

Chapter Title and Section: The Affordances and Challenges of Enacting Culturally Relevant Science and Mathematics Pedagogy; to be included in Section 5 (STEM Teacher Education) or Section 4 (Critical Issues in STEM).

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Author Expertise:

Paula Magee is a Clinical Professor in Science Education & Teacher Education in the School of Education at Indiana University-Purdue University Indianapolis. Dr. Magee's research and teaching focuses on using inquiry and culturally relevant pedagogy as a framework for teaching science in urban elementary schools. She uses anti-racist teaching and critical whiteness studies, to make visible, structural and systemic barriers to equitable teaching. Paula has worked with both pre-service and in-service teachers in elementary schools for over 20 years. Her work is grounded in developing long-standing partnerships with local elementary schools where teachers, administrators, and communities work together to develop critically conscious science curriculum. Paula's scholarship has been published in a variety of research and practitioner-focused journals and edited volumes.

Craig Willey is an Assistant Professor of Mathematics Education and Teacher Education in the Indiana University School of Education at IUPUI. His research focuses on 1) supporting teachers to develop mathematics discourse communities with urban students, primarily Latinas/os; 2) understanding barriers and pathways to establishing equitable mathematics classrooms; 3) the development and incorporation of curricular features that provide bilingual learners better access to mathematical ideas and more opportunities to engage meaningfully; and 4) the limitations and affordances of a school-university partnership model of urban teacher development. Craig

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engages the theoretical and analytical frameworks of Culturally Relevant Pedagogy and Whiteness to make sense of teachers' interpretations of schooling contexts their instructional decision-making processes. Much of his research is conducted in bilingual contexts, including Dual Language classrooms and schools. From 2006-2011, Craig was a Research Fellow with the Center for the Mathematics Education of Latinos/as (CEMELA) at the University of Illinois at Chicago (UIC). Prior to joining CEMELA at UIC, he taught 6th, 7th, and 8th grade math in Denver Public Schools' Bilingual Education program.

Esra Ceran is a doctoral candidate in Educational Science program at Marmara University in Istanbul, Turkey. She has an appointment as a research assistant at Istanbul University and is currently a Visiting Scholar at Indiana University-Purdue University Indianapolis. Esra has research expertise in integrated STEM curriculum and culturally relevant teaching in elementary grades. Her dissertation entitled "Case Studies of Elementary Teachers' Experiences with Integrated STEM Curriculum" focuses on teachers' instructional practices during implementation of science and math through an integrated approach and teachers' beliefs about, and perceptions of, STEM integration. Before being a member of Istanbul University, she worked as a primary school teacher for over 6 years and received several grants to explore STEM integration through funding from the European Union and Marmara University. Her project, "My Inventor Dad is in my Science Class," received Best of Education Award in the Innovation and Technology category from Classroom.

Summary of Chapter:

In this chapter, we examine the current literature base involving the use of culturally relevant pedagogy (Ladson-Billings, 1995) in elementary science and mathematics classroom settings. Using synthesized themes from the literature, we developed a visual representation that organizes the ways in which culturally relevant teaching can be/is enacted in classrooms, including a critical analysis using the construct of whiteness.

Chapter Abstract:

In this chapter, we examine the current literature base involving the use of culturally relevant pedagogy (CRP) (Ladson-Billings, 1995) in elementary science and mathematics classroom settings. We then explore, synthesize and represent themes from the literature review through a visual tool (i.e., iceberg of culturally relevant teaching; Weaver, 1986) that organizes the ways in which culturally relevant teaching can be/is enacted in classrooms. Finally, we use the lens of critical whiteness studies (CWS) (DiAngelo, 2011) to understand why some components of CRP, as revealed from the literature review and identified on the visual representation, are enacted more or less frequently.

Preparing socially just and critically conscious elementary science and math teachers is not simple nor straightforward. Teacher educators contend with teachers' fear of science and mathematics, as well as the ingrained, and often invisible, structurally racist practices that exist in elementary classrooms. Identifying resources, activities and theoretical frameworks that are accessible to teachers and pre-service teachers, and support their development in these key areas, remains difficult (Ladson-Billings, 2012). Often, considerations of race, equity and oppression are far removed from the expectations elementary teachers have when they teach science and mathematics or engage in professional development. One approach to connecting theory to practice is to help teachers understand and use the tenets of CRP (Ladson-Billings, 1995). While teacher educators have engaged and used CRP for decades, with mixed success, some published work in this area falls short of complex enactments, and some misinterprets Ladson-Billings' ideas (Ladson-Billings, 2014; Young, 2010). In this chapter we examine the existing literature around CRP, specifically, Culturally Relevant Science and Math Pedagogy (CRSMP), and synthesize the research into relevant themes. We offer two particular frameworks that theorize inherent difficulties found in enacting CRSMP. First, we use the idea of the "iceberg of culture" (Weaver, 1986) to develop a new visual representation that outlines the range of activities constituting CRSMP in classrooms. For example, it is common for teachers to honor cultural diversity through celebrating or acknowledging holidays or practices, perhaps weaving these into science and/or math curricula. Being relatively comfortable classroom practices, these are situated at the top of the iceberg, above water. It is less common, however for teachers to invite families into the classroom to participate in developing curricula that connect family practices with science and mathematics. This practice would be towards the bottom of the iceberg, underwater, indicating a more contentious practice. While the iceberg is a helpful visual, it does not offer teachers a pathway to understand hegemonic schooling practices. Second, and with this in mind, we use CWS (DiAngelo, 2011; Michael, 2015), to unpack barriers to CRSMP in elementary classrooms. CWS calls into question and makes visible the systemic practices that benefit White people, oppress others and maintain the status quo with regard to inequitable science and mathematics school practices (DiAngelo, 2011; Michael, 2015). This chapter concludes with a discussion of how CRSMT research and practice represents the potential to alter power dynamics and support more equitable school experiences.

References

- DiAngelo, R. (2011). White fragility. *International Journal of Critical Pedagogy* 3(3), 54-70.
- Ladson-Billings, G. (1995). But that's just good teaching! The case for culturally relevant pedagogy. *Theory into practice*, 34(3), 159-165.
- Ladson-Billings, G. (2014). Culturally relevant pedagogy 2.0: aka the remix. *Harvard*

Educational Review, 84(1), 74-84.

Ladson-Billings, G. (2012). "Yes but how I do it?" Practicing culturally relevant pedagogy. In J. Landsman & C. W. Lewis (Eds.). *White teachers/diverse classrooms: Creating inclusive schools, building on students' diversity, and providing true educational equity*. Sterling, VA: Stylus Publishing, LLC.

Michael, A. (2015). *Raising race questions. Whiteness & inquiry in education*. New York, NY: Teachers College Press.

Weaver, G. R. (1986). Understanding and coping with cross-cultural adjustment Stress. In R.M. Paige (Ed). *Cross-cultural orientation. New conceptualizations and applications*. Lanham, MD: University Press of America.

Young, E. (2010). Challenges to conceptualizing and actualizing culturally relevant pedagogy: How viable is the theory in classroom practice? *Journal of Teacher Education*, 61(3), 248-260.