

# Unpacking Culturally Responsive Mathematics Teaching for Young Learners

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**Abstract:** *This abbreviated literature review features studies regarding elementary mathematics instruction and the mathematics teachers that act in ways that lend to and further cultural responsiveness. Teachers presented in the review utilized a pedagogical style referred to as responsive teaching (Empson, 2014) and studies were re-read and analyzed with a lens of cultural responsiveness, specifically that of culturally responsive teaching (CRT). The analysis exposed common practices across this vein of mathematics teaching that uphold the tenets of cultural responsiveness. The value that this form of instruction holds for young learners is also presented.*

## Introduction

In 1995, Ladson-Billings laid the framework for considering students' cultures in teaching and challenged the deficit conversations around under-performing learners. She used her theory of culturally relevant pedagogy (CRP) to focus on the success of students who were typically seen as the least successful in order to "reveal important pedagogical principles for achieving success for all students" (2014, p. 76). Ladson-Billings found that teachers within the CRP realm attend to the domains of academic success, cultural competence, and sociopolitical consciousness. Adding to the research of cultural implications for the classroom was Gay's (2001) culturally responsive teaching (CRT). Gay defined CRT as utilizing the "cultural characteristics, experiences, and perspectives of ethnically diverse students as conduits for teaching them more effectively" (p. 106).

Specifically in mathematics, Mukhopadhyay, Powell, and Frankenstein (2009) explored subject-matter cultural implications. They believed that "beyond academic mathematics there lies a wealth of human activity that should be acknowledged as mathematical – historical and contemporary mathematical knowledge and practices of all peoples" (p.76). However, Gutiérrez (2009) cautioned against simply replacing traditional mathematics curriculum with a prescribed culturally responsive curriculum. Rather the content of culturally responsive mathematics is dependent upon the learners in the room, and the culturally responsive math teacher is one who seeks to expose all learners' contributions to the mathematics at hand and integrate their identities into the instruction.

## Lens and Guiding Question

Lampert's (2001) research foreshadowed what culturally responsive teaching may mean for the elementary context when she explained that while teaching the elementary mathematics content, she simultaneously made and maintained relationships with all students and maintained relationships among their diverse ideas. Lampert explained this type of teaching as, "shaping and being shaped by the evolving intellectual and social networks in which I am acting" (p. 2). It is commonly recognized in the field of culturally responsive education that building relationships matters to student success, however, there is less work around why cultural responsiveness matters specifically to the elementary mathematics classroom. This review addresses that by analyzing across authors with a lens of cultural responsiveness in order to explore how this form of instruction

impacts young learners of mathematics. The following question guided this literature review: What does culturally responsive teaching in elementary mathematics entail and how does this teaching contribute to children's learning of mathematics?

### **Search Methods**

Record searches were done with the term "Culturally Responsive Mathematics" in Google Scholar and Article+ for peer-reviewed articles and book chapters to which 211 and 48 records resulted, respectively. Adding "elementary" as a keyword to the search then dropped the results to 139 and 32 records. Author searches were also done around noted social justice mathematics researchers Gutiérrez and Frankenstein, and around mathematics education researchers in the responsive teaching realm such as Lampert and Empson. Records in each database were scanned, noting commonalities. Abstracts were read and records sorted by their relevance of addressing the overarching question. Nine peer-reviewed pieces were selected to cross-analyze for themes of the culturally responsive elementary mathematics classroom. Note that a parameter of publication dates was not used for the records in this review. The purpose of the review was for analysis and integration of key pieces of literature regardless of publication date, in order to shed light on cultural responsive teaching for children's mathematics.

### **A Review of the Literature**

In reviewing these nine touchstone pieces, three overarching themes emerged. The pieces called educators to action, outlined the elements of responsive elementary mathematics classrooms, and/or discussed the impacts of the responsive mathematics classroom.

### **A Call to Action**

Schoenfeld (2002) claimed that the historical context of students' poor achievement in mathematics is a result of traditional

instructional approaches and urged for mathematics reform. Schoenfeld heralded Robert Moses' (2001) argument that those in poverty and people of color are affected by a lack of economic access due to a lack of mathematical literacy. A lack of mathematical literacy means a lack of opportunities in higher education or in the work force.

Schoenfeld then referred to the National Council of Teachers of Mathematics (NCTM) Principles and Standards document released in 2000 that made clear the intent for equity in reform-based mathematics instruction. He explained that mathematics equity results in part due to teachers who are prepared to help students learn through quality mathematics curriculum and problem solve in ways related to their worlds outside the classroom. Prescriptive curriculums that give teachers little discretion only serve to suffocate the intuitive mathematics that students bring into the room. Both Schoenfeld and Gay (2001) acknowledged that curriculum design has shown improvement, but Gay noted that the culturally responsive teacher must still evaluate curriculum for components like complexity, context, and authenticity to make the changes that improve its overall quality for all the learners in the room.

In 2013, NCTM furthered its stance on equity with its release of the Mathematics in Early Childhood Learning position statement. The statement echoed past recommendations of curriculum and teaching for young students that are both developmentally appropriate and culturally and linguistically responsive. NCTM asserted that this work must start in pre-kindergarten in order to ensure future success in mathematics for students. The position stated that teaching practices should be built around the mathematics as well as the child's development. Teachers must interact with their children in deep ways in order for the children to interact with the mathematics in deep ways. This view recalled Mukhopadhyay et al.'s (2009) explanation of culturally responsive math instruction that starts "from the points of cultural familiarity, brought out in the curriculum

in a deep way connected with the entire context of intellectual activities of the particular culture” (p. 77).

### **A Look into the Culturally Responsive Elementary Mathematics Classroom**

Lampert’s (2001) work purported that for students to be successful in mathematics, the teacher must do more than teach the content and find a way to elicit and integrate the various ideas in the classroom into that content.

Empson (2014) explained responsive mathematics teaching as “taking into account the evidence provided during instruction about children’s thinking and its advancement. To teach in ways that are responsive to children’s mathematical thinking, teachers need to elicit children’s thinking, interpret this thinking, and then ‘respond helpfully’” (p. 24). Analyzing across the work of responsive mathematics classrooms, two subthemes emerged: communication and development of the whole child.

**Communication.** In the action-research done in her preschool and kindergarten classrooms, Paley (1986) discussed her goal to listen to children with genuine curiosity and intrigue. She became aware of the intuitiveness her students brought to problem solving in the play that was grounded in their real life experiences and began attaching the mathematics to that. By posing questions to students rather than directing them she opened her classroom to discussions that stretched the young learners. She allowed children time to explain, persuade, and justify until they felt satisfied with their reasoning. Paley found that while she was facilitating students in learning math, she was also helping them navigate the question, “What is going on in this place called school, and what role do I play?” (p. 124).

Noddings (1993) specifically cited the use of dialogue in the math classroom as an avenue to culturally responsive teaching. She informed that dialogue could be integrated into math through allowing students to work together,

through discussions around word problem contexts, or through a collaborative discussion around the question “How shall we do this problem?” (p. 156). This question allows teachers to draw out student ideas and connect student contributions. Noddings explained that when dialogue is used thoughtfully it allows for students to learn to build upon and appreciate one another’s varying ideas. This not only enhances the mathematics at hand, but also enhances the chance at cooperative living outside the classroom.

Lampert (2001) also cited the use of dialogue in the action-research about her elementary classroom. She facilitated communication between students in order to establish a climate in which a student believes that he/she and every other classmate is capable of learning mathematics, no matter their “gender, race, or parents’ income” (p.2). Lampert saw the diversity in student ideas and strategies as a rich resource, and deemed it her responsibility to decide how to use this resource to benefit the learners. Responsive mathematics teachers know that their job is not as easy as following a rote curriculum, but they see the value in providing a classroom space that is open to all mathematicians and ground their pedagogy in listening to children for the sake of exposing and integrating diversity of experiences and ideas.

**Development of the Whole Child.** Similarly to NCTM’s 2013 plea for mathematics teachers who teach with both the mathematics and child’s development in mind, Noddings (1993) stated that teachers must attend to students’ developmental themes such as, “Who am I? Who will I be? How hard should I work and toward what end?” (p. 153). Noddings asserted that while math teachers should promote mathematical growth, their primary aim should be “the growth of students as competent, caring, loving, and lovable people” (p.159).

Gutiérrez (2009) added to this theme of the research through her work on equity in mathematics and proposed four key dimensions

of access, achievement, identity, and power. Student identity in mathematics was recognized as providing children “opportunities to draw upon their cultural and linguistic resources (e.g., other languages and dialects, algorithms from other countries, different frames of reference) when doing mathematics” (p. 5). Gutiérrez explained that teachers must also acknowledge that they work within the context of school and a dominant culture, and that many of their children have learned to neglect their personal and cultural selves to be a part of school. The culturally responsive teacher holds this as true and seeks to include those personal aspects that may have been previously silenced in the math classroom for the betterment of the whole child.

Empson’s 2014 piece closely followed her decision-making with second grade students in a mathematics group and shed light on the attention to whole child. One specific teaching segment highlighted her interactions with a student, Emilio, when he chose not to work on a problem. Rather than jump to deficit thinking about the child, Empson stated,

I decided I did not want to assume that he was avoiding work. Perhaps it was his way of expressing boredom or confusion, maybe he was preoccupied with a personal problem more important to him than counting candies in a roll (p. 41).

However, she continued to work with Emilio on the problem until he could provide a correct answer. Many teachers have fallen trap to placing the answer above underlying student need, but Empson reflected on her interactions by asking herself, “What did he take away from it? A new understanding of ten as a unit? A feeling of confidence that he can solve problems? A feeling of being forced to do something he did not want to do?” (p. 41). She mused that the answer to “What did he take away from it?” was much more of an important instructional component to consider than Emilio getting the correct answer. For the culturally

responsive mathematics teacher, it is crucial that there is reflection and that one admits to judgments and self-motives that may threaten the teaching of the whole child. The responsive math teacher must understand the child first then work towards instilling mathematical goals that build upon this understanding.

### **The Impact of Culturally Responsive Mathematics**

Noddings (1993) explained the efficacy that culturally responsive mathematics can produce for students by noting the empowerment this type of teaching offers. Through a culturally responsive style, teachers can use their personal power to help students acquire power, and thus help them gain control over other aspects of their lives and have efficacy. Noddings asserted that the aim of the classroom teacher should be to promote dialogue “both within mathematics lessons and about mathematics as a potential avenue of self-affirmation” (p. 156). Children deserve to discuss and make sense of the mathematics, and see how their ideas inform the mathematics of the classroom. If this happens from an early age, positive affirmation about mathematics as a subject becomes a part of the child’s discourse, along with that component of self-affirmation.

Beyond just the socio-emotional and developmental needs that culturally responsive mathematics addresses, there is an access issue that culturally responsive mathematics helps to remedy. Schoenfeld (2002) pointed out that mathematics courses are linked to technological literacy and opportunities for higher education. An early foundation in mathematics through high quality mathematics instruction may allow for students to continue on a mathematics coursework path they would have otherwise been denied. Robert Moses (2001), as cited by Schoenfeld, discussed the technological literacy that current and future jobs in the workforce require and that technological literacy is gained through mathematical literacy. Justifying, communicating, and sense-making about

mathematics from an early age sets all students up for success in the field that has historically shown that “disproportionate numbers of poor, African-American, Latino, and Native American students drop out of” (Schoenfeld, 2001, p.13).

### Implications and Future Studies

In a field that is a product of “the apprenticeship of observation” (Lortie, 1975), a cycle of skill-based, rote mathematics instruction continues. Rather than open the mathematics classroom to a space of students as living generators of knowledge, many teachers continue to stifle them. Teachers treat mathematics as what Freire (1970) referred to as banking education, in which teachers are the bearers of knowledge and deposit it into students. Teacher education programs must address the embedded traditional mathematical beliefs of prospective elementary teachers (PTs) and counteract these with positive experiences that expose them to the openness and cultural obligation of equitable mathematics. University courses that model responsive mathematics teaching with the PTs will be important to future reform movements. This will be crucial to PTs’ understandings of how this type of teaching is possible in their future classrooms.

Future research studies are needed around the implementation of culturally responsive elementary mathematics teaching and what it entails for both prospective and practicing teachers. Longitudinal studies that follow young students of culturally responsive mathematics classrooms into future school years would add valuable insight to the research-base in this field. In addition, revealing the opinions and insights from young learners who are a part of a responsive mathematics classroom environment would expose a new perspective not yet seen in research. Interviews and observations specifically focusing on the opinions of children in these classrooms are needed.

If like Schoenfeld we believe that mathematics should be democratizing rather than a mechanism for furthering elitism, then we must

acknowledge that cultural and racial gaps in achievement exist and that a responsive form of mathematics education is needed. Children need to be able to use mathematics to make sense of the world around them and come to value the contributions of a myriad of different ideals, strategies, viewpoints, and histories. The culturally responsive mathematics teacher must work thoughtfully to ensure that all students have a voice and are able to see themselves reflected in the mathematics of the classroom and the greater world.

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