Tun, M. (2016). Current Trends in Ethnomathematics. *Revista Latinoamericana de Etnomatemática*, 9(2), 4-11.

Editorial

Current Trends in Ethnomathematics

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This issue of the *Revista Latinoamericana de Etnomatemática* (RLE, Latin American Journal of Ethnomathematics) serves as evidence of the extensive work carried out by researchers around the globe that contributes to the continually growing field of Ethnomathematics and its applications. While Ethnomathematics has a long tradition of scholarship and presence within Latin America, this shared endeavor is a dynamic and diverse effort constantly informed by conversations with the community of practice at large. In this way, we can consider this publication a snapshot of the connections, conversations, efforts, and initiatives that our membership and readership continually maintain, across many language, disciplinary, and institutional divides. This issue is also indicative of the diversity of Ethnomathematics. The featured contributions represent all languages (Spanish, Portuguese, and English) and genres (articles of investigation, reflections, literary reviews, and interviews) currently supported by the journal. The contributing authors have positioned their work in relation to a wide range of geographic contexts (including Chile, Argentina, Colombia, Brazil, Mexico, Paraguay, Papua New Guinea, Panama, Costa Rica, Nicaragua, Guatemala, and the United States), demographics (Mapuche, Arhuaco, Kanamari, Mixtec, Guarani-Ñandeva, community leaders, students, low-income populations, teachers, women artisans, farmers, researchers), and pedagogical settings (indigenous schools, elementary schools, high schools, one-room schools, the workplace, the home, the community) and have employed diverse methodologies and theoretical frameworks in their research design and conclusions.

Because of the great breadth of topics and approaches covered in this collection of essays, it becomes a challenge to identify the exact ways in which these essays collectively advance the

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Ethnomathematics Program; nonetheless, these articles, in one way or another, do articulate the general consensus that mathematics, as well as the teaching thereof, is inherently social. Because math systems and practices are ultimately social constructions, it is of importance to examine the ways in which these social constructions are portrayed, promulgated, and taught. The underlying theoretical framework common to the scholarship here presented is that mathematics is not a given, true form, in the Platonic sense, left to be discovered in new places, but rather a collection of rules, logic, and rationality operating in different ways in different contexts. From an understanding that mathematics and its practices are cultural (as opposed to natural or universal), the authors of this issue have made innovative and new contributions to the field of Ethnomathematics by presenting and analyzing topics not previously explored in Mathematics scholarship (which oftentimes emerges from the very contrary premise that mathematics is indeed natural and universal). By situating and subjectifying the mathematics practices at hand, the authors introduced below add personal voices to the mathematics lived in multiple contexts including the community, the classroom, the institution, the workplace, and the greater society.

Community-based mathematics

One such tendency of Ethnomathematics research prevalent in this particular collection of work is that of the presentation of methods, logic, and knowledge of diverse cultural communities, oftentimes considered non-dominant or underrepresented. These studies oftentimes use ethnographical approaches to document or further understand math practices particular to members of a shared cultural and/or lingual community with the goal of validating or recognizing these alternate logics and ways of knowing. The first article of the collection "The *Rakin*, Mapuche counting, knowledge with use value" by Gloria Quidel Catrilaf and Karla Sepúlveda Obreque takes a critical stance on the cognitive colonization of the eurocentric vision of knowledge and proposes that social justice will only be achieved through cognitive justice--a vision in which knowledge must also be constructed from the point of view of and in connection with indigenous populations. The authors' collection and analysis of interviews in the Mapunzugun language with local leaders greatly contributes to our understanding of Rakin, the Mapuche system of decimal numeration. Like the previous article, "Numbers and arhuaco universe" by Ever De la Hoz Molinares, Juan Pacheco

Fernández, and Omar Trujillo Varilla acknowledges that ancestral communities of the Americas possessed systems of measuring and counting prior to the arrival of the Spanish, and that these systems, born from specific sociocultural contexts, are a reference that can be used to understand and explain one's surroundings as well as solve community-based problems. In this framework, the authors provide details about the principles and symbolic meaning of the Arhuaca number system, as structured and systematized in the Iku language.

Ethnomathematics in the classroom

One way to further validate alternate forms of counting, measuring, and quantifying is to introduce these methods into the classroom. In the case of the article "Ethnomatematics: The teaching of length measurement in 6th-grade at the Indigenous Elementary School in Kanamari- Maraã-AM, Brazil" Benedito de Oliveira Júnior and Edilanê Mendes dos Santos maintain that it is important to associate the knowledge used by the Kanamari indigenous group throughout the years with the school system, in order to help recover and preserve their culture, give a voice to those that have been historically silenced, and convey how their communal knowledge is just as important as that printed in the school textbooks. Through approved visits to the community, interviews, and classroom intervention, the authors effectively document traditional Kanamari patterns of measurement and then use tangible, hands-on measurement activities to introduce the 6th-graders of this indigenous school to these traditional methods both inside and outside the classroom. While each community's math practices are unique, this effort to introduce traditional knowledge into the classroom setting can serve as a replicable model for other similar contexts. Another way to incorporate cultural mathematics into the classroom is by designing math tasks and models related to a student's experienced reality that, in turn, elicit an active participation of both students and teachers. Such a proposal is outlined by Francisco Javier Camelo Bustos, Wilson Yesid Perilla Triana, and Gabriel Mancera Ortiz in the article "Mathematical modeling practices from a critical perspective with high school students." This proposal is innovative in that the social realities of the students become relevant and protagonistic (as opposed to a more traditional method dictated by textbook content), the instructors become mediators, and the classroom becomes a collective space of knowledge construction. The authors apply this technique in a low-income, eleventh-grade math class in Bogotá, document the sessions, and

analyze in detail how the topic of cell-phone use in Colombia can lead to critical and active math modeling and problem-solving in the classroom.

Math teacher and curriculum development

Given the benefits of integrating ethnomathematics into the classroom, as highlighted in the articles mentioned above, the researchers Armando Aroca-Araujo, Hilbert Blanco-Álvarez, and Diana Gil problematize the current state of initial teacher-training in Colombia. Their article "Ethnomathematical and initial training of mathematics teachers, the Colombian case" compiles and analyzes the responses to a survey administered to instructors of undergraduate math and math education programs in regards to the incorporation of ethnomathematics courses in their programs. Their effort not only identifies which programs have incorporated ethnomathematics into the curriculum and highlights the benefits and obstacles of such incorporation, but has the potential to inform institutional policy-making which, in turn, can further promote ethnomathematics from within degree programs (as a complement to the many initiatives of conferences, journals, and publications that operate outside of these programs). Another way to support math teacher training and the integration of ethnomathematics in the classroom is to develop and make available related pedagogical materials; in the article "Instructional design in indigenous numeration: developing an instructional sequence for one-room schools" the authors José Luis Cortina and Gerardo Crisanto Rojas provide such materials and theoretical justification thereof. These authors are both part of a team of scholars that have worked on promoting the teaching of numbering systems in indigenous schools since 2008 and in this article they present specific lesson plan and pedagogical materials designed to teach Mixtec (*tu'un savi*) numeracy in a one-room indigenous school in an interactive way. By recognizing numbering systems as central to language and culture, this work is of interest to those working in intercultural education or multilingual classroom settings in which bilingual education in mathematics can be perceived as a benefit to students as opposed to a detriment.

The mathematics of the workplace and recreation

Beyond the classroom and institutional settings, ethnomathematics research has also brought attention to the numeric methods and logic prevalent in the workplace or alternate spaces of expression. The National Council for Scientific and Technological Development (of Brazil),

for example, provided funding for projects focused on traditional agriculture and fishing methods, including that carried out by Alice Stephanie Tapia Sartori, Juliano Espezim Soares Faria, Claudia Glavam Duarte, and Valdirene Teixeira Flor and published in the article titled "The language games of cassava flour production process: one Ethnomathematics study." This work highlights the logic and numeric reasoning of the cassava flour workers, in connection with a methodology informed by a) Foucault's problematization of hegemonic scientific discourse, in so that the goal is not to understand a particular cultural group's knowledge in terms of academic mathematics but rather in its own terms and subjectivity, and b) Wittgenstein's problematization of language, in so that the existence of diverse languages gives rise to diverse rationalities, thus making the pretension of a universal language of mathematics an impossibility. Karen François and Eric Vandendriessche further explore the Wittgenstein theories of "language games" in connection to socially-constructed rationalities which have proven foundational to the field of ethnomathematics. Their article "Reassembling mathematical practices: a philosophical-anthropological approach" provides a philosophical background for understanding the diversity of mathematical language, making it an extremely useful article for scholars and anthropologists working with math practices of diverse contexts. They pair this philosophical approach with ethnographic methods and extensive fieldwork in the context of string figure-making and sand drawing practices in multiple non-western cultures across the globe.

The mathematics of artisan work

In this issue of the RLE we also see the exploration of mathematics concepts operating in the production of craftsmanship. While there is a tendency to wrongly assume that any aesthetically pleasing craft produced in a traditional way or by a defined cultural group is necessarily an example of ethnomathematics, much work has been done to dispel this misconception by uncovering and exploring the math principles and practices at play in the production of select objects. In the article "Women of clay: an ethnomathematics record of the craftswomen of Arraias (Tocantins)" (*As mulheres do barro: um registro etnomatemático das mulheres artesãs de Arraias (Tocantins)*) Alcione Marques Fernandes and Leila Chalub Martins trace the story of the last remaining artisans of the painted clay pots of Arraias (Brazil) and the ethnomath concepts used in the production thereof. Along with the other

articles of this collection, this work challenges the strict divide between traditional knowledge and formal mathematics education and further fosters dialogue between the two seemingly disjoint spheres of knowledge production. Similarly, in the case of the "Craftswomen of Aritapera/PA: techniques and processes in an ethnomathematical perspective" José Ricardo e Souza Mafra and Maria Cecilia Fantinato address and discuss informal education in the context of a group of women artisans that create ornamental gourds on the banks of the Amazon River (in Brazil). Through ethnographic methods including journal writing, interviews, photography, and film, the authors of this article document the methods and math knowledge underlying the artisan work including the measurements, mental calculations, geometric patterns, and symmetry involved in the process and final product. Both articles on craftsmanship highlight the connections that exist between anthropological and ethnomathematical inquiry, and as stated in the latter article, such work must take care to avoid the ethnocentric or legitimizing paradigm that places strict limits on what constitutes mathematical practices, or correspondingly, portrays knowledge outside that strict delineation as exotic.

The Ethnomathematics Program

Since its emergence in the second half of the twentieth century, ethnomathematics over time has become consolidated into what now could be considered the Ethnomathematics Program, or collection of research, conferences, classes, and initiatives associated with this field of study and its many applications. This program is by no means formally defined, and the act of identifying which efforts have and do contribute to its agenda runs the risk of perpetuating exclusionary paradigms similar to those critiqued by the ethnomathematics community. Nonetheless, it is important to reflect on the initiatives that have shaped the program thus far, in an effort to see where we've come from and where we're headed. In this regard, the national and regional RELEAT (*Revista Latinoamericana de Etnomatemática* or Latin American Journal of Ethnomathematics) coordinators of Central and North America (Domingo Yojcom Rocché, Central America, North America, and the Caribbean; Elidia Castillo Guerra, Panama; María Elena Gavarrete, Costa Rica; Molly Tun, United States; Sergio Pou Alberú, México; William Oswaldo Flores López, Nicaragua; Leonel Morales Aldana, Guatemala; Armando Aroca, Advisor) have collaborated to write a literary review of

the ethnomath efforts carried out since the inception of Ethnomathematics in their respective countries. Their article "The Ethnomathematics Program in Central and North America" is monumental in that it unites the input of authors from seven countries working together on a common goal to trace the particular manifestations and development of Ethnomathematics across the American continent. Because of the nascent nature of this project, the authors acknowledge the impossibility of tracing all ethnomathematics efforts on a national or continental scale, but hope this article will lead to future conversations and compilations. In a similar fashion, Armando Aroca compiled the proceedings of a focus-group interview carried out at the CIAEM XIV (*Conferencia Iberoamericana de Educación Matemática* or Iberoamerican Conference on Mathematics Education) in Tuxtla, Mexico in May 2015 among 15 advocates of the field: Ubiratan D'Ambrosio (via email), Claudia Sabba, Milton Rosa, Olenêva Sanches Sousa, Daniel Orey, Giselle Americo, José Linhares, Hélio Simplicio Rodrigues Monteiro, Línlya Sachs, Paulo Jorge Ambrozine, Anahí Huencho, André Cauty, Natalia Ruiz, Diana Jaramillo y Armando Aroca. This article titled "Ethnomathematics Program: Progress, Challenges, and its Role in Economic Globalization and the Neoliberal Project" presents the participants' responses to a series a questions designed by the executive committee of the RELEAT at the time (Hilbert Blanco-Álvarez, Aldo Parra, Pilar Peña-Rincón, and Armando Aroca) regarding the state of the Ethnomathematics Program in light of current affairs. For ethnomathathematics scholars, this document serves as an excellent resource and introduction to the topics pertinent to the field today, and in the true spirit of ethnomathematics, reads as a conversation of multiple voices as opposed to a monologue.

As evidenced by the articles featured in this number of the RLE, collaboration is at the heart of ethnomathematics; every article is co-authored and/or the product of a joint effort and conversation among ethnomathematics professionals, instructors, students, community members, etc. In this way, ethnomathematics not only challenges the content of mathematics and mathematics education research but even the very norms of academia and institutional practices which oftentimes tend to privilege the work carried out by individuals in isolation to their surroundings and greater community. This shared and committed scholarship connects peoples and cultures across various social and institutional divides, thus challenging the tensions existing between those on the "inside" and "outside" of educational institutions and

systems and promoting politics and practices that might bridge the gap between the two spheres of knowledge production. Looking forward, one challenge facing this articulation of an impartial intellectual history and inclusive portrayal of knowledge production is the identification of language appropriate to express these "other" methods and knowledge systems without resorting to a dichotomization between the Western and non-Western world (as suggested in terms such as "indigenous" which in effect has been used to express that which is non-western, "artisan work" which in practice stands in contrast to "design" and "innovation" typical of dominant cultures, and "cultural," "ethnic," or "traditional" groups as seen in opposition to the normative populations deemed culture-free). I am confident that the ethnomathematics community as a collective will continue working together to tackle these important issues and be at the forefront of theoretical and practical mathematics research and initiatives. I would also like to extend my many thanks to the reviewers that made this publication possible, Ángela Mora Valencia for her careful revisions and patience, and Hilbert Blanco-Álvarez for overseeing and directing the entire process.