# Chapter 40
# Social Justice Research in Science Education: Methodologies, Positioning, and Implications for Future Research

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To evaluate trends in social justice citations, I searched for the phrase "social justice" using the online search fields in each of the following journals: *Journal of Research in Science Teaching*, *Science Education*, *Research in Science Education*, *International Journal of Science Education*, *Journal of Science Teacher Education*, *Elementary Journal of Science Education*, and *Cultural Studies of Science Education.* My search identified 105 journal articles, including empirical studies, literature reviews, book reviews, editorials, and forums spanning 1981–2008. I searched within each journal article for each social justice citation. Out of the 105 articles, 66 had a single mention of the phrase and in 29, social justice only appeared in the references list in the title of a book or journal article. Studies with a single social justice citation in the references list were eliminated from further review. The most frequently cited text (13 citations) was *Teaching Science for Social Justice* (Calabrese Barton et al. 2003).

Figure 40.1 shows a breakdown of the number of articles and the number of times the phrase "social justice" was cited in the text of the journal article for the remaining 76 articles. For example, there were 39 articles with one in-text citation, and one article with 46 in-text citations of this phrase. This analysis shows that very few articles addressed the topic of social justice throughout the paper.

Figure 40.2 shows the distribution of the number of articles that included at least one in-text citation of social justice by year. In 1977, for example, there was one journal article that cited social justice and in 2008 there were 22 articles. This analysis shows that the concept of social justice is gaining some traction in the field of science education research, with the number of articles citing the concept increasing over time.

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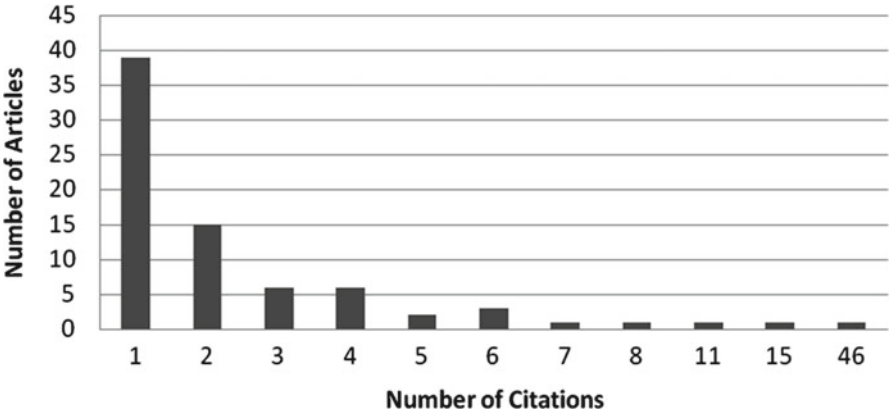


**Fig. 40.1** Number of articles by number of in-text citations

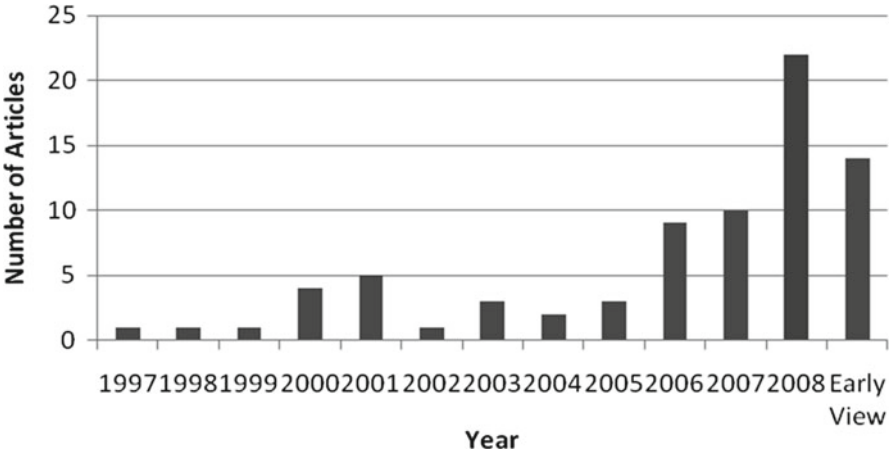


**Fig. 40.2** Social justice citations by year

Figure 40.3 shows the distribution of articles by journal citing social justice. *Cultural Studies of Science Education* had the largest number of citations, with 33 articles that included at least one in-text reference to social justice, followed by the *Journal of Research in Science Teaching*, with 14 articles.

The above analysis indicates social justice is an idea that is gaining some traction among members of the science education community. However, a close look at the studies reveals a tendency for authors to list social justice alongside equity as an overarching goal. Other studies clearly align theoretically and methodologically with a social justice framework; yet, this alignment is not made explicit in a consistent way. Thus, social justice in science education remains a concept that requires further definition and theorizing. In the following section, I review three early studies of social justice in science education.

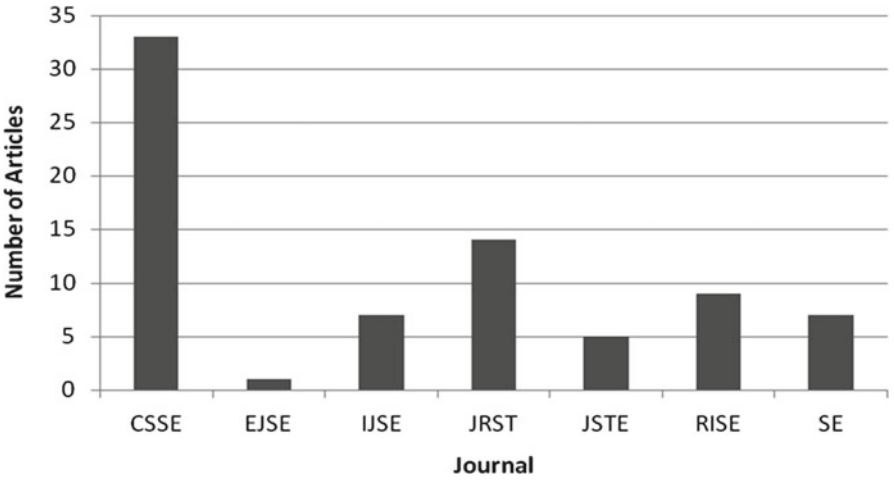


**Fig. 40.3** Social justice citations by journal

## Early Framing of Social Justice in Science Education

One of the first scholars to write about social justice in science education was Alberto Rodriguez (1997), who published a critique of the National Science Education Standards in JRST. He argued that the standards document engaged in a discourse of invisibility because it did not provide a clear argument for why or how teachers should work to improve the achievement of traditionally marginalized groups of students – women, the poor, and students of First Nation, African, and Latino/ethnic background. Rodriguez wrote:

> In the case of education reform, an individual's political will must come from a clear sense of purpose and understanding that social justice requires one not only to question, but to take action even when these actions may lead to transforming one's own comfort and institutionalized privilege (or lack of it). (pp. 28–29)

Rodriguez provides a critical analysis of trends in student achievement across gender and ethnicity, drawing on data from the National Assessment of Educational Progress (Mullis et al. 1994) to highlight inequitable outcomes. He concluded that the standards should provide "more visible theoretical frameworks and arguments in support of learning science for understanding and for teaching science in more inclusive and multicultural ways" (p. 32).

Angela Calabrese Barton (1998) takes up the issue of social justice from the perspective of what it means to teach science for all with homeless children. Calabrese Barton explores issues of representation and identity in science and demonstrates that when youth have the power to shape science for their needs and interests, the borders of science expand. Calabrese Barton explains: "The doing of science involved merging the emotional with the physical and intellectual. The students found their experiences with the ugliness of their community or with hunger

as important and more complex than science could describe in its neutral language" (p. 391). At the same time, blending activism with scholarship requires the researcher to navigate relationships and ethical issues. For example, Calabrese Barton shared the following:

> In an initial interview with a leader and activist within the local social services community, I was told that this research project was not only a commitment to research, but also to the children, and that "unless I was on my death bed," I had better not miss a scheduled visit. I recognized that I had begun to earn Gilma's trust simply by returning each week to spend time with her and the other children. (p. 385)

Calabrese Barton concludes: "If *all* students are to participate in science in genuine ways, then teachers need to find ways to value the diverse ways of knowing brought to class by the students" (p. 391, emphasis in original).

William Kyle (1999) aligned teaching science with teaching for social justice. In an editorial for a theme issue focused on science in developing countries, he noted:

> The totality of an education in science is equally as much oriented toward social justice, critical democracy, empowerment, action-taking, and investing in our future's intellectual capacity as it is about constructing conceptual understandings of the world. (p. 255)

Kyle recognized that beyond a way of knowing about the world, science education could be a way of acting in the world to transform it:

> Education is about hope, dreams, aspirations, and struggle. … Education must be *for* something. But what? Education ought to be for the purpose of fostering critical and participatory democracy, enabling students to recognize that the world that is being presented to them is in fact a world that is being made – it is changing constantly – thus, for this very reason, it can be changed, it can be transformed, and it can be reinvented. (p. 256, emphasis in original)

Further, he argued that social justice in science education could foster the types of global communication and collaboration that could address issues of poverty, development, and sustainability in the world.

The above articles position science education and science education research as tools and contexts for challenging injustice. In the remainder of this chapter, I review five studies that illustrate some of the ways social justice research balances needs for scholarship with needs for activism in the field. I will explore each author's positioning with respect to social justice and their particular social justice issue. Then, I will analyze the methodological approaches used in each study. I recognize that this focus might marginalize other scholars whose work incorporates a social justice framework. However, I believe a more focused review will provide a clearer justification for further research and highlight ways to strengthen the reporting of social justice research in science education.

## Positional Identity and Social Justice Research

To understand positioning, I draw on the idea of positional identity, as "understanding how social markers such as race, class, gender, religion, among others, influence views of teaching and learning science" (Moore 2008a, p. 593). Just as the standards

**Table 40.1** Foundations of social justice research in science education

| Discourse | Central ideas |
|---|---|
| Feminist | • Urges rethinking the nature of science and science education<br>• Proposes liberatory rather than oppressive science education<br>• Positions knowledge as subjective and contextually mediated<br>• Shifts away from compensatory programs |
| Multicultural | • Challenges notions of science grounded in the Western tradition<br>• Urges use of culturally relevant and responsive pedagogy and science for self and social transformation<br>• Emphasizes role of community action |
| Critical | • Critiques the role of schools and institutions in reproducing inequity<br>• Highlights the role of hegemony, power, and privilege in sustaining oppression<br>• Critiques enculturation and reproduction of the dominant culture<br>• Struggles to address entrenched inequalities |
| Science for all | • Positions scientific literacy as a national goal<br>• Asserts equity goals in science education<br>• Clarifies the nature of science<br>• Emphasizes inquiry-based methods for science teaching and learning |

engage in a discourse of invisibility (Rodriguez 1998), science education research also engages in a discourse of invisibility when it does not convey an adequate understanding of the researchers' agendas or the ways their positional identities frame how they perceive and work to address social justice issues. Since social justice research blends scholarship and activism, researchers also position themselves with respect to the theory and practice of social justice and the particular social justice issues addressed by the project. Thus, researchers may also position themselves in relation to discourses, texts, issues, people, and places.

Social justice research in science education has its roots in feminist, multicultural, and critical approaches to science education and takes up the challenge of science for all in ways that position science as a dynamic, contextual tool for promoting equity and empowerment (Rivera Maulucci 2008a). Table 40.1 summarizes some of the central tenets that inform work in social justice in science education. Rather than providing an exhaustive list, the table conveys the idea that the ways researchers position themselves with respect to these and other discourses, provides for multiple, nuanced, situated, and emerging definitions of social justice in science education.

For example, Rodriguez (1998) provides a clear sense of his positionality through the following statement:

> As a Latino science teacher educator, I am deeply committed to closing the gap in student achievement and participation, as well as to making science more socially relevant and accessible to all children. (p. 590)

He explains that, "in the secondary science methods class that I teach, I am the only Latino and the only member of a typically underrepresented ethnic group in

the sciences" (p. 603). Rodriguez situates his work within discourses related to multiculturalism and equity in science education:

> It is not enough just to encourage all learners to celebrate and study the contributions of men and women from various ethnic backgrounds to the advancement of scientific knowledge. Multiculturalism seeks to provide learners with opportunities for empowerment. (p. 591)

He draws on critical, multicultural, and sociocultural theories of education and learning to propose sociotransformative constructivism (STC) as a way to teach for diversity and understanding, and notes that "the STC orientation provides spaces where existing contexts can be collaboratively transformed to meet social justice goals. Power, then, is a central construct in STC – power is the currency of social change" (p. 599). In this case, the social justice issue is framed by his position as a science teacher educator in a program that seeks "to prepare teachers to work respectfully and effectively with children from diverse backgrounds (i.e., from diverse socioeconomic status, cultures, ethnicities, abilities, sexual orientation, family units, and so on)" (p. 593). Rodriguez clearly states: "This is an ideological orientation based on a principle of social justice in which I personally believe" (p. 590).

In her article, Felicia M. Moore (2008b, p. 595) positions herself as a science educator:

> As a science educator, I am always open to new approaches to my teaching and research. Over time, I have become interested in not only what I do in my teaching but also how it informs and provides a space for research.

Moore defines social justice work in science education as attending to students' right to learn science (Tate 2001): "Social justice considers action toward developing learning environments that support all students in learning, such that every student has a right to learn and to have a quality education" (pp. 589–590). And she explains further:

> By taking on social justice education as a science educator I challenge preservice teachers to understand what it means to create science classroom communities with access, equity, quality, and opportunity to learn science as fundamental goals. (p. 591)

Moore situates "learning about social justice for preservice teachers … within the context of multicultural education" (p. 591). She also highlights the need for preservice teachers to understand issues of power and privilege in education, how social structures and hierarchies marginalize students, and how preservice teachers might deconstruct such social structures through their practice (Lewis 2001). Her definition of agency draws on critical and multicultural perspectives:

> [F]or this study, agency is defined as individuals or groups reflecting, acting, modifying, and giving significance to the teaching of science in purposeful ways, with the aim of empowering and transforming themselves and/or the conditions of their lives, students and others … it is the way that teachers use power, influence, and science to make decisions that effect positive social change in science classrooms. (p. 591)

One way in which Moore could have strengthened her positioning in this study might have been to include the ways her race, ethnicity, and gender influence her positioning with respect to social justice in science education and the

ways her positioning with respect to critical and multicultural theories frame her vision of science.

In my study, I address the issue of English language learners (ELLs) and science education (Rivera Maulucci 2008b). Through an in-depth case study of a preservice teacher, Elena, I undertake a critical exploration of school policies and procedures that render native language proficiency as a deficit that immigrant students must overcome. In the study, I position myself as a teacher educator in a social justice teacher education program concerned with the question of how, "social justice teachers [can] be prepared to meet the challenges of supporting immigrant youth in a climate that increasingly calls for immersion…" (p. 18). I reveal my personal positioning with respect to the issue of language, as I argue against school policies that do not allow immigrant students to maintain their native language and culture:

> What would I have chosen? As a third-generation Puerto Rican, speaking English at home, and divorced from many of the trappings of culture that enable one to fit in–the language, idioms, dance, music, and modes of dress – I have lived in a borderland between Puerto Rican and not Puerto Rican. What would I have chosen? I would have chosen science *and* Spanish. (pp. 36–37, emphasis in original).

My positioning with respect to critical and multicultural discourses comes through examination of US immigration patterns that favor elites and assimilationist ideologies that undergird school language policies and equate "science for all" with "English only." For example: "Such policies cannot be neutral; rather they confer privilege and access to standard English, scientific discourse, and bilingualism, differentially across race, class, and ethnic categories, as well as immigration status" (p. 41). I argue that we cannot understand the case of Elena without situating her microlevel experiences in the classroom within mesolevel structures of schooling for ELLs and macrolevel patterns associated with globalization. My positioning with respect to the issue of language would be strengthened by a discussion of the demographics of students in my teacher education program and the schools we partner with, to highlight the need for preservice teachers to develop strategies to support ELLs.

Edna Tan and Calabrese Barton (2008) indicate their position with respect to global feminism: "Global feminism is a phrase we use to describe the ideas emerging from the most recent wave of feminist scholarship attentive to transnational and globalization issues while drawing upon critical, anti-racist and postcolonial perspectives" (p. 46). In their study, Tan and Calabrese Barton focus on urban, Latina girls' participation in science:

> We believe that by paying careful attention to how and why urban girls author identities-in-practice, we can gain deep insight into the noncommodified forms of knowledge, relationships and activities that girls often employ to participate in science related communities in ways that are culturally and socially just and sustainable. (p. 46)

Their study conveys a clear positioning with respect to the research context, with detailed descriptions of the school, the principal, the science teacher, and the neighborhood. However, the authors do not share how their own gender, class, race, or ethnic identifications impact their positioning or how they navigated their

insider/outsider status as social justice researchers from an elite college working in a high-poverty community.

Rowhea Elmesky and Kenneth Tobin (2005) address the issue of urban youth's social capital in contrast to the deficit models that dominate how policy-makers, schools, teachers, and the educational reform literature typically construct the problem of underachievement in inner city schools:

> We contend that the trends of science education in urban settings will continue if theoretical frameworks of cultural poverty, deprivation, and social reproduction continue to inform research. We find these theories to be hegemonic – laden with deficit views of marginalized youth and with a static view of culture. Moreover, these theories reinforce the cycles of oppression experienced by the urban poor … (p. 809)

Their critical perspectives are clear in their attention to issues of power and hegemony. Elmesky and Tobin also position themselves with respect to current science education research by highlighting how their approach "challenges traditional views" (p. 811) by engaging youth as researchers. Their social and cultural positioning is established in an endnote that states: "The first author is from a mixed racial background, yet has been enculturated to some extent with white, middle-class value systems. The second author is white" (p. 825). On the one hand, they seek to share methodologies that provide for a more inclusive understanding of student agency in research; however, their positionality in terms of gender, ethnicity, race, and class and how that impacts their relationships with the youth is framed by the labels, insiders and outsiders. For example, "When Ken began to teach science in an inner-city high school, to afford his roles as teacher educator and researcher, he quickly realized that he needed insider perspectives to inform his practices" (p. 813). In a similar way, they wrote: "Although we wanted to learn more about student researchers' homes and neighborhoods … we could not ignore the fact that we would be outsiders in those fields …" (p. 816).

## Critical Ethnography in Social Justice Research

A methodology is a theory of method and as such encapsulates epistemological, ontological, tactical, and catalytic assumptions. For example, as a researcher, I employ critical narrative inquiry methodology (Rivera Maulucci 2008b). Critical narrative inquiry rests on the epistemological assumption that people come to know the world and its power relations through story. From an ontological perspective, the researcher attends to narrative elements, including character, setting, events, dialogue, action, emotions, and time. Critical narrative inquiry views storytelling as a meaning-making experience, both for the participants, as they tell their stories, and for the researcher, as they interpret and retell stories to advance theoretical and analytical points. Telling, interpreting, and retelling stories, changes or transforms participants and the researcher in ways that implicate the need for further personal or contextual change. Critical narrative inquiry also foregrounds a need for tactical authenticity, in that the research process empowers participants and the researcher

to act on the need for change. In essence, social justice methodologies encapsulate assumptions about how people individually, collectively, and contextually, come to know and change the world and each other.

All the studies in this review employ critical ethnographic methods. What makes these studies critical is their focus on issues of power and the need for transformation. For example, according to Moore (2008b): "Research grounded in critical methodologies is particularly suitable for understanding preservice teacher identity, agency and stance toward social justice because it seeks to document the process of empowerment" (p. 590). Elmesky and Tobin (2005), assert: "A critical research process invokes a goal of determining the existence of injustice, finding methods for altering it, and identifying the sites for transformation" (p. 810). Ethnographies typically: (a) focus on a particular context; (b) employ multiple research methods, such as interviewing, participant observation, and collection of artifacts to explore a wide range of social behavior in the setting; (c) use grounded theory approaches to data analysis; and d), are marked by prolonged engagement and an understanding of complexities, rather than generalizations (Pole and Morrison 2003). Thus, critical ethnography rests on the assumptions that knowledge is situated, that it requires an insider's perspective, and that participants' perspectives matter. Furthermore, Rodriguez (2001) proposes "catalytic validity" as "a way of conceptualizing our research as valid by the degree to which participants and researchers have substantially improved their condition as a direct result of their involvement in the study" (p. 345). Bringing the need for transformation together with the need to understand participants' perspectives on change requires researchers to negotiate their activist role in the field. Relationship-building, dialogue, trust, and continued negotiation play central roles in maintaining a course of activism that remains responsive to the needs, hopes, and desires of the participants alongside needs for scholarship.

For example, to meet the challenge of preservice teachers' ideological and pedagogical resistance, Rodriguez (1998) plans and implements four strategies of counter-resistance: the dialogic conversation, authentic activity, metacognition, and reflexivity. His year-long ethnography begins with 18 preservice teachers during their methods course and continues with four students during their student teaching assignments. He triangulates multiple data sources, including ethnographic field notes, course evaluations, and student-produced artifacts from the class, interviews, focus group notes, videotapes of two lessons during student teaching and notes from discussions of the videotaped lessons. Throughout the report, it is clear how Rodriguez advocates for the need to teach for diversity and understanding through an STC orientation. He summarizes some of this advocacy as follows:

> In short, the strategies for counterresistance discussed thus far consisted of providing students with authentic activities in the methods class to bring their taken-for-granted beliefs into the open. This was followed by in-depth discussions of critical readings and activities that allowed them to consider alternate points of view. Next, the members of the focus group were placed in schools where they were able to explore the applicability of their metaphors of teaching and learning in various school contexts. (p. 609–610)

In a similar way, Tan and Calabrese Barton (2008) engage in a year-long ethnographic study of 6th grade, urban Latina girls. Their long-term work with

the case-study teacher and students situates the study as intervening in the world to enhance girls' participation in science. Tan's advocacy is evident as she assists the teacher in preparing materials for lessons, coteaches some of the lessons, interacts with case-study girls during the lesson, debriefs lessons with the teacher, and helps brainstorm ideas for subsequent lessons. Thus, teaching for social justice involved the collective effort of students, teacher, and researchers to promote opportunities for girls to author identities-in-practice. Tan and Calabrese Barton conclude:

> [P]aying attention to who girls are, who they want to be and the relationships that are important to their science learning – aspects of science education which are decidedly non-commodified and un-economic in focus – can open up the dialogue around Science for All. (p. 64)

Elmesky and Tobin (2005) share their evolving approaches to working with youth as student-researchers over a 5-year period. In addition to traditional forms of data-gathering, such as interviews, classroom observations, and journals, the youth created unique artifacts, such as a science-related movie and rap videos. Importantly, the creation of these artifacts required youth to develop technical and theoretical expertise, and afforded the youths agency in the day-to-day practice of research. Elmesky and Tobin explain that:

> … we have developed new windows into the lives of urban youth, to contest the privileging of our voices as the adult, university-based researchers and so as not to put forth claims rooted in our own experiences of research, teacher education, and teaching and learning of science…. (pp. 810–811)

Moore's (2008b) study seeks to understand how preservice teachers' conceptions as change agents relate to their science teacher identities. She closely analyzes the coursework of 23 students and follow-up interviews with five students. In the course, students read *Ways with Words: Language, Life, and Work in Communities and Classrooms* (Heath 1983), engage in small group dialogues, and wrestle with ideas of diversity, teacher identity, and science teaching. A final, individual reflection paper addresses "their ideas about issues of diversity and teaching science in urban classrooms; identity as an agent of change; and worries, fears and issues about science teaching in urban elementary classrooms" (p. 593). The study is based on the epistemology that preservice teachers come to know themselves as potential science teachers through their interactions with texts, dialogue with others, and classroom experiences. Finally, in my study (Rivera Maulucci 2008b), across Elena's narratives from her schooling experiences as an immigrant acquiring English, through preservice field experiences in an international high school that serves predominantly English language learners, her emotions emerge as commentaries upon her enduring concerns (Archer 2004) related to issues of language, power, and identity. The study draws on interviews and coursework, including field journals, reading responses, teaching autobiographies, and fast-writes across three semesters of Elena's participation in a teacher education program. I use a metalogue, a written dialogue between Elena and me at the end of the study, to share the educative and transformative value the study had for Elena.

## The Road Ahead: Implications for Future Social Justice Research

Individually and collectively, the above studies contribute to several key implications for future social justice research in science education. First, the social justice framework should be evident throughout the study. Social justice should comprise an overarching goal of the research, drive the conceptual framework, inform the methodology, methods, and analysis of the data, and frame the implications and conclusions. Second, the researchers' subjectivities, or vested interests in the outcomes of the project and the findings of the research, should be made evident. Researchers should indicate their positional identities with respect to social markers that might have bearing on how they frame social justice issues or science education. They also should articulate a clear positioning with respect to the major discourses that contribute to social justice perspectives, including critical, feminist, and multicultural theories, and science for all.

Rather than a universal or monolithic understanding of science, a social justice lens situates scientific literacy as a collective endeavor shaped by the needs and interests of the community and developed through social relationships and interactions. Whether the study focuses on girls authoring identities in practice, preservice teachers preparing to teach for diversity and understanding, or youth engaged in the role of researchers, the meaning of scientific literacy is contingent upon the needs and interests of the participants. By employing methodologies sensitive to the collective needs of all stakeholders, reports of research can indicate the contradictions and how they are negotiated during the research process. Future research should highlight the researchers' social and theoretical positioning. In this way, a social justice perspective shifts the focus from science as a body of knowledge and skills to be learned on its own merits, to a social activity that students, teachers, teacher educators, and science education researchers engage in for the purpose of personal and community understanding and transformation.

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