BETWEEN THE BOUNDARIES OF KNOWLEDGE: THEORIZING AN ETIC-EMIC APPROACH TO MATHEMATICS EDUCATION

Lee Melvin Peralta
Michigan State University
peralt11@msu.edu

Researchers and reformers across multiple areas of scholarship have challenged the idea of mathematics as fixed, politically neutral, and value-free. Ethnomathematics has brought attention to the mathematical practices of particular cultural groups that differ from Western ways of mathematical understanding. These practices raise the following question for mathematics education, especially within Indigenous communities: whose knowledge should be taught and from whose perspective? One response to this question is to teach both dominant and non-dominant perspectives on mathematics, which can be considered an "etic-emic" approach to mathematics education. Drawing on the literature on decolonizing studies in education, I offer a theorization of this etic-emic approach in terms of re-mythologizing mathematics, pursuing recognition and reconciliation, and refusing colonization.

Keywords: Ethnomathematics

The sociopolitical turn in mathematics education calls for an examination of the ways mathematics is framed, conceptualized, and presented in the curriculum (Gutiérrez, 2013a). For instance, ethnomathematics researchers have brought attention to the mathematical practices of particular cultural groups that differ from Western ways of understanding mathematics (D'Ambrosio, 1985; Barton, 1996). These mathematical practices, even when they are not explicitly labeled as ethnomathematical, can serve as important resources for mathematics educators seeking to draw connections between dominant and non-dominant forms of knowledge and challenge the notion that there is only one way to learn, understand, and do mathematics.

Ethnomathematics seeks to promote expanded views of what counts as mathematical activity. This raises the question for mathematics education, especially within Indigenous communities, of how to balance the perspectives created by and enacted through dominant and non-dominant mathematical practices. One response is for teachers to teach both dominant and non-dominant perspectives on mathematics, a practice that I will refer to as an etic-emic approach to mathematics education. In this paper, I seek to theorize this etic-emic approach and, in doing so, to highlight how historicized and ongoing effects of colonization make it difficult, if not impossible, to reconcile dominant and non-dominant ways of knowing. I begin with existing conceptions of and approaches to ethnomathematics in order to provide background on the various ways in which researchers have brought attention to and grappled with multiple systems of mathematical knowledge, particularly as the existence of these multiple systems implicate approaches to mathematics education. I proceed by reviewing the work of scholars who have proposed an etic-emic approach to mathematics education. Drawing on the literature on decolonizing studies in education, I conclude by theorizing this etic-emic approach in terms of re-mythologizing mathematics, pursuing recognition and reconciliation by Indigenous communities, and refusing colonization.

Ethnomathematics

Ethnomathematics began as an endeavor to identify and elaborate on the practices of cultural groups, particularly from the point of view of one immersed in scholarly mathematics (D'Ambrosio, 1985). Over the past four decades, ethnomathematics has branched out in several directions. Barton (1996) identifies a few of these directions, including an interest in the ways mathematics is culturally

In: Sacristán, A.I., Cortés-Zavala, J.C. & Ruiz-Arias, P.M. (Eds.). (2020). *Mathematics Education Across Cultures: Proceedings of the 42nd Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*, Mexico. Cinvestav / AMIUTEM / PME-NA. https:/doi.org/10.51272/pmena.42.2020

based, the nature of mathematical thought and activities across cultures, the evolution of mathematics from a socio-anthropological perspective, the politics of mathematics, the use of culturally specific contexts in schools, and the relationship between mathematics education and society. He proposes the following definition for ethnomathematics:

> "a research program of the way in which cultural groups understand, articulate and use the concepts and practices which we describe as mathematical, whether or not the cultural group has a concept of mathematics" (Barton, 1996, p. 214).

The term *mathematics* refers to the work of school and scholarly mathematics (e.g. algebra) and the term *mathematical* refers to concepts and practices identified as somehow related to mathematics (e.g. kinship systems that can be interpreted in terms of algebraic structures) (Barton, 1996). Barton (1996) points out that this definition of ethnomathematics is not absolute or definitive. The meanings of the terms are culturally situated and depend on the person or group using them. Ethnomathematics is a culturally specific practice performed by one cultural group seeking to make sense of another, often by reference to a specific conceptualization of mathematics (Barton, 1996).

Barton's approach to define and frame ethnomathematics is joined by other perspectives. D'Ambrosio (2006) argues that ethnomathematics concerns the history and philosophy of mathematics with pedagogical implications, the goal of which is to develop a broader vision of knowledge by making cross-cultural comparisons of the ethnomathematics of different groups. Borba (1990), Gerdes (2005), and Powell and Frankenstein (1994) emphasize the importance of ethnomathematics for education, pointing out the ways mathematical practices of cultural groups can be brought into the classroom. Pais (2013) suggests a path for ethnomathematics that critiques its own directions and purposes, particularly those that would render ethnomathematics a mere pedagogical tool for importing cultural contexts into schools.

Pais (2011, 2013) and Vithal and Skovsmose (1997) raise concerns regarding ethnomathematics. When a mathematical lens is applied to a cultural practice, there is a risk this lens becomes a "gaze" that suggests a group's cultural activity is valuable only because one can see mathematics in it (Pais, 2013, p. 3). This gaze also highlights the unidirectional nature of ethnomathematics, the alternative being that ethnomathematics can and should be directed back toward dominant mathematics through a critical examination of how mathematics has taken its current form and how it powerfully formats reality in ways that are often unjust (Pais, 2013).

In the context of mathematics education, a mathematics gaze focuses on bringing local knowledge into mathematics classrooms in the name of promoting diversity and highlighting that mathematics appears everywhere in the world (Pais, 2013). Although this is often accompanied by good intentions and the promises of multicultural education, there is a risk that an essentialist view of culture will be promoted that positions communities and peoples as foreign Others and ignores the tensions inherent in cultural approaches to education in multicultural contexts (Pais, 2011, 2013; Vithal & Skovsmose, 1997). For instance, in South Africa the meaning of *ethno* in *ethnomathematics* was used by policymakers to separate individuals into supposed cultural groups organized by race, wherein white students were provided a higher quality mathematics education (Vithal & Skovsmose, 1997). Ethnomathematics thus became associated with the racism of apartheid. Vithal and Skovsmose (1997) point out that in using ethnomathematics to structure the learning experiences of students in South Africa, there was a failure to specify the relationship between culture and power and a failure to recognize the formatting power of dominant mathematics and to teach toward cultural competence and self-empowerment.

Etic and Emic Perspectives

Albanese, Adamuz-Povedano, and Bracho-López (2017) propose two distinct approaches to incorporating ethnomathematics into mathematics education. Under the first approach, the

mathematics of cultural groups are studied, understood, and taught from the point of view of dominant mathematics. The researcher, teacher educator, or teacher identifies and chooses cultural material to translate into the formal language of mathematics, even if this formal language does not exist within the studied community (Albanese et al., 2017). For example, Ascher and Ascher (1986) analyzed kin relationships found among the Aranda of Australia using diagrams and group theoretical terms. Borrowing terminology from anthropology (Rosa & Orey, 2012, 2013), Albanese et al. (2017) call this an *etic* perspective. In short, the etic approach is "the *recognition* of *mathematics in cultural practices*" (Albanese et al., 2017, p. 324). The goal of the etic approach is to build bridges between dominant mathematics and the mathematical practices of other cultures and to establish communication between them (Albanese et al., 2017). It suggests that dominant mathematics is a universal system that can be found everywhere, including within the cultural practices of communities that would not necessarily characterize these practices as mathematical (Pais, 2013). The pedagogical implication is that teachers ought to bring cultural contexts into the classroom under the assumption that students have experiences with or interests in out-of-school mathematical practices and that relating school mathematics to students' life experiences will lead to better learning (Pais, 2013).

The second approach is *emic*, which takes into account the categories and schemes of thinking of the community or cultural group of interest (Albanese et al., 2017). This leads to "the *discovery* of different *ways of thinking*" (Albanese et al., 2017, p. 324). For instance, bricklayers in some rural areas of Mozambique build houses with rectangular floors but do not have tools for designing right angles (Albanese et al., 2017). They use sticks and ropes of equal measure to find the vertices of a rectangle. This practice may be identified as deploying the property of rectangles that diagonals are equal and bisect each other (i.e. an etic perspective) or may be identified as a practice-embedded, operational definition for these bricklayers (i.e. an emic perspective). Barton (1999) explains that this approach to ethnomathematics rejects the idea of a universal mathematical or logical system to which both scholarly and cultural mathematics are a mere approximation. Mathematics in its most general form is instead a system for dealing with quantitative, relational, and spatial aspects of human experience, which Barton (1999) calls a "QRS system" (p. 56). Certain cultural groups have their own QRS systems. Dominant mathematics is one QRS system, and the purpose of ethnomathematics is to explore how different QRS systems relate to one another. Rather than being used to locate cultural contexts to import into classrooms, the emic approach suggests that ethnomathematics should be incorporated into a larger project of critiquing schooling and the curriculum (Knijnik, 2012; Pais, 2011, 2013).

Albanese et al. (2017) argue that both etic and emic approaches should be considered in every ethnomathematics project, including the use of ethnomathematics for teaching and learning mathematics. For instance, artisan-architects on an Indonesian island use a stick and pencil to find the midpoint of a segment based on a sequence of moves that yield a better approximation with each iteration (Albanese et al., 2017). An emic perspective would acknowledge the situatedness of this practice while an etic perspective would view the practice in mathematical terms, observing the ways the practice resembles error reducing algorithms (Albanese et al., 2017). Problems arise when both perspectives are not brought into dialogue. Merely contextualizing mathematical tasks without reflecting on the nuances between dominant and non-dominant forms of mathematics misses out on the opportunity to think about different ways of knowing (Albanese et al., 2017). Focusing exclusively on cultural ways of knowing misses out on the opportunity to seek correspondences between dominant mathematics and the cultural practices of other communities (Albanese et al., 2017).

Theorizing an Etic-Emic Approach to Mathematics Education

The previous discussion highlights the diversity in how one might approach the study, understanding, framing, and teaching of mathematics, particularly in light of the findings of ethnomathematics researchers that multiple mathematical systems exist. This motivates a framework for making sense of how an understanding of multiple mathematics might impact ones approach to mathematics education. For Albanese et al. (2017), a reasonable response is to seek dialogue between etic and emic perspectives on mathematics knowledge. In doing so, they acknowledge the significant formatting power of dominant mathematics and its role in modern society while still embracing different ways of knowing mathematics. However, if we are to take this suggestion seriously, there is a need to theorize what exactly such an etic-emic approach would entail. The next section proposes three dimensions to this theorization: re-mythologizing mathematics, pursuing recognition and reconciliation for Indigenous communities, and refusing colonization. Through these dimensions, a theorization would propose to do three things—deepen our understandings of ethnomathematics and its role in mathematics education, emphasize the relevance of decolonizing studies to mathematics education research, and speak to broader conversations about balancing dominant and non-dominant perspectives on knowledge within school curricula and teachers' instructional practices.

Re-Mythologizing Mathematics

Scholars in fields as diverse as anthropology, sociology, and education have shown the many ways in which mathematics is neither universal nor politically neutral (Appelbaum, 1995; Borba, 1990; D'Ambrosio, 2006; Eglash, 1997; Ernest, 1998; Gerdes, 1998; Gutiérrez, 2013a; Hersh, 1999; Iseke-Barnes, 2000; Knijnik, 2012; Skovsmose, 2011). Modern conceptions of mathematics have been shown to be rooted in mathematics' alleged purity and close connections to technology and the natural sciences (Skovsmose, 2011). The theorems and objects of mathematics have been shown to be cultural products created through human activity (Ernest, 1998; Hersh, 1999). Bishop (1990) challenges the idea that dominant mathematics is value-free, pointing out that such mathematics is grounded in four values: rationalism, objectism, power and control, and progress and change. Related to this conception of mathematics is a Western-based hierarchy of rationality that privileges abstract thought as the highest form of intellect (Gutiérrez, 2013b). Drawing on Foucault and Wittgenstein, Knijnik (2012) argues that dominant mathematics "expels 'out of its margins'" different kinds of mathematics by constraining the circulation of divergent mathematical discourses (p. 97). In each case, a critique is made that not only seeks to challenge mathematics education but also seeks to challenge the status of mathematics itself.

An etic-emic approach to mathematics education can be seen as part of this larger project to re-right views of mathematics that perpetuate myths about its universality and political neutrality. Wagner and Herbel-Eisenmann (2009) call on scholars to "re-mythologize" mathematics by reconceptualizing it with human stories that are not traditionally part of dominant mathematics discourses. The purpose is not to discredit dominant mathematics nor is it to "de-mythologize" dominant mathematics in an attempt to render it powerless. It must be acknowledged that the "myth of mathematics" continues to powerfully position students, teachers, and practitioners (Wagner & Herbel-Eisenmann, 2009) and that dominant conceptions of mathematics inevitably impose themselves on interactions among doers of mathematics. Ethnomathematics has and can continue to be used as a counter-narrative and engine for re-storying a plural understanding of mathematics. By balancing etic and emic perspectives on mathematics knowledge, reformers can continue to dismantle notions that Western mathematics is the only legitimate mathematical system. The ability to shift from one mathematical system to another promotes the view that Western mathematics is simply one of a multitude of culturally based mathematical systems, where each system is grounded in human activity and a particular set of values. In teacher education contexts, this approach can be

used to support mathematics teachers in undergoing the epistemological shifts that Knijnik (2012) and Pais (2011, 2013) say are necessary for widespread mathematics education reform.

Pursuing Recognition and Reconciliation

An etic-emic approach to mathematics education can also be seen in relation to broader politics of recognition and reconciliation for Indigenous peoples. The dominant status of Western mathematics means that throughout history, alternative conceptions of mathematics among Indigenous peoples have been, and continue to be, marginalized or subject to erasure. Bishop (1990), for instance, shows how through dominant conceptions of mathematics, Western explorers sought to replace Indigenous mathematics through regimes of trade, administration, and education, which mediated a process of cultural invasion by dominant methods of measurement and numerical procedures and by a value system grounded in rationalism. Takeuchi (2018) finds that hierarchies created by dominant conceptions of mathematics led Filipina mothers to undervalue their mathematics knowledge—particularly with respect to calculating international currency conversions—and involvement in school education for their children. As Takeuchi (2018) explains, "[P]arents' funds of knowledge...can be masked through school practices if only certain ways of knowing are treated as legitimate and valued" (p. 139).

This process of erasure of Indigenous ways of knowing is not a mere accident of history but rather one of historicized and ongoing colonization (Bernales & Powell, 2018; Iseke-Barnes, 2000; Stathopoulou & Appelbaum, 2016). Bernales & Powell (2018) point to the Programme for International Student Assessment (PISA) and the tendency to "unreflectively copy the developed countries curricula, reinforcing power structures in the societies" (p. 566) as well as the "hominization of curricula that OECD's PISA causes on national curricula" (p. 566). An etic-emic approach can be seen as serving the project of reversing erasure and pursuing recognition and dignity in the face of dispossession of land and knowledge (Stathopoulou & Appelbaum, 2016). In schools, this would mean modifying curricula and pedagogical practices so that instruction begins with students' out-of-school knowledge and worldview of local culture while still giving students access to dominant mathematical discourses. Doing so provides recognition and dignity to students whose contemporary and heritage practices are delegitimated and displaced by Western mathematical values and practices (Stathopoulou & Appelbaum, 2016), and it can promote social justice through the fundamental values of ethnomathematics, which include respect, solidarity, and cooperation with other cultural groups (D'Ambrosio, 2007). Developing fluency around both dominant and non-dominant mathematical forms confronts what Battiste (1998) calls the educational model of "cognitive imperialism" (p. 17), which comprises of "Eurocentric strategies that maintain their knowledge is universal, that it derives from standards of good that are universally appropriate, that the idea and ideals are so familiar they need not be questioned, and that all questions can be posed and resolved within it" (Stathopoulou & Appelbaum, 2016, p. 38). This approach not only gives students access to mathematical practices necessary for social mobility but it also aids toward a process of "reconciling [the] dignity of each person" in light of "legacies of centuries of privilege and power, cultural authority and school-based deligitimation practices" (Stathopoulou & Appelbaum, 2016, pp. 39-40).

This approach of balancing "insider" and "outsider" views of mathematics must be seen as part of a larger movement in education to provide marginalized and minoritized youth with both dominant and non-dominant knowledge. Ladson-Billings (1995), for instance, puts forth a framework of culturally relevant pedagogy (CRP), which calls for academic excellence, cultural competence, and sociopolitical consciousness for students. CRP entails the development of "literacy, numeracy, and technological, social, and political skills in order to be active participants in a democracy" (p. 160). Paris and Alim (2006) extend CRP by proposing culturally *sustaining* pedagogy as a way to emphasize the preservation of students' heritage and contemporary practices and to foreground the

way students often enact their cultural identities in novel ways. Stathopoulou & Appelbaum (2016) call for a similarly expansive view of culture within ethnomathematics, which have historically been based on static colonialist categories of culture. In contrast to these static colonialist categories, an etic-emic approach emphasizes a *fluidity* not just in how mathematics can be viewed but also how people and knowledge can be granted dignity and recognition.

Refusing Colonization

In contrast to the politics of recognition, an etic-emic approach can be theorized in terms of a *politic of refusal* (Coulthard, 2014; Grande, 2018; McGranahan, 2016; Mignolo, 2011; Simpson, 2007; Tuck, 2009; Tuck & Yang, 2014). Grande (2018) describes this politic of refusal in terms of Indigenous sovereignty, noting that refusal is not about attaining recognition but rather about reconstructing culture and tradition in a way that "positively asserts Indigenous sovereignty and peoplehood" (p. 59). Drawing on scholars such as Glen Coulthard, Audra Simpson, Walter D. Mignolo, and Anibal Quijano, Grande (2018) theorizes refusal as "a stance or space for Indigenous subjects to limit access to what is knowable and to being known" (p. 59) and a form of "epistemic disobedience" (p. 59) that severs the link between Indigenous and Western understandings of knowledge. Two important points must be made about refusal. First, refusal is an alternative to recognition, which seeks reconciliation with the state—an idea that several critical Indigenous scholars criticize "as a technology of the state by which it maintains its power (as sole arbiter of recognition) and thus settler colonial relations" (Grande, 2018, pp. 49-50). Second, refusal is connected to settler colonialism, which refers to colonialism premised on the removal of Indigenous peoples from land followed by the creation of labor and knowledge systems and infrastructures to make the land productive for settlers (Bonds & Inwood, 2016; Grande, 2018). In this light, refusal is premised on the idea that decolonization "is a political project that begins and ends with land and its return", and thus "the very nature of settler colonialism precludes reconciliation" (Grande, 2018, p. 53).

A politics of refusal troubles the possibility of taking an etic-emic approach to mathematics education. By seeking to recognize and reconcile both insider and outsider perspectives of Indigenous mathematical practices, one continues to legitimate the Western "gaze" as the arbiter of recognition. That is, attempts to reconcile dominant and non-dominant perspectives on mathematics reproduce configurations of colonial power that have and continue to deprive Indigenous people of knowledge. Raising the issue of *psycho-affective attachment* to colonialist forms of recognition, Grande (2018) discusses the "unequal exchange of institutionalized and interpersonal patterns of recognition between the colonial society and the marginalized" (p. 54). By seeking recognition and reconciliation, one may not be able to avoid the feelings of attachment to dominant knowledge forms felt among the colonized, as such feelings often stem from "inducements" (Wolfe, 2013), which manifest as the material and psychological rewards often associated with success in dominant mathematics.

This is not to say that Indigenous communities should not be taught dominant forms of mathematics knowledge, which can be instrumental for social and economic mobility. Rather, a politics of refusal highlights the competing impulses that can arise when one attempts to take an etic-emic approach to mathematics education—on one hand, a yearning to reconcile dominant and non-dominant ways of knowing but, on the other hand, a refusal of Western mathematics premised on Indigenous sovereignty and the delegitimization of the settler colonial state. For instance, Stanton (1994) describes a "both ways" mathematics curriculum for aboriginal teacher education, pointing out the extent to which dominant conceptions of mathematics were entrenched within the beliefs and attitudes of participants. He further describes the tensions created when teachers expressed the need for Aboriginal children to become prepared for key positions within their community through the mastery of dominant mathematical techniques. Stanton (1994) is ultimately optimistic about cross-

cultural attempts to bridge dominant and non-dominant forms of mathematics, though his concerns highlight the difficulty that historicized and ongoing effects of colonization create with respect to reconciling etic and emic perspectives on mathematics.

Concluding Remarks

There has been a significant increase in attention toward concerns for equity and social justice within mathematics education, and yet ethnomathematics and decolonizing studies in mathematics education remain niche areas of research. This is despite the fact that dominant mathematical activity is a form of ethnomathematics. I discuss the project of balancing etic and emic perspectives on mathematics not only because it represents a key tension within ethnomathematics and decolonizing studies in mathematics education but also because it highlights how these research areas can speak to larger conversations about the role of dominant and non-dominant ways of knowing in curriculum and instruction. In this paper, I have raised the question of whose knowledge should be taught and from whose perspective. Although a reasonable response to this question might be to say, "everyone's knowledge and everybody's perspective", I have sought to nuance and problematize such an attempt at an etic-emic approach to education. The historicized context of math-making cannot be separated from the mathematical practices we seek to teach in classrooms. We cannot avoid the fact that much of the mathematics knowledge we seek to teach youth is laden with histories of settler colonialism, racial violence, and white supremacy. How, then, do we move forward? This paper's theorization does not offer a definitive resolution. At best, I offer this theorization to highlight the relevance of ethnomathematics and decolonizing studies for mathematics education research and to urge researchers to continue to critique dominant and oppressive forms of knowledge as part of a larger project of individual and collective empowerment.

Acknowledgments

This paper was supported by the University Distinguished Fellowship funded by the Michigan State University Graduate School.

References

Albanese, V., Adamuz-Povedano, N., & Bracho-López, R. (2017). The evolution of ethnomathematics: Two theoretical views and two approaches to education. In M. Rosa, L. Shirley, M. E. Gavarrete, & W. V. Alangui (Eds.), *Ethnomathematics and its diverse approaches for mathematics education* (pp. 307-325). Switzerland: Springer International Publishing.

Appelbaum, P. (1995). *Popular culture, educational discourse, and mathematics*. Albany, NY: State University of New York Press.

Ascher, M., & Ascher, R. (1986). Ethnomathematics. *History of Science*, 24, 125-144.

Barton, B. (1996). Making sense of ethnomathematics: Ethnomathematics is making sense. *Educational Studies in Mathematics*, 31, 201-233.

Barton, B. (1999). Ethnomathematics and philosophy. *ZDM*, 31(2), 54-58.

Battiste, M. (1998). Enabling the autumn seed: Toward a decolonized approach to Aboriginal knowledge, language, and education. *Canadian Journal of Native Education, 22*(1), 16-27.

Bernales, M., & Powell, A. B. (2018). Decolonizing ethnomathematics. *Ensino em Revista, 25*(3), 565-587.

Bishop, A. (1990). Western mathematics: The secret weapon of cultural imperialism. *Race & Class, 32*(2), 51-65.

Bonds, A., & Inwood, J. (2016). Beyond white privilege: Geographies of white supremacy and settler colonialism. *Progress in Human Geography, 40*(6), 715-733.

Borba, M. C. (1990). Ethnomathematics and education. *For the Learning of Mathematics, 10*(1), 39-43.

Coulthard, G. S. (2014). *Red skin, white masks: Rejecting the colonial politics of recognition*. Minneapolis, MI: University of Minnesota Press.

D'Ambrosio, U. (1985). Ethnomathematics and its place in the history and pedagogy of mathematics. *For the Learning of Mathematics, 5*(1), 44-48.

D'Ambrosio, U. (2006). The program ethnomathematics: A theoretical basis of the dynamics of intra-cultural encounters. *The Journal of Mathematics and Culture, 6*(1), 1-7.
D'Ambrosio, U. (2007). Peace, social justice and ethnomathematics. *International perspectives on social justice in mathematics education*, Monograph 1, 25-34.
Eglash, R. (1997). When math worlds collide: Intention and invention in ethnomathematics. *Science, Technology, & Human Values, 22*(1), 79-97.
Ernest, P. (1998). *Social constructivism as a philosophy of mathematics*. Albany, New York: State University of New York Press.
Gerdes, P. (1998). On culture and mathematics teacher education. *Journal of Mathematics Teacher Education*, *1*, 33-53.
Gerdes, P. (2005). Ethnomathematics, geometry and educational experiences in Africa. *Africa Development, 30*(3), 48-65.
Gutiérrez, R. (2013a). The sociopolitical turn in mathematics education. *Journal for Research in Mathematics Education, 44*(1), 37-68.
Gutiérrez, R. (2013b). Why (urban) mathematics teachers need political knowledge. *Journal of Urban Mathematics Education, 6*(2), 7-19.
Hersh, R. (1999). *What is mathematics, really?* Oxford, UK: Oxford University Press.
Iseke-Barnes, J. M. (2000). Ethnomathematics and language in decolonizing mathematics, *Race, Gender, & Class, 7*(3), 133-146.
Knijnik, G. (2012). Differentially positioned language games: Ethnomathematics from a philosophical perspective. *Educational Studies in Mathematics, 80*, 87-100.
Grande, S. (2018). Refusing the university. In E. Tuck, & K. W. Yang (Eds.), *Toward what justice? Describing diverse dreams of justice in education* (pp. 47-65). New York, NY: Routledge.
Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal, 32*(3), 465-491.
Ladson-Billings, G. (2014). Culturally relevant pedagogy 2.0: A.k.a. the remix. *Harvard Educational Review, 84*(1), 74-84.
McGranahan, C. (2016). Theorizing refusal: An introduction. *Cultural anthropology, 31*(3), 319-325.
Mignolo, W. (2011). Epistemic disobedience and the decolonial option: A manifesto. *Transmodernity: Journal of Peripheral Cultural Production of the Luso-Hispanic World, 1*(2), 44-66.
Pais, A. (2011). Criticisms and contradictions of ethnomathematics. *Educational Studies in Mathematics, 76*, 209-230.
Pais, A. (2013). Ethnomathematics and the limits of culture. *For the Learning of Mathematics, 33*(3), 2-6.
Paris, D., & Alim, H. S. (2014). What are we seeking to sustain through culturally sustaining pedagogy? *Harvard Educational Review, 84*(1), 85-100.
Powell, A. B., & Frankenstein, M. (1994). Towards liberatory mathematics: Paulo Freire's epistemology and ethnomathematics. In P. L. McLaren, C. Lankshear (Eds.), *Politics of liberation: Paths from Freire* (pp. 74-99). London, UK: Routledge.
Rosa, M., & Orey, D. C. (2012). The field of research in ethnomodeling: Emic, etic, and dialectical approaches. *Educação e Pesquisa, 38*(4), 865-879.
Rosa, M., & Orey, D. C. (2013). Ethnomodeling as a research theoretical framework on ethnomathematics and mathematical modeling. *Journal of Urban Mathematics Education, 6*(2), 62-80.
Simpson, A. (2007). On ethnographic refusal: Indigeneity, 'voice' and colonial citizenship. *Junctures: The Journal for Thematic Dialogue*, *9*, 67-80.
Stathopoulou, C., & Appelbaum, P. (2016). Dignity, recognition, and reconciliation: Forgiveness, ethnomathematics, and mathematics education. *International Journal for Research in Mathematics Education, 6*(1), 26-44.
Skovsmose, O. (2011). *An invitation to critical mathematics education*. Rotterdam, NL: Sense Publishers.
Stanton, R. (1994). Mathematics "both ways": A mathematics curriculum for aboriginal teacher education students. *For the Learning of Mathematics, 14*(3), 15-23.
Takeuchi, M. A. (2018). Conversions for life: Transnational families' mathematical funds of knowledge. In T. G. Bartell (Ed.), *Toward equity and social justice in mathematics education* (pp. 127-143). Switzerland: Springer International Publishing.
Tuck, E. (2009). Suspending damage: A letter to communities. *Harvard Educational Review, 79*(3), 409-428.

Tuck, E., & Yang, K. W. (2014). R-words: Refusing research. In M. W. Winn, D. Paris (Eds.), *Humanizing research: Decolonizing qualitative inquiry with youth and communities* (pp. 223-248). Thousand Oaks, CA: SAGE Publications.

Vithal, R., & Skovsmose, O. (1997). The end of innocence: A critique of 'ethnomathematics'. *Educational Studies in Mathematics, 34*(2): 131-157.

Wagner, D., & Herbel-Eisenmann, B. (2009). Re-mythologizing mathematics through attention to classroom positioning. *Educational Studies in Mathematics, 72*(1), 1-15.

Wolfe, P. (2013). Recuperating binarism: A heretical introduction. *Settler Colonial Studies, 3*(3-4), 257-279.