockwell, 2002) helped to build a trust essential to embark on this journey together. Intercultural dialogue was critical to communicating across cultures in a mutually respectful manner essential for Mayan ethnomathematics to emerge. A key piece of this dialogue was rooted in respect for indigenous ways of knowing and practicing the humility needed to genuinely follow the leadership of the Mayan teachers (promoters).

Definition and Scope of Ethnomathematics

The working definition of ethnomathematics that has been theoretically and pragmatically sound in the context of autonomous Mayan education is rooted in a dual perspective in the early work of D'Ambrosio (1988). First, ethnomathematics is understood as cultural groups having their own ways of doing mathematics. Second, what is often known as the history of mathematics is "actually the history of European mathematics" (D'Ambrosio, 1988).

This two-pronged definition of ethnomathematics was both useful in my own thinking and practice but also in conveying a cogent argument to Mayan promoters. This approach framed the initial discussions in workshops we had together and continued to be a framework for deconstructing the "universalism" of Eurocentric mathematics. It rang true in countless examples provided by young Mayan promoters who had been degraded by Mexican official schools in mathematics as well as in all arenas of interaction.

An additional conceptual approach that proved very useful in our context comes from the work of Gerdes, who had ample evidence from his own experiences working with indigenous Africans historically colonized by Europe. Gerdes talked about the need to "unfreeze mathematics frozen by colonialism" (Gerdes, 1988, p.142). This notion captured the imagination of promoters in the short term and was integral to our process over time.

It is important to recognize, as part of the conceptual scope of ethnomathematics, the influential work of others whose research and practice in international and indigenous settings has been inspirational and guiding. This includes the work of D'Ambrosio (1985), Gerdes (1985, 1988), Knijik (1998, 2004), Lipka (1998), Hernández (2002), Morales Aldana (2001), Pinxton (1997) and Verran (2001). While not an exhaustive list, the work of those mentioned had notable impact and helped to provide theoretical and practical comparative evidence.

Indigenous Knowledge and Ethnomathematics Research

There have been important developments in the last ten years that confirm the role of colonialism in some research practices particularly in relationship to indigenous communities. Several indigenous and non-indigenous scholars have explained why practices of outsiders that seek to control and define how research should be carried out in indigenous communities, as well as be the sole owner of the final research product, have been rejected by indigenous communities from Latin America to Canada and New Zealand (Apffel-Marglin, 1998; Battiste, 2002; Kawagly & Barnhardt, 2005; Tuhiwai Smith, 2002).

In light of these understandings, it is even more important to adopt a pedagogical approach that seeks to learn from and respect indigenous knowledge. Only in this context, from my experience, can an ethnomathematics capacity be developed, rooted in Freirean dialogics and problematizing (Freire 1970, 1985) as well as in transformative, decolonizing methodologies (Gerdes, 1988; Tuhuwai Smith, 2002).

At the autonomous Mayan secondary school in Chiapas, the emergence of an ethnomathematics perspective was integrated within a theoretical framework and practice of indigenous ways of knowing (Hirsch-Dubin, 2005). What this meant in a practical sense was working collectively at a pace determined by the Mayan community to examine, discuss and digest ideas presented, with many concrete examples, to decide what they thought over time. It meant recognizing Mayan ways of knowing as experiential, observational, holistic, rooted in ancestral teachings and in the importance of thinking and communicating in original languages. Articulation and affirmation of indigenous ways of knowing provided a constructive counterpoint to the damage caused by over 500 years of colonial policies and gave voice to Mayan epistemology.

It was only in this complex interactive context that adopting an ethnomathematics perspective could be understood. The stated goals of the school were to reclaim "culture, language and resources" (Hirsch-Dubin, 2005) which had not been applied to the area of mathematics when I began work at the school. Through a four-year process that involved a dialogic, problem-posing methodology (Freire 1970, 1985), mutual conscientization (ibid), and intercultural dialogue (Apffel-Marglin, 1998; Rockwell, 2002), promoters internalized a Mayan ethnomathematics approach, as evidenced by the articulation of the language of ethnomathematics (Hirsch-Dubin, 2005). For example, a group of promoters said in July 2002 "*We did not receive Mayan mathematics in school because they* (*the government) did not want the indigenous to know our true history*" (Hirsch-Dubin,

2005, p.183). In response to a question posed in July 2003 "*What is ethnomathematics?*" a group of promoters said, "*Ethnomathematics is created in the environment of each people, each culture, like the example of Mayan mathematics, which is its own knowledge*" (ibid, p. 183).

Furthermore, the adoption of a Mayan ethnomathematics was made possible by relating it to daily practices in the communities. This included practices related to agriculture, which is the basis of Mayan subsistence economy as well as held sacred, as well as weaving, which is one of the oldest Mayan traditions carried out principally by women. Agriculture and weaving still utilize the vegisimal system of the ancestors, from examples of the 20X20 cornfield *(milpa*) to multiples of twenty used to calculate dimensions for weaving. Thus, ethnomathematics was grounded in everyday experiences shaped by Mayan culture.

Implications for Ethnomathematics and Mathematics Education

Ethnomathematics is a potential material resource in which "material resource" is defined as "a set of ideas and practices made available in interactional spaces" (Hirsch-Dubin, p.166). Practically speaking, this means that once a body of culturally generated knowledge of mathematics thinking and practices is collected, it becomes a material resource to draw upon and reference. Utilizing intercultural dialogue (Apffel-Marglin, 1998; Rockwell, 2002), which is rooted in Freire's concept of "conscientization" (Freire, 1970, 1985) and principles of emancipatory popular education (O'Cadiz & Torres, 1994), enables ethnomathematics to become an even more viable material resource.

An instructive consequence of our work in Chiapas is that an ethnomathematics perspective can be encouraged but is ultimately the decision of the specific community to adopt. I believe this understanding has broader implications for theory and practice, as asserted in the work of activist scholars like Gerdes (1988) and Knijik (1998, 2004). Illustrated by the autonomous Mayan school in Chiapas, the evolution and emergence of a community commitment to an ethnomathematics approach takes time and multiple spaces to develop. This is certainly needed to "unfreeze the mathematics frozen by colonialism" as argued by Gerdes (1988) but is also applicable to mathematics arenas dominated by Eurocentric ways of thinking about and practicing mathematics, which are prevalent in mathematics education.

In the United States, the term "culturally relevant mathematics (Gutstein, Lipman, Hernández & Reyes, 1997; Tate, 1995) is used more often than "ethnomathematics." Many of the research and practical implications are the same,

given the large numbers of marginalized students of Latina/o, African American and Native American students who feel a profound alienation from mathematics, even more accentuated along gender lines. As a result, there has been a growing attempt to relate both mathematics and science to some of the cultural background of the students. I believe students of all background would benefit from the opportunity to learn about and identify with their rich mathematics heritage and ongoing cultural practices (Khisty, 1995).

Conclusion

What I have argued in this paper is that the conceptual basis and practice of developing a Mayan ethnomathematics perspective through conscious decolonizing methodologies (Tuhiwai Smith, 2002) including intercultural dialogue (Apffel-Marglin, 1998; Rockwell, 2002), was essential to building a strong foundation at the autonomous school in Chiapas. This process took four years to accomplish and is being pursued today. Acknowledging the time and rhythm of the Mayan-based process was essential to respect and follow for myself as an outsider to their community. While I was responsible for initiating this process, it quickly became a collective product led by the Mayan community and myself.

Once the Mayan autonomous educational community was exposed to the powerful examples provided by the foundational work of D'Ambrosio (1988), and the inspirational research of Mozambican mathematician Paulus Gerdes (1988) working with indigenous Africans to uncover the mathematics hidden in their cultural practices, there was a strong basis to begin to reclaim and give voice to Mayan mathematics. A pivotal example provided by Gerdes working with future mathematics teachers in uncovering the mathematics embedded in woven buttons, was illustrated by the statement "*Had Pythagoras-or somebody else before him-not discovered the theorem, we would have discovered it*" (Gerdes, 1988 p. 152). This statement, shared at a workshop in Chiapas in 2001, provided a brilliant insight into what was indeed possible to uncover and recover in marginalized, colonized indigenous communities.

I would like to conclude with a quote translated from workshop evaluations by the Mayan promoters and students at the autonomous school:

> *We are descendants of the ancient Mayas. They had extraordinary knowledge and could calculate many things in a very advanced way. We want to follow in their footsteps because we are also Mayan.*

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