

What *Is* and *Who* Can Do Science?

Supporting Practice-Linked Identities in Science for Racially/Ethnically Underrepresented Youth

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Abstract. This study examines the development of students' science and racial identities during summer science research programs. I utilize qualitative and quantitative data sources to examine students' incoming ideas about *what* science is and *who* can do science, how these ideas shift while participating in scientific practices, and program resources that support these shifts. Findings show that ideas about *what* and *who* shift together and unique resources support the co-construction of students' science and racial identities.

Introduction

The issue of racial/ethnic underrepresentation in science (Oakes, Ormseth, Bell & Camp 1990) is complicated by dominant representations of *what* science is and *who* can do science. These representations provide narrow images of science (e.g. prescribed labs) and scientists (e.g. white, male) that are problematic for students from diverse backgrounds. A typical solution to increasing diversity in science is through instructional and policy reforms (i.e. focusing on *what* science is), yet racially-based achievements gaps are persistent (National Science Board, 2012). In order to dismantle persistent issues of equity, equal attention must be paid to the messages youth of color receive in science contexts about *who* can do science.

Objective

This study examines trajectories of developing interest in, and identification with science for high school students of color as they participate in summer science research programs designed for racially/ethnically underrepresented youth. Students conduct investigations alongside scientist mentors as part of the programs. I explore science identity in relation to racial/ethnic identity to examine how ideas about *what* science is and *who* can do science develop together through participation in the practices of science. I ask three questions:

- What are racially/ethnically underrepresented students' incoming ideas about *who* does/can do science?
- How does conducting research alongside scientist mentors inform students' views of *what* science is?
- How do program resources support shifts in students' ideas about *what* science is and *who* can do science?

Potential Significance of Work

Though research shows that racial positioning matters for women of colors' long-term science trajectories (e.g. Carlone & Johnson, 2007; Malone & Barabino, 2008), treatments of race in relation to science are limited. New theoretical frameworks are needed that consider relationships between science learning and multiple aspects of identity construction (racial, disciplinary, academic) (Varelas, Martin, Kane, 2012). This research provides empirical evidence for how students' racial and science identities develop together in science contexts and the types of program resources that support shifts in students' ideas about what science *is* and *who* can do science.

Theoretical Framework

I draw on socio-cultural theories of learning and identity (Wenger, 1998). I view identities as fluid, dynamic and socially constructed from the resources available (Holland et.al., 1998) as students are positioned and position themselves in science learning environments (Harre, 2008). Science identity literature offers insights into the types of identities offered to underrepresented youth (e.g. Polman & Miller, 2010; Tan & Calabrese Barton, 2010), yet research that examines how youth of color negotiate their racial positioning in relation to science is limited (Rahm, 2007). I utilize the "practice-linked identity" framework (viewing participation in a practice as integral to who one is) and its supporting identity constructing resources (material, relational, ideational) (Nasir & Cooks, 2009; Nasir, 2012) in order to explore *how* learning, positioning, engagement, and connection to science develop *in context*.

Overview of Methods

Programs. The three summer science programs involved in this study contrasted in two main ways: 1) program content: race/diversity explicit (directly addresses race/diversity) vs. race/diversity implicit, and 2) science investigation content: community-based (e.g. environmental science) or traditional (e.g. physics). **Participants.**

1) Students: grades 9-12, Northern California high schools, 2) Mentors: science instructors, science graduate students. *Data Sources*. 1) Pre/post student surveys; 2) Pre/post student content assessments; 3) Semi-structured interviews: a) student interviews (pre/post, 6 focal students/program), b) scientist mentors; 4) Program observations.

Findings

Analyses show that students' incoming ideas about *who* does science are often shaped by stereotypical images of scientists (e.g. white, male, lab coats) and science practices (e.g. mixing chemicals). As a result, students often see their own racial background and experiences as discontinuous with scientists. This informs students' sense making regarding racial/ethnic underrepresentation in science in ways that often places blame on the individual or ones' culture/racial group. Findings show that students' ideas about *what* science is (e.g. practices) and *who* can do science shift together while participating in the practices of science. Conducting research alongside scientist mentors broadens students' views of what counts as science, and allows students to identify as capable science learners. In addition, different practices (e.g. presenting research) serve different identity functions for students impacting how they see themselves in relation to science. Some program resources utilized by instructors/mentors support holistic (science and racial) identity construction. Instructors who employed a racially conscious lens made unique resources available that supported the co-development of students' science and racial identities. Findings from this research illuminate program resources that increase students' understanding of and ability to take up the practices of science and create opportunities that allow for shifts in students' ideas of *who* can do science.

Conclusions and Implications

This research challenges and extends our understanding of scientific practices that can be leveraged in science programs and classrooms to create more authentic experiences and broaden opportunities for participation in science. Likewise, this research illuminates program resources that allow students to negotiate their racial/ethnic identities and positioning in relation to science and create opportunities for shifts in their ideas of *who* can do science. Together these findings can inform the design of learning environments that create multiple pathways for learning and identification in science and better support practice-linked identities in science for all learners.

References

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Workshops

