

BOOK REVIEW

Self-Empowering Urban Students and Teachers: A Book Review of *Math Is a Verb: Activities and Lessons from Cultures Around the World*¹

Jessica Hopson Burbach
Portland State University

Finally, there is a practical book providing specific lesson plans concerning teaching mathematics in a culturally inclusive manner! Barta, Eglash, and Barkley's (2014) *Math Is a Verb: Activities and Lessons from Cultures Around the World* presents eleven lessons that demonstrate how mathematics influences culture and how culture influences mathematical practices. Each of the eleven chapters is focused on a specific location and cultural context and outlines three lesson plans based on different grade bands: grades K–3, 4–8, and 9–12. Every lesson includes the objectives, materials, and content standards aligned to the Common Core State Standards (CCSS) and the National Council for Teachers of Mathematics (NCTM) Standards (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010; NCTM, 2000). Within each lesson, students learn about the cultural context; explore the cultural context using a variety of mathematical skills; and create a product, including designs, patterns, data tables, algorithms, and mathematical models. At the end of every lesson, there are ideas for further application and extension and discussion questions that serve to formatively assess student learning, pushing students to think of mathematics beyond what is traditionally taught in U.S. classrooms. Similar to the work of other mathematics education researchers (e.g., Aguirre, Mayfield-Ingram, & Martin, 2013; Aguirre & Zavala, 2013; Gutiérrez, 2009; Gutstein, 2006; Martin, 2000), Barta and colleagues provide concrete examples of how teachers and students can challenge traditional school mathematics by asking three important questions: (1) What is mathematics? (2) Who does mathematics? (3) For what purpose is mathematics done?

¹ Barta, J., Eglash, R., & Barkley, C. (2014). *Math is a verb: Activities and lessons from cultures around the world*. Reston, VA: The National Council of Teachers of Mathematics. 163 pp., \$29.85 (paper), ISBN 9780873537070 <http://www.nctm.org/store/Products/Math-Is-a-Verb--Activities-and-Lessons-from-Cultures-Around-the-World/>

JESSICA HOPSON BURBACH is a mathematics teacher at an alternative school, Portland YouthBuilders, and a doctoral student in the Educational Leadership program at Portland State University; email: jhopson@pdx.edu. Her research interests include culturally responsive and social justice mathematics teaching, the experiences of youth who are pushed out of school, and youth participatory action research.

What is Mathematics?

Traditionally, mathematics is viewed as culturally neutral and “objective”; *Math Is a Verb* represents a direct challenge to this perspective. The lessons presented in the book encourage teachers to approach mathematics with their students from an ethnomathematical lens. Ethnomathematics studies how different cultures have various ways of thinking, learning, and doing mathematics (D’Ambrosio, 1997). Barta and colleagues (2014) suggest that mathematics is not fixed or rigid, but rather that it “is a process shaped and influenced by its use and by the culture of those using it” (p. v). In other words, mathematics is influenced by and also influences cultures.

Barta and colleagues (2014) present a broader definition of mathematics that goes beyond the mathematics that is taught in school. For example, they recognize the mathematical practices in people’s everyday lives. Some researchers have referred to these everyday practices as “funds of knowledge” (González, Moll, & Amanti, 2005), which are based on the idea that all people gain knowledge through their life experiences. These researchers recognize that people’s cultural, community, and household tools and practices are valuable and valid knowledge that influence how people think and develop (González et al., 2005). As an example of honoring students’ funds of knowledge, Chapter 3 explores nonstandard forms of measurement as students learn about how a historic city in Brazil was built using measurements based on the emperor’s own body parts. Students are also encouraged to think about how their own family members use nonstandard forms of measurement.

The definition of mathematics that Barta and colleagues (2014) present in *Math Is a Verb* is also influenced by Bishop’s (1988) six universal actions in mathematics performed by people throughout the world: counting, measuring, designing, locating, explaining, and playing. For example, Chapter 11 focuses on the mathematical probabilities involved in playing the Potawatomi two-sided dice game. As students play the game and analyze probabilities, they are asked to think about early applications of mathematics given that gaming and gambling have been a pastime of people since the dawn of civilization. Students also get to design and explain the mathematics found in graffiti in urban areas around the world in Chapter 7. These lessons show students how activities they enjoy and encounter in their own communities are mathematical in nature, thereby expanding their definition of what mathematics is.

Within their definition of mathematics, Barta and colleagues (2014) include culturally responsive mathematics, which is the process of reciprocal interaction between mathematics and culture. An example of culturally responsive mathematics is found in Chapter 4 where they suggest that students analyze the mathematics in Navajo beading and weaving patterns. As students learn about Navajo values of

beauty, harmony, and balance, they explore the geometric patterns, shapes, and frequency of different colors found in Navajo beadwork. Students are asked to consider how the beadwork illustrates shapes and images valued in the Navajo community and whether they think that Navajo craftspeople believe mathematics is beautiful. Eventually, students design their own beadwork pattern. In essence, students are enacting the connection between mathematics and culture. Barta and colleagues (2014) quote educator and member of the Navajo nation, Clayton Leong, “Mathematics and life are one for the Navajo people...traditional arts and crafts...illustrate our constant use of mathematics shaped by who we are, the Navajo!” (p. 48). Thus, mathematics is influenced by culture, is alive, is changing, and is responsive to those who use it. Equally evident in Leong’s quote is another theme found in the book—the interconnectedness of identity and mathematics; discussed in the next section.

Who Does Mathematics?

Barta and colleagues (2014) posit that identity and a person’s relationship to mathematics are fundamentally important to learning mathematics. Other researchers have suggested that in order to build robust mathematics identities, students must “see themselves as legitimate and powerful doers of mathematics” (Aguirre et al., 2013, p. 14). Mathematics educators must support students to develop strong mathematical identities by affirming their students’ racial, gendered, cultural, and academic identities while countering the negative views of these identities (Aguirre et al., 2013). For students to develop a positive relationship with mathematics, they need to “dance with the numbers” (Barta et al., 2014, p. 4). In other words, students need to have meaningful interactions with relevant mathematical activities. For this reason, all of the lessons in *Math Is a Verb* invite students to interact with the mathematics with hands-on, inquiry-based, or technology-infused activities that allow them to design, create, and model. Additionally, the lessons create spaces for students with diverse backgrounds to experience the joy of mathematics as embedded in cultural practices.

There are examples of lessons in which students “dance with the numbers” throughout the book. In Chapter 1, students use a web-based application to study the geometry of cornrow braiding and to create their own braid design. Students in grades 9–12 can use the same web-based application to plot a logarithmic spiral to fit the curvature of a cornrow braid. Consequently, students see people from contemporary urban communities and African communities since 500 BCE that participate in cornrow braiding as important doers of mathematics (Barta et al., 2014). Throughout the lessons, Barta and colleagues emphasize the ways in which people from various cultures and various occupations engage in the practice of mathematics. When students integrate their cultural heritage into the mainstream pedagogy of

mathematics, they are more likely to see themselves as doers and part of the world of mathematics.

Identity also plays an important role in the teaching of mathematics. *Math Is a Verb* serves to educate teachers about the vast array of cultural mathematics practices and, hopefully, shift their own definitions of mathematics and their conceptualizations of who does mathematics. Barta and colleagues (2014) assert, “We do this to encourage teachers to further investigate their own understanding of culture and its influence on how they teach an increasingly diverse student population” (p. vi). Teachers’ approaches and practices are affected by their beliefs about who they believe can do mathematics. Overall, the authors assist teachers in deconstructing their beliefs about mathematics and in developing pedagogical approaches that will benefit (most likely) the growing number of culturally and linguistically diverse students in their classrooms.

For What Purpose is Mathematics Done?

The purpose of learning mathematics in many U.S. schools is based in the achievement of key competencies for standardized tests. Instead, Barta and colleagues (2014) show how mathematics can be used to investigate social issues and can be a tool for problem solving. Hence, students are taught that the purpose of mathematics is more than just learning knowledge and skills needed to graduate high school. Social justice advocate and consultant for *Math Is a Verb*, Dan Lyles, believes that students need to see the purpose that mathematics plays in their own lives and in the world. He argues:

We, as a culture, are obsessed with improving math education, teaching it, and we all wish we were a little better at it. However, we’re not spending the critical time talking to each other about what we intend to do with that math or what wonderful things we can create in the world. When working with kids, they’re thankfully too honest to do what they’re supposed to. If you can’t connect that math education to something that means something to them and gives them room to participate both in the process and in the world, then you’re going to lose them. (as cited in Barta et al., 2014, p. 87)

As a result, mathematics education environments have the potential to be spaces where students are *self*-empowered to use mathematics as a tool for understanding and confronting issues in their communities and in the world.

There are many examples of how mathematics can be used to analyze social issues throughout *Math Is a Verb*. One particular lesson in Chapter 2 illustrates how students might use mathematics to problem solve about social issues in a Guatemalan farming community. Students learn about the corn growing practices of the Maya, which are still practiced in the highlands of Guatemala. Farmers are constantly battling crop loss due to disease and insects. In the lesson, students create mathe-

mathematical models to determine whether farmers should continue to use their traditional planting practices or explore a new method. At the end of the lesson, students are asked, “How does using mathematics as a tool for investigation leading to social change affect the way we think about mathematics as a subject and about ourselves as students of mathematics?” (Barta et al., 2014, p. 33). Through this lesson, students are exposed to the idea that mathematics can be a tool for affecting pro-social change. This lesson in particular lays the groundwork for teachers to present social justice mathematics lessons where mathematics is used to reveal and respond to contemporary issues in students’ own communities.

Conclusion: Self-Empowering Urban Students and Teachers

As a secondary mathematics teacher who works at an urban alternative school, I am inspired by how *Math Is a Verb* respects my students’ intellects and my own agency as a classroom teacher. Although my students are what some consider high school “dropouts,” most have a story about how the comprehensive high school system pushed them out or failed to meet their needs. I hypothesize that this pushing out might be because the mathematics curriculum was neither relevant nor reflective of their everyday lives. Similarly, Barta and colleagues (2014) do not blame students for developing a negative relationship with mathematics. Instead, they question whether there are other ways to teach and engage students with mathematics. They argue for making mathematics “a bridge to their own heritage culture” (p. 1).

My urban alternative school serves a disproportionately large number of students of color and students from working class families. Some researchers suggest that these are students who believe that mathematics is developed and owned by a community that they do not belong to (Barta, Cuch, & Exton, 2012). Delpit (2012) argues that one of the biggest barriers to learning for students of color in traditional school systems is that students do not see themselves or their own life experiences reflected in the curriculum, especially in mathematics. It also may devalue their home cultures and may disengage students from learning the content. As a result, it can be more difficult for students of color to build strong mathematics identities. Ultimately, by presenting mathematics in culturally situated contexts, *Math Is a Verb* honors the intellect and capacity for mathematical thinking of our urban students, especially those who are culturally and linguistically diverse.

The lessons throughout *Math Is a Verb* create spaces for urban students to tell counternarratives (Solórzano & Yosso, 2009) about the mathematics knowledge within their communities and their own potential for obtaining mathematical excellence. Hence, students who live in urban environments are self-empowered because they see themselves and members of their community as powerful doers of mathematics. Beyond the rhetoric of providing urban students greater access to mathe-

matics, the lessons seek to change the definitions of mathematics and mathematics education to include the knowledge and practices of urban communities. These lessons serve to strengthen urban students' mathematics identities and beliefs in their ability to use mathematics as a tool for exploring injustices in their communities. Thus, mathematics becomes a space influenced by and within the lives of urban students, instead of one to which urban students need access.

In a mathematics education system of increasing standards and scripted curricula, there is a sense of distrust in the ability of teachers to design lessons that are responsive to the specific needs and backgrounds of students while, at the same time, challenging students with rigorous content. Barta and colleagues (2014) assert that that is simply not true. They show how executing culturally situated mathematics lessons do not require sacrificing rigorous mathematics. For example, lessons have students use logarithmic functions to model the curvature of a cornrow braid and curves in graffiti art, create a mathematical model to explore the relationship between corn planting and production, and create an algorithm for designing cobblestone streets like those in southeastern Brazil, to name a few. Furthermore, the authors show that examples of advanced mathematics and mathematical applications can be found in the everyday practices of communities around the world.

To achieve equity in mathematics education, teachers need to prepare students not only to play the game of mathematics education but also to change the game of mathematics education (Gutiérrez, 2009). *Math Is a Verb* shows teachers how to do both. To play the game of mathematics education, teachers can easily justify their use of these culturally responsive lessons by citing their alignment to specific standards as advocated by both the CCSS and the NCTM. On the other hand, teachers can change the game of mathematics education by using the lessons to promote a vision of mathematics that is culturally situated and privileges the knowledge and practices of urban communities and of the students themselves. *Math Is a Verb* acknowledges that we, as practicing teachers, are working within a system; however, the text encourages us to challenge the mental models that influence our thinking about what is mathematics, who does mathematics, and for what purpose mathematics is done.

In addition, Barta and colleagues (2014) respect my agency as a teacher to design my own lessons using those in the book as a model. In fact, they express a hope that teachers "will realize that they too can create personalized math lessons specifically developed for those that they teach" (p. vi). Hence, they honor the knowledge I have about my students and self-empower me to incorporate that knowledge into lessons I design. For example, I plan to create a new lesson that combines my favorite elements from each of the different grade-brand lessons in a single chapter from the book. *Math Is a Verb* inspires me, and I look forward to trying these lessons with my students to see how they respond to cultural ways of doing mathematics. Teachers can examine the lessons, and connect a lesson to a

standard to introduce and deepen students' understanding of the mathematical concepts within that standard.

As Barta and colleagues (2014) suggest, by employing an ethnomathematics perspective of how culture and mathematics influence each other in my mathematics classroom, I have begun to create lessons involving issues of social justice. Using the work of social justice mathematics educator Eric (Rico) Gutstein (see, e.g., 2013), I have developed a series of lessons in which students analyze police traffic stop data for evidence of racial profiling. The lessons are relevant, engaging, and create spaces where students can share their experiences of being racially profiled. Students also begin to see how mathematics can be used as a tool for revealing and exploring social justice issues. Gay (2010) states, "empowerment translates into academic competence, personal confidence, courage, and the will to act" (p. 34). When students find connections between mathematics and their everyday lives, it validates their experiences in their communities and can increase their engagement with the mathematical concepts. As a result, students can build their confidence and competence in mathematics. Additionally, social justice mathematics lessons create spaces where students can enact their agency and respond to the injustices in their communities. My personal experience tells me that culturally situated and social justice oriented mathematics lessons are important for the education of urban youth; it is inspiring to see my experience validated by other mathematics educators in *Math Is a Verb*. While NCTM has been critiqued for ignoring culturally responsive mathematics education (Martin, 2015), *Math Is a Verb* represents a nod toward embracing a culturally responsive approach to teaching mathematics. It gives me hope for the future of mathematics education—a future in which urban students see themselves and their experiences reflected in the mathematics taught in schools.

References

- Aguirre, J., Mayfield-Ingram, K., & Martin, D. (2013). *The impact of identity in K–8 mathematics: Rethinking equity-based practices*. Reston, VA: National Council of Teachers of Mathematics.
- Aguirre, J., & Zavala, M. (2013). Making culturally responsive mathematics teaching explicit: A lesson analysis tool. *Pedagogies: An International Journal*, 8(2), 163–190.
- Barta, J., Cuch, M., & Exton, V. N. (2012). When numbers dance for mathematics students: Culturally responsive mathematics instruction for Native youth. In S. T. Gregory (Ed.), *Voices of Native American Educators* (pp. 145–166). Lanham, MD: Lexington Books.
- Barta, J., Eglash, R., & Barkley, C. (2014). *Math is a verb: Activities and lessons from cultures around the world*. Reston, VA: National Council of Teachers of Mathematics.
- Bishop, A. (1988). *Mathematical enculturation: A cultural perspective on mathematics education*. Norwell, MA: Kluwer.
- D'Ambrosio, U. (1997). Ethnomathematics and its place in the history and pedagogy of mathematics. In A. B. Powell & M. Frankenstein (Eds.), *Ethnomathematics: Challenging Eurocentrism in mathematics education* (pp. 13–24). Albany, NY: State University New York Press.

- Delpit, L. (2012). *"Multiplication is for white people": Raising expectations for other people's children*. New York, NY: The New Press.
- Gay, G. (2010). *Culturally responsive teaching: Theory, research, and practice* (2nd ed.). New York, NY: Teachers College Press.
- González, N., Moll, L., & Amanti, C. (2005). *Funds of knowledge: Theorizing practices in households, communities, and classrooms*. New York, NY: Routledge.
- Gutiérrez, R. (2009). Embracing the inherent tensions in teaching mathematics from an equity stance. *Democracy & Education*, 18(3), 9–16.
- Gutstein, E. (2006). *Reading and writing the world with mathematics: Toward a pedagogy for social justice*. New York, NY: Routledge.
- Gutstein, E. (2013). Driving while Black or Brown: A mathematics project about racial profiling. In E. Gutstein & B. Peterson (Eds.), *Rethinking mathematics: Teaching for social justice by the numbers* (2nd ed., pp. 16–18). Milwaukee, WI: Rethinking Schools Publication.
- Martin, D. B. (2000). *Mathematics success and failure among African-American youth: The roles of sociohistorical context, community forces, school influence, and individual agency*. Mahwah, NJ: Erlbaum.
- Martin, D. B. (2015). The collective Black and *Principles to Actions*. *Journal of Urban Mathematics Education*, 8(1), 17–23. Retrieved from <http://ed-osprey.gsu.edu/ojs/index.php/JUME/article/view/270/169>
- National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: National Council of Teachers of Mathematics.
- National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common Core State Standards for mathematics*. Washington, DC: Council of Chief State School Officers.
- Solórzano, D. G., & Yosso, T. J. (2009). Critical race methodology: Counter-storytelling as an analytical framework for educational research. In E. Taylor, D. Gillborn, & G. Ladson-Billings (Eds.), *Foundations of critical race theory in education* (pp. 131–147). New York, NY: Routledge.