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## EXPLORING MATHEMATICAL KNOWLEDGE THROUGH POLYSEMIC CONNECTIONS OF ETHNOMATHEMATICS

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As editors, we would like to thank all of the authors for accepting the invitation to write for the dossier entitled *Exploring Mathematical Knowledge through Polysemic Connections of Ethnomathematics*. As the readers can see, this project is sponsored by the *Revista ETD: Educação Temática Digital*, Faculdade de Educação, Universidade Estadual de Campinas (UNICAMP). We are extremely grateful for the support and encouragement of the editors and faculty at UNICAMP for the development of this project as well. The 15 authors of this dossier were invited to discuss their ideas, perspectives, and share their research on the polysemic connections of ethnomathematics. The 08 articles presented here represent 04 (four) countries: Brazil, Greece, South Africa, and the United States of America.

In this special edition, we also emphasize the importance of Brazilian mathematician and philosopher Ubiratan D'Ambrosio in relation to the development and evolution of ethnomathematics as a program. As one of the most important theoreticians in this research and knowledge field, D'Ambrosio offers encouragement, leadership, and dissemination of new ideas, concepts, and perspectives involved in ethnomathematics around the world and its applications in mathematics education.

In this dossier, the authors discuss the emergence of important terminologies related to an emerging research field named *ethno-x*. We use this generic term, where *x* is a particular subject or area of study that pertains to the classification of academic knowledge while *ethno* refers to cultural traditions identified by codes, conduct, symbols, myths, and in a more specific way by the modes by which members of sociocultural groups reason and infer. A major goal of *ethno-x* knowledge fields is to promote a theoretical foundation able to integrate different branches of natural and social sciences to other fields of scientific knowledge.

In order to clearly address the interrelationships of local knowledge sources with broader universal forms, we need to understand concepts found in traditional knowledge, such as science and mathematics, supported by research in the ethnosciences and ethnomathematics. Philosophically, this approach links or bridges different cultures in an attempt to clarify understanding and mutual respect among all peoples. In this regard, an ethnomathematics program aims to stimulate broader reflections about the nature of mathematical thinking in cognitive, historical, social and cultural environments motivated by the intention to clarify understanding from knowing and doing as the knowledge built by

mankind in different cultural or ethnic contexts, communities, peoples and nations found worldwide.

In their article entitled *Polysemic interactions of ethnomathematics: an overview*, Rosa and Orey state that local knowledge interrelationships related to assorted academic knowledge areas are important to enable a more precise understanding about a particular study field in relation to diverse forms of mathematics. This approach is important in order to further advance research and understanding in relation to an ethnomathematics research program and its polysemic relation with other knowledge fields.

In his article entitled *Ethnomathematics: Three Pedagogical Proposals for Education Fundamental School*, Bandeira affirms that the ethnomathematics diffusion in the scope of fundamental school is still scarce, despite its proposals for the pedagogical action. Thus, he presents three researches directed to the teaching of fundamental education under the light of the dambrosian conceptions of Ethnomathematics.

In his article entitled *Ethnomathematics and the Pursuit of Peace and Social Justice*, Ubiratan D'Ambrosio argues that issues affecting society such as national security, personal security, economics, social and environmental disruption, relations among nations, relations among social classes, people's welfare, the preservation of natural and cultural resources, and many others can be synthesized as Peace in its several dimensions: Inner Peace, Social Peace, Environmental Peace, and Military Peace, which are intimately related.

In this article entitled *Mathematical Concepts from Community Elders: Exploring the Connection between Ethnomathematical Contexts and Classroom Practices*, Mosimege argues that members of the community possess a wealth variety of knowledge in indigenous activities and artifacts. Even though some of the community members have not attended formal schooling or have not studied to a significantly high level, they are able to use the related mathematical concepts with ease as they engage in the activities.

In her article entitled *Conversations, Controversy, and Calculations in na Unpublished Chilam Balam of Yucatan*, Tun explores the benefits and dangers of intercultural contact in the context of the creation and diffusion of Chilam Balam books, sacred texts compiled mainly during the colonial period and used by Maya communities of Yucatan. This reproduction of an original unpublished Chilam Balam manuscript is a unique contribution to the field of Maya studies and evidence of the Maya episteme regarding numbers, time, and the universe.

In their article entitled *Ethnomathematical Confluence Intersection of Native and Academic Worldviews*, Shockey and Mitchell adopt the concept of confluence as a metaphor to consider their ethnomathematical engagement for the past fourteen years. They have worked with students and teachers and have realized that the diversity of meanings brought to our collective mathematical commitment has had many influences. The confluence of the Native worldview and Western academic view is what guides our story. From the Native view we bring the richness of story and oral traditions.

In their article entitled *Polysemic Provocations of Border Negotiation*, Stathopoulou and Appelbaum consider ethnomathematics as path to a renovated education in order to discuss it together with curricular ideas exploring mathematics knowledge in different contexts and the communication/translation among them. Permeable borders of mathematics education force translation that is rarely made visible to those involved: young learners move from school to home to various communities; teachers try to translate mathematical discourse into school cultures that can accommodate multiple student life languages of mathematics and learning.

In the last article of this dossier, entitled *A Mathematical Tool Kit for Generativa Justice*; Eglash, Bennett, Drazan, Lachney, and Babbitt discuss how mathematics can best contribute to social justice and sustainability. They argue that distributive justice addresses poverty and related problems from the top down: by moving extracted value from private to state ownership. Generative justice, in contrast, works from the bottom up: replacing value extraction and alienation with value circulation. In the case of vernacular knowledge systems, colonization by commercial interests has already occurred, and the challenge is to develop a decolonized alternative.

In order to elucidate, clarify and perhaps to facilitate new discussions about the polysemic connections of ethnomathematics, we truly hope that readers will be able to capture the authors' thoughts and concepts regarding ethnomathematics. From the authors own particular vantage points they each have accomplished a great deal to add to the growing body of scientific discourse of this program.

There exists a need to create a new role in relation to mathematics instruction that empowers teachers to understand power and oppression more critically by considering the effect of culture and language on mathematical knowledge by working with their students to uncover the often distorted and hidden history of mathematical knowledge. Any study of ethnomathematics and its polysemic interactions represents a powerful means for

validating a student's real life experiences, and gives us the tools to become critical participants in society.

This perspective forms the basis for significant contributions of a Dambrosian-based ethnomathematical perspectives in re-conceiving the discipline of mathematics and its pedagogical practice. In this context, the use of Freire's dialogical methodology is essential in developing the curricular praxis of ethnomathematics by investigating cultures and languages in constructing a curriculum with people from other cultural groups to create school curricula that enable the enrichment for people's knowledge of mathematics.

Therefore, in the context of an international dialogue, we would like to broaden the discussion for possibilities of the inclusion of ethnomathematics and its polysemic interactions in the mathematics curriculum that respect the social and cultural diversity of all people in their search for peace. This approach guarantees the development of understanding our differences through dialogue and respect in order to avoid all kinds of domination and oppression.

In this regard, ethnomathematics demonstrates how mathematics is composed of many diverse and distinct cultural traditions, not just those emerging from the European-Mediterranean region. For example, local knowledge interrelations are related to varied academic knowledge areas and are important in enabling a more precise understanding about a particular study field and its use of the polysemic interrelations of the mathematical processes.

These interrelations must be clearly addressed, especially, wherever one needs to understand specific concepts acquired through academic knowledge broadly based on biology, ecology and mathematics; which may be supported by ethnosciences and by the newer research fields of ethnomodeling, ethnocomputing, and ethnopedagogy in order to understand polysemical relations and ethnomathematical interactions. The main goal in this discussion is to further advance the research and understanding on the context of ethnomathematics research programs in diverse locations in the world.

Mathematical thinking, in concert with science, has been influenced by a diversity of human characteristics such as our languages, religions, morals, and economical-social-political activities. In concert with these, humanity has developed logical processes related to our universal need to pattern, quantify, measure, model and explain, all shaped and operating within different social and historical contexts. Because each cultural group has its own way of doing mathematics, these connections have come to represent and are embedded in a given cultural system, especially in the way that diverse peoples quantify and

use numbers, use geometric forms and relationships, measure or classify objects in their own environment.

As part of this, each cultural group has developed its own way to *mathematize* their own realities. Western scientific arrogance often presents a disrespect of and outright refusal to acknowledge diverse cultural identities and puts processes of understanding and comprehension of the many non-Western cultural systems at risk. Because this aspect gives a sense of confidence and dignity to students when their previous knowledge is acknowledged, these particularities should not be ignored and they should be respected when individuals enter school. Thus, a search for new methodological approaches is necessary to share, record, and include diverse forms of mathematical thinking, ideas, procedures, and techniques developed in different cultural contexts. The polysemic interactions of ethnomathematics may be one of the ways to reach this goal.

The focus of the ethnomathematics program is related to the development of student competencies, abilities, and skills through the study of mathematical ideas, notions, procedures, and practices that are directly connected to the student's own sociocultural context. In an ethnomathematical perspective, numeracy relates to abilities that allow students to develop, affirm and further study their own unique local, logical, and mathematical reasoning abilities. This approach depicts a capacity to use mathematical knowledge to solve real life problems by applying number sense, numerical operations, and the interpretation of statistical information.

Once again, in this dossier, the authors have shared and debated the necessity of issues regarding mathematics education, classroom practices, and the knowledge of specific cultural groups in order to explore mathematical knowledge through the use of the polysemic connections of ethnomathematics, which clearly has a role in helping us to clarify the nature of mathematical knowledge and of knowledge in general.

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