

Thematic Section Presentation

International perspectives on Ethnomathematics: from research to practice

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Invited Editors

As editors, we would like to thank all of the authors for accepting our invitation to write for the thematic section entitled: *International Perspectives on Ethnomathematics: From Research to Practice*. This project is sponsored by the REVEMOP, a scientific journal, edited by the *Mathematics Education Graduate Program* of the *Universidade Federal de Ouro Preto* (UFOP). As well, we are extremely grateful for the support and encouragement by our colleagues at UFOP for the development of this project.

The 22 authors of this thematic section were invited to share their ideas, perspectives, and discuss research that represents a truly rich sample of the international perspectives on ethnomathematics. The 14 articles presented in this thematic section represent 10 countries: Australia, Brazil, Greece, Nepal, New Zealand, Norway, Portugal, South Africa, United Arab Emirates, and the United States of America.

In this thematic section, the authors focus on new and innovative investigations in regard to research related to diverse mathematical ideas, procedures, and practices conducted worldwide and the connections related to the pedagogical actions and investigations in ethnomathematics from research to practice.

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 ethnomathematics.

Philosophically, the approaches discussed in this thematic section link or bridge different cultures in an order to clarify the many diverse understandings, as well to the development of mutual respect among members of distinct cultural groups.

An ethnomathematics program aims to stimulate broader reflections about the nature of mathematical thinking in cognitive, political, historical, social, and cultural

environments motivated by the intention to comprehend different forms of *knowing* and *doing* as the knowledge built by mankind in distinct cultural contexts, communities, peoples, and nations found worldwide, and represented in this thematic section

Most importantly, this thematic section highlights the importance of Brazilian philosopher and mathematician Ubiratan D'Ambrosio in relation to the development and evolution of ethnomathematics as a program. Considered by many the *Father of Ethnomathematics*, he is one of, if not the most, important theoretician in the field. Professor D'Ambrosio has continued to support, encourage, and offers leadership, and dissemination of new ideas, concepts, and perspectives involved in ethnomathematics and its applications in mathematics education.

The first article of this thematic section, entitled *Ethnomathematics: Past and Future*, Ubiratan D'Ambrosio (2020) acknowledges that each culture develops ways, styles, and techniques of doing, as well responses to the search of explanations, of understanding and of learning, which are organized as systems of knowledge and religions that lead to the concept of ethnomathematics. D'Ambrosio also shares new trends in the theoretical basis and practices of ethnomathematics by acknowledging different cultural environments and the consequences of the growing migratory dynamics. He also discusses the move towards globalization and the internationalization of education that favors the reinforcement of local considerations. In his point of view, localization has consequences for the future of ethnomathematics as a research program with powerful pedagogical implications.

In the article entitled: *The Taking of Western/Euro Mathematics as Reappropriation/Repair*, Peter Appelbaum and Charoula Stathopoulou (2020) proposed the need to position local knowledge as the authorities that re-appropriate Western mathematical traditions in the service of local concerns. They drew from several post-colonial novels in which a divided world and clash of traditions is at the center of character, plot, politics, and the human condition on the construction of indigeneity as a form of coloniality. They urge the application of a metaphor in order to understand and interpret mathematics education through the prism of ethnomathematics, and question how one might enjoy the privileges of western civilization and yet perceive resistance in this acculturation process as a positive action of affirmation, as well they ask, what are the corresponding costs for any choice? What about students — mostly out of mainstream — at school that very often are confronting a similar dilemma?

In the article entitled: *Stars in the Sky: Pleiades Invite Plenitude. An Ethnomathematics Memoir in Central Brazil*, Mariana Leal Ferreira (2020) acknowledged

that this is a day, a month, a year, and a few decades (dry and rainy seasons included) in real-life mathematics of the Kisêdjê people of the Wawi Territory in Brazil. According to the Kisêdjê (aka Suyá), the sun and the stars rule the sky, while people, animals, and plants create reality on earth. Starting in 1981, this ethnomathematics memoir traces factual moments of her life as a mathematics educator in indigenous schools. Her objective is to show that mathematics education, including map-making, provides important resources in the fight for sovereignty and autonomy for all indigenous peoples.

In the article entitled: *Elementary Pre-Service Teachers Working in Mathematical Borders*, Carlos A. López Leiva (2020) speaks to the importance in using the border metaphor to portray the common separation between school mathematics and students' everyday lives. He described processes that a group of elementary pre-service teachers (PSTs) have experienced to learn about their students and bridge these borders. Content analysis of mathematical activities and PSTs' reflections developed in a mathematics teaching methods course revealed that although they asserted that the process of developing bridges between mathematics and everyday experiences has transformed their self-concept and confidence in mathematics and teaching. He also discussed about possibilities to generate more genuine ethnomathematical approaches to the teaching and learning of mathematics.

In the article entitled: *Challenging the Traditional Curriculum by Traditional Knowledges: From Ethnomathematical Fieldwork to Classroom Practices*, José Roberto Mafra (2020) provided a discussion related to the development of educational practices, having as basic assumptions the planning, organization and implementation of an ethnographic field research, from the production of decorated and incised bowls, by women artisans in the Aritapera region, state of Pará, northern Brazil. He presented the initial development of the proposal, carried out in the Aritapera region, based on joint planning with teachers from the region, based on the design of a set of local activities for later implementation in the classrooms. With this investigation, he expects to contribute to the field of research in ethnomathematics by bringing empirical reflections aiming at the implementation of local curricular practices based on good educational practices.

In the article entitled: *Revising the History of Number: How Ethnomathematics Transforms Perspectives on Indigenous Cultures*, Kay Owens and Charly Muke (2020) affirmed that many accounts of the history of number rely on written evidence such as clay,

stone, and wood engravings or paintings. They also argued that some of the oldest cultural groups (between 5 000 and 30 000 years old) have had only recent contact with the rest of the world, namely between 80 and 140 years ago but these were oral cultures without written records. Their objective is to find out about how the members of these cultural groups' understanding of number has involved analysis of the types of counting but also how counting related to the rest of their cultural relationships. They also provided brief summaries of the history of number in Papua New Guinea and Oceania; as well they discussed how the diversity of systems can inform school mathematics learning in any part of the world.

In the article entitled: *Ethnomathematics and Indigenous Teacher Education: Waka Migrations*, Tony Trinick and Tamsin Meaney (2020) presented findings from a project in which pre-service teachers investigated ethnomathematical practices using the context of ancestral ocean voyages by canoes. They chose this context because as a primary identification marker for Māori people, it is related to ancestral canoes. The results indicated that pre-service teachers in this study did not generally associate these ancestral voyages with mathematical practices, indicating that more work is needed to increase their understandings of ethnomathematics in which practices connected to traditional methods of navigation were disrupted by myths perpetuated by European colonists. They also acknowledge that despite this, a renaissance in canoe building and interest in traditional navigation practices provided the pre-service teachers with valuable information.

In the article entitled: *The Use of Indigenous Games in the Teaching and Learning of Mathematics*, Mogege Mosimege (2020) argued that games play an important role in various communities. He also pointed out that despite how some research indicates that these games can be used to advance and create a connection between classroom activities and the real-life contexts, the connection has not been explored adequately to make this a reality in many classrooms. In this article, He reported on various indigenous games that are a common feature in South Africa. He also identified a number of indigenous games that are popular and how such games have been used to promote cultural heritage. As well he discusses examples of the use of such games in the teaching and learning of mathematics in schools.

In the article entitled: *Ethnomathematical Paths to Financial Educacion: Analysing Cultural Traits of Deaf Students*, Rodrigo Carlos Pinheiro and Milton Rosa (2020) looked at the cultural traits produced by Deaf students concerning the development of their financial education in accordance to the perspective of the Ethnomathematics Program. They outlined the participants' profile; and provided a brief description of grounded theory that was the

methodological design used to conduct their study by using specific coding procedures. The authors also emphasize the relation between ethnomathematics and deaf culture through the use of jargon and procedures used by Deaf students in the study of mathematical content related to financial education. The results showed that ethnomathematics contributed to the understanding and awareness of the main characteristics of Deaf culture and its relations to school mathematics.

In the article entitled: *Connecting Ethnomathematics and Modelling: a Mixed Methods Study to Understand the Dialogic Approach of Ethnomodelling*, Diego Pereira de Oliveira Cortes and Daniel Clark Orey (2020) conducted research on ethnomodelling in both a state public school and in a local farmers' market in a metropolitan region near Belo Horizonte, in Brazil. The main objective of their study was to identify how dialogical approaches of ethnomodelling contributed to the process of re-signification of function concepts learned by 38 students in the second year of high school during their interaction with a local farmer and his labor practices. Data were analyzed simultaneously by applying mixed method study through a QUAN+QUAL design. The results show that ethnomodelling provides an integrative approach to school mathematics curriculum by using both the emic and etic mathematical knowledge through the development of a dialogic approach that shows the relevance of cultural encounters.

In the article entitled: *Reaching the 21st Century Student in the United Arab Emirates Using Ethnomathematics through #Innovation*, Jason D. Johnson and Darryl Corey (2020) developed a project to create a mathematics application to encourage young Emirati students to engage with mathematics. The project aimed to provide Emirati students opportunities to explore mathematics based on modules grounded in Emirati culture, such as henna, prayer beads, and bamboo baskets. The henna activities explored geometric transformations; prayer beads investigated patterns in algebra, and the baskets examined circumference, diameter, reading a ruler, and the origins of π . They provide here a short analysis of grade six Emirati students' henna designs, which related to geometric transformations.

In the article entitled: *Developing Mathematical Skills and Moral Behavior Through Cultural Artifacts: A Study of Math Trial Activities at Patan Durbar Square In Nepal*, Toyanath Sharma, Trilochan Sharma, and Daniel Clark Orey (2020) conducted an ethnographic case study in one of the schools that is transforming itself from a traditional book-based teaching

and learning approach to a curriculum specific child friendly learning environment. Their research also indicates how moral behavior can be developed through mathematics trail activities where students developed field work in groups for different objectives. They changed instruction in order to design activities and projects that demanded children to work in outside school contexts. Their research supported the assumption that mathematical knowledge, skill and moral behavior can be developed through different cultural project-based instructional activities and cultural artifacts and practices are key to ensure effectiveness of learning through ethnomathematics.

In the article entitled: *Ethnomathematical Study on Folk Dances: Focusing on the Choreography*, Sara Ribeiro, Pedro Palhares, and María Jesús Salinas (2020) investigate ethnomathematics in order to analyse the mathematical structure inherent in various elements that constitute folk dances specifically, choreography, music, and accessories of Northern Portugal and Galicia. The authors focus on choreography with the intention to represent and describe movements that dancers perform and have identified different types of choreography based on their dispositions during the dances. They elaborated diagrams and numerical schemes that represent the successive positions occupied by dancers or pairs through folk dances and have concluded that mathematical ideas and procedures resulting from this ethnomathematical research can be used for school practice through the construction of tasks to be applied in classrooms.

In the last article of this thematic section entitled: *Cultural Artefacts as a Metaphor to Communicate Mathematical Ideas*, Jaya Bishnu Pradhan (2020) investigated the cultural artifacts created by the culture of particular group of people embed sophisticated mathematical ideas and knowledge in which cultural artifacts familiar to students mediate and communicate abstract ideas of mathematics. He explores the mathematical ideas embedded in cultural artifacts and assesses its contribution in the process of teaching and learning of school mathematics. The results showed that highly sophisticated mathematical ideas were found in the analysis of different cultural artifacts observed in out-of-school environment. As well, the cultural artifacts familiar to students are the source domain of conceptual metaphors for communicating difficult and abstract concepts of mathematics.

In order to elucidate, clarify, and perhaps to facilitate new discussions about international perspectives on ethnomathematics and its connections from research to practices, we truly hope that readers will be able to capture the diversity of thoughts and concepts regarding the development of this program as presented here in this collection. From the authors own unique vantage points they have accomplished a great deal here in

adding to a growing body of ethnomathematics research.

In so doing, there exists a need to create new roles in relation to mathematics instruction that empowers teachers to understand power and oppression, and how they can consider the effect of culture and language on mathematical knowledge by working with students to uncover the often distorted and/or hidden history of mathematical knowledge. Thus, any study of ethnomathematics and its international perspectives represents a powerful means for validating and valuing real life experiences and gives us the tools to become critical and reflective participants in society.

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

Consequently, 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 in the development of harmony of mathematical thinking and processes.

These interrelations must be clearly addressed, especially, wherever one needs to understand specific concepts acquired through academic knowledge broadly based on mathematics; which may be supported by the related research fields of ethnomodelling, ethnocomputing, ethnomethodology, and ethnopedagogy in order to understand 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 contexts in the world by discussing its international perspectives.

Mathematical thinking has been influenced by a diversity of human characteristics such as languages, religions, morals, and economical-social-political activities. In concert with these, humanity has developed logical processes related to the 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 relations, measure or classify objects in their own environment according to their own surroundings. 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 put 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 in the educational systems, these particularities should not be ignored and must be respected when individuals enter schools.

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 recognition of emerging international perspectives on ethnomathematics that are developed from research to practices may be one of the ways to reach this goal.

The focus of any ethnomathematics program is related to the development of unique student competencies, abilities, and skills through the study of their own mathematical ideas, notions, procedures, and practices that are directly connected to their own sociocultural contexts. This perspective enables 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 in cultural ways.

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

Hence, in the context of the international dialogue, we hope that we were able here to broaden the discussion for possibilities of the inclusion of diverse and new international contexts and perspectives on ethnomathematics in relation to the sociocultural diversity of all peoples in their search for survival, transcendence, and peace. This approach supports the development of understanding, sharing and respect of our unique differences through

dialogue in order to avoid domination and oppression.

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