A Black Feminist Book Club as a Multicultural Professional Development Model for Inservice Secondary Science Teachers

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Submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy under the Executive Committee in the Graduate School of Arts and Sciences

COLUMBIA UNIVERSITY

2017
ABSTRACT

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According to science teacher educators, science teachers often struggle to embrace and implement multicultural teaching practices due to limited awareness of the biases, assumptions, and oppressive structures that hinder the success of Students of Color in science classrooms. At its core, teachers lack this awareness due to incomplete understanding of the ways identity markers, such as race, gender, and socioeconomic status, work together to shape one’s coming into, understanding of, and success in the sciences. To this end, this case study features four science teachers of diverse backgrounds who engaged in a book club structured to support their understanding of their intersectionality and their identity development. These four science teachers met as a science department to engage with the text *Black Feminist Thought* (BFT) (Collins, 2009) and other critical texts over a six-month period at a New York City, charter high school. The findings revealed the ways racial stereotypes, propagated by many factors—including images of scientists, relationships with teachers, and expectations of peers and family— influenced their coming into and understanding of science. Additionally, the findings show the ways teachers discovered their intersectionality—particularly the interplay of their race and gender— influenced their approaches to teaching science. As teachers learned about the multidimensionality of their positional identities, they became aware of discriminatory structures of power that disadvantage their Black female science students and reported implementing more student-centered pedagogical practices. Altogether, this study offers a professional development model for building critical consciousness with inservice secondary science teachers.
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ACKNOWLEDGEMENTS

Praise be to the God and Father of our Lord Jesus Christ for continuously directing my path.

I could not have accomplished this dissertation and completed this journey towards a Ph.D. without the love, prayers, and constant affirmation of some very important people.

To my husband, Tommy Sharell Hoard, who has shown unwavering support of my scholarship and shares my commitment to ensuring educational equity for Students of Color. Thank you for your prayers, the sacrifices you endured during this journey, and your clear vision of equity that continues to challenge and inspire me!

To my daughter, Arielle Euphemie Hoard, our Lion of God that is well spoken. Thank you for bringing so much light into our family. Our prayer is that you will grow up in a more equitable world and that you will add to the long legacy of scholarship and service in our family as you grow into an intelligent and faithful Black woman.

To my parents, Michael and Kimberly Lyman, who sacrificed so much to prioritize my education and my well-being. You have always affirmed Lauren and I as powerful, insightful, and faithful Black women. Thank you for the many pep talks and for never giving up on me! Now you can proudly say that you raised two doctors!

To my advisor, Dr. Felicia Moore Mensah, a trailblazer in her scholarship and a beacon of light by the way she mentors and trains up the next generation of scholars. Thank you for always believing in me and patiently developing my lens as a scholar.

To my sister, Lauren Lyman, J.D., thank you for always supporting me and constantly making me better, as iron sharpens iron.

To the intelligent, Women of Color in my life, my grandmothers, Elizabeth Young and Alida Lyman, my great aunt, Francis Goodwin, my aunts, Dionne Chapman and Vanessa Epps, and my cousin, Alexis Epps. You encourage me, pray for me, and I continue to learn from the example you set by the way you live life.

To my colleagues, Dr. Sheila Borges and Dr. Raghda Daftedar; I could not have finished this program without you!

To my committee, Dr. O. R. Anderson, Dr. Erica Walker, Dr. Maria Rivera Maulucci, and Dr. Janell N. Catlin, thank you for the light your shine for others to follow in your scholarship and your mentorship.

To all of my family and friends, thank you for your extravagant love!
Chapter I

INTRODUCTION

Purpose and Rationale

Even as critical theorists work diligently to highlight the unique issues and challenges facing Students of Color in STEM (science, technology, engineering, and mathematics), there is still a lingering gap that rarely finds itself on the pages of science education scholarship—the needs, challenges, contributions, and intellectual promise of Women of Color. Many factors have contributed to this gap. To start, National Science Foundation (NSF, 2013) statistics reveal a stark deficit in the matriculation of Women of Color in STEM (high school and college) programs compared to all other cross-sections of race and gender. The appendices of the NSF webpage show that while 59,932 White females and 20,663 Black males were enrolled in undergraduate engineering programs in 2013, only 6,500 Black females were enrolled in the same programs in 2013 (NSF, 2013). This underrepresentation of Women of Color in STEM holds true in the computer sciences and the physical sciences such as chemistry and physics (Hill, Corbett, & Rose, 2010). Stemming from this underrepresentation, it is common for Women of Color to feel ostracized and out of place in collegial science classes where they often have difficulties forming mentoring relationships with college science professors and fostering supportive peer partnerships (Hanson, 2004; Rosa & Mensah, 2016). The above-mentioned statistics and findings reflect a gap within the gap—the undertheorization of the experiences and challenges that Women of Color face in the sciences.

Similarly, the literature in science education reflects incomplete attempts to develop methods that cater to the needs and develop the intellectual promise of Women of Color. Most
studies by critical theorists in science education take a dualistic approach to unpacking issues related to sexism and racism. A large majority of studies in multicultural science education isolate the experiences of Students of Color by race, thereby upholding the White versus non-White duality without discussing gender (Archer, Dewitt, & Osborne, 2015; Schwartz, 2012; Varelas, Kane, & Wylie, 2011). To date, only a handful of studies in multicultural science education have cross-examined the challenges Women of Color face at the interstices of racism and sexism (Carlone, Johnson, & Scott, 2015; Chinn, 2002; Parsons, 1997; Tan & Barton, 2008; Tan, Barton, Kang, & O’Neill, 2013). Multicultural teacher development is mostly tailored to White female teachers (Agee, 2004; Gay, 2000; Knight, 2002; Milner, 2006; Sleeter, 2001; Zeichner, 1992). Given the focus of multicultural teacher development, female Teachers of Color feel like outsiders in professional development spaces (Burant, 1999; Knight, 2002; Mensah, 2016; Su, 1996). Rarely do science teacher educators consider the unique professional development needs and potential contributions of female science Teachers of Color (Blackwell, 2012; Mensah, 2015, 2016; Rivera Maulucci, 2013). In all, the pipeline to professional success and career mobility for Women of Color in STEM and science education has gaping, unattended holes.

This study is anchored in critical race theory and Black feminist theorizing. First, inspired by critical theory, I raise concerns about how the success of Women of Color in the sciences is “mediated by systems of inequity such as classism, racism and sexism” (Lather, 1992, p. 87). My hope is to challenge the dominant narrative in academia which often takes a color-blind and apathetic stance that legitimizes or, at best, overlooks the underrepresentation of Women of Color in the sciences. As a Black feminist scholar, I selected Black Feminist Thought (Collins, 2009) as the central text for the book club examined here, based on the belief that “seeing the
world through women’s eyes, provides the possibility of more complete and less distorted understandings” (Lather, 1992, p. 93). Drawing from a Black feminist standpoint, this study aimed to illuminate the discontinuities in the sciences that systematically overlook the narratives, experiences, and viewpoints of Women of Color, who are subjected to coexisting discrimination based on their race and gender. The current study represents a continuation of an intentional, precise, and concerted movement by feminist scholars in science education to carve out an intellectual space where science is reconstructed as a place for all.

Factors That Determined the Origin of the Study

My journey to the doorpost of Black feminism was circuitous. When I began my doctoral studies, I could not verbalize the effect that being the only Black female pupil in my secondary and college science and engineering classes had on me. However, after reading paper after paper, from critical theory to critical race theory to Black feminist theorizing, I finally found a place to examine my own experiences of learning and teaching science. For me, the literature in Black feminism gave me the language to reconcile my love of science with the ever-present feelings of being an outsider in the field. Black feminist theorizing provided me with a way to explain the butterflies in my stomach I experienced every time I stepped into an academic space that was seemingly welcoming, but infiltrated with “imperialist White-supremacist capitalist patriarchy” (hooks, 2000, p. 1). For most of my academic life, I held up the torch of my “onlyness” (Harper, 2013) as if it were a proverbial medal of honor—the only Black female student in the engineering program, the only Black female teacher in the urban school, the only Black female academic dean. Only now do I realize how self-deprecating, futile, and lonely it has been to be elected to single-handedly represent my race and gender, with no promise that it would be any
better for the next Black woman chosen to carry a similar torch. My doctoral studies made me aware of the rich legacy and intellectual contributions of women Teachers of Color scholars who came before me and from whom I benefit today (Collins, 2009; Irvine, 1989). In all, it took me a very long time to realize that—as a Black woman—my personal history in the sciences and those of other Women of Color have an important place in scholarship and academia. It is our imperative as science teacher educators to guide all teachers with developing the critical consciousness needed to honor and facilitate the success of all science students, especially female Students of Color.

**Key Definitions**

**Dominant Logics:** “. . . hegemonic (ideas, cultures, and ideologies), structural (social institutions), disciplinary (bureaucratic hierarchies and administrative practices), and interpersonal (routinized interactions among individuals) playing fields upon which race, gender, class, and other categories or traditions of difference interact to produce society” (Hancock, 2007, p. 74).

**Feminism:** “. . . a movement to end sexism, sexist exploitation and oppression” (hooks, 2000, p. viii).

**Positional Identity:** “In terms of multiple social markers (i.e., race, ethnicity, economic status, gender, religion, and age) and how views of self through these social markers influence the ways in which teachers talk about teaching and science teacher identities” (Mensah, 2012, p. 106).
**Intersectionality:** “... matrix model that approaches lived identities (such as race, gender, ethnicity, sexuality) from their interstices, from the nodal point where they hinge or touch” (May, 2015, p. 2).

**Matrix (Orientation):** “... wherein lived identities are treated as interlaced and systems of oppression as enmeshed and mutually reinforcing: one form of identity or inequality is not seen as separate or superordinate” (May, 2015, p. 117).

**Race:** “... a way of referring to and disguising forces, events, classes, and expressions of social decay and economic division” (Morrison, 1992, p. 63).

**Racial Literacy:** “... the ability to read, discuss, and write about situations that involve race or racism” (Sealey-Ruiz, 2013, p. 386).

**Racism:** “... culturally sanctioned beliefs which, regardless of the intentions involved, defend the advantages Whites have because of the subordinated positions of racial minorities” (Wellman, 1977, p. xviii).

**Stereotype:** “... an exaggerated belief associated with a (racial) category” (Allport, 1979, p. 191).

**Teachers of Color:** “references individuals of indigenous, African, Latina/o, Asian/Pacific Islander descent. This definition also applies for the terms ‘Women of Color,’ ‘Students of Color,’ ‘Communities of Color’ (Scientists of Color) and ‘People of Color,’” (Kholi, 2008, p. x).

**Research Questions**

The underpinning need and motivation for this study are to attend to and appreciate the well-being, academic contributions, and intellectual potential of the Women of Color who are
science students, science teachers, and science teacher educators—all of whom are scientists and scholars. Accordingly, this study offers a professional development model crafted with a dual purpose. First, this book club was structured to demonstrate an approach to multicultural science teacher professional development that is inclusive of the unique needs and contributions of women science Teachers of Color who teach in high-needs schools. Second, the professional development model intends to offer guidance on how to support science teachers in recognizing the needs and contributions of their female science Students of Color. To this end, the questions that drove this study are:

1. What are the racial experiences of the Teachers of Color while learning and teaching science?
2. In what ways do the words and writings of the Teachers of Color reflect their development of racial literacy during the book club?
3. How do science teachers discuss their intersectionality in the book club?
4. How do the teachers reflect on their approaches to teaching their Black female science students?

Organizational Overview of the Chapters

In the following section (Chapter II), I provide an overview of the literature on multicultural science teacher preparation, with a special emphasis on science teacher identity development literature. In addition, a summary of the use of book clubs as a format to inform teachers about issues of diversity is also provided. Finally, Chapter II provides a description and integration of the theoretical frameworks utilized in this study, namely critical race theory (Soloranzo & Yosso, 2002) and intersectionality (May, 2015).
Chapter III presents the overall research design and methodologies of this case study. I provide a rationale for the use of these research methodologies, describe the setting and participants, and delve into my role as a researcher. In this chapter, I also summarize the data sources and address the approaches to reliability, validity, and rigor.

The findings chapters (IV and V) in this dissertation are presented in manuscript format. Chapter IV, the first findings chapter, focuses on Research Questions 1 and 2. In short, Chapter IV shows the ways the Teachers of Color in this study developed racial literacy in the book club when they delved into how racial stereotypes influenced their success in the sciences. Chapter IV focuses on Research Questions 3 and 4 by highlighting how in-service science teachers (ISTs) reflected on Black Feminist Thought and personalized the theory of intersectionality to their personal histories of studying and teaching science (Collins, 2009).

The dissertation concludes with Chapter VI, which offers a summary of the major findings across Chapters IV and V and a synthesis of the findings across the research questions. Implications for multicultural in-service teacher professional development and recommendations for professional developers are presented in this final chapter.
Chapter II

LITERATURE REVIEW

Multicultural Science Education

For the purpose of this study, multicultural science teacher education is defined as methods for preparing science teachers to “acknowledge, appreciate, value, and promote diverse perspectives in the science classroom” (Mensah, 2009a, p. 1045). The end goal of multiculturalism is to level the playing field by creating learning environments that facilitate the academic success of all students. This approach in developing science teachers is rooted in a commitment to providing quality professional development to create socially just and equitable science learning environments for all students, especially Students of Color (Mensah, 2013; Rivera Maulucci, 2010; Rodriguez, 2001). To implement these strategies fully and successfully, science teachers will need professional development. In particular, science teachers need opportunities to examine their biases critically and develop pedagogical practices for teaching Students of Color. The necessary professional development counteracts hegemonic beliefs, inequitable systems, and prejudiced perspectives that undermine the success of Students of Color.

Though there are currently numerous models for developing science teachers’ multicultural practices, these common approaches have significant setbacks. In general, the literature shows that teachers receive inadequate preparation for teaching in urban science classrooms and insufficient opportunities to learn about issues of diversity in their preservice training (Goodwin, 1994; Pang & Sablan, 1998; Villegas & Lucas, 2002; Zeichner, 2002). As a result, teachers often leave preservice learning with little to no awareness or understanding of
discrimination in schooling (Avery & Walker, 1993; Bryan & Atwater, 2002; Furman, 2008; Gay & Howard, 2000; Mensah, 2009a, 2013; Rivera Maulucci, 2013). A lack of adequate preservice preparation may be one of the key reasons why inservice science teachers have difficulty embracing and successfully implementing multicultural science teaching practices in their classrooms.

**Professional Development of Inservice Science Teachers for Multiculturalism**

Oftentimes, science teachers struggle to implement culturally responsive and culturally relevant teaching practices. The challenges inservice science teachers face can be grouped into four broad categories. First, science teachers must navigate competing and, at times, contradictory school-wide practices that clash with the theoretical standpoint and methods of multiculturalism (Braaten & Sheth, 2017; Rodriguez, 2015). Second, science teachers have difficulties translating the toolbox of responsiveness techniques to new science concepts (Bianchini & Brenner, 2010; Nam, Roehrig, Kern, & Reynolds, 2012; Patchen & Cox-Peterson, 2008). Third, teachers find it difficult to redistribute power in their classrooms such that learning becomes more student-centered and inquiry-focused (Adamson, Santau, & Lee, 2013; Blackwell, 2012; Lee, 2004). Fourth, science teachers resist implementing responsiveness methods due to persistent prejudices and biases about the innate, intellectual potential of Students of Color (Mensah, 2009a; Whipp, 2013; Yerrick & Beatty-Adler, 2011; Young, 2010).

**Building the Critical Consciousness of Teachers**

The strategy-focused approach to multicultural teacher preparation has been criticized for being only minimally effective (Brand, 2014; Buxton, Lee, & Santau, 2008; Irvine, 2010; Ladson-Billings, 1998). To this end, Ladson-Billings (1995a) characterized culturally relevant pedagogy as “artistry, not a technical task that could be accomplished in a recipe-like fashion”
Likewise, researchers who study the successful practices of responsive teachers note that at the core of a successful urban classroom is a teacher with a multicultural mindset. Wallace and Brand (2012) agreed: “sociocultural awareness is the ‘brain’ which informs culturally responsive qualities” (p. 370).

The literature in teacher education presents multiple ways to conceptualize sociocultural consciousness (Banks, 1991; Bennett, 1995; Rodriguez, 1998; Smith-Maddox & Solorzano, 2002; Villegas & Lucas, 2002; Zeichner & Hoeft, 1996). Yet, as Young (2010) articulated, “what it means to be a relevant pedagogue is widely misconceived by scholars and practitioners alike” (p. 249). When reflecting on a model for responsive science teacher development, Brown and Crippen (2017) added that “additional research is required on how to develop sociocultural and critical consciousness in science teachers, as well as how to support teachers as designers of science-specific critical culturally relevant materials” (p. 129). The published inservice science teacher professional development models offer incomplete and vague connections between the methods used for the inservice science teachers in urban settings and the outcomes these methods produced (Berg & Mensah, 2014). The aforementioned studies cite the need for a clearer articulation of cultural consciousness and additional models of professional development that increase teachers’ capacity to recognize, reflect on, and act against factors that limit Students’ of Color access to and success in science. To this end, the purpose of this study was to propose a professional development model aimed at developing the critical consciousness with inservice science teachers in an urban high school setting.

To start, the literature calls for a clearer articulation of what it means to develop teacher critical consciousness. From a review of the literature, two characteristics stand out. Professional development that builds the critical consciousness of science teachers:
• assists teachers with “deconstructing unjust and oppressive structures within science classrooms for students who are marginalized from learning science” (Mensah, 2013, p. 319), and

• “challenges [teachers’] “assumptions and biases about teaching science to diverse learners” (Mensah, 2009a, p. 1043).

**Deconstructing unjust and oppressive structures within science classrooms.** First, professional development that engenders critical consciousness helps teachers acknowledge the systems and structures in the sciences that downgrade the intellectual potential of Students of Color. In other words, effective science teachers of Students of Color have an intricate knowledge of implicit structures of privilege and oppression in the sciences and in the system of education. For example, Wallace and Brand (2012) found that the distinguishing characteristic of two effective science teachers of African American students was their “critical awareness of social constraints imposed upon their African American students’ identities” (p. 341). Similarly, when implementing a feminist-based professional development model, Capobianco (2007) found that the science teachers who shifted their pedagogical practices to become more student-centered had a deeper knowledge of how their “privileged experiences as a student compared with that of [their] marginalized students” (p. 27). In Suriel and Atwater’s (2012) multicultural professional development study, the teachers who had “identified as the marginalized ‘cultural other’” had deeper awareness of these unequal hierarchies and were more apt to implement multicultural approaches (p. 1288). Moreover, Whipp (2013) documented that teachers who were “structurally oriented” or had knowledge of “structural, institutional barriers to learning” practiced socially just teaching, compared to those who were “colorblind” (pp. 454-456). Altogether, these descriptions reveal that science teachers with consciousness have knowledge of
structural oppression in the sciences, including but not limited to the inequitable hierarchies of privilege in education based on factors such as race, gender, and class. These findings support the literature that having productive responses to structural constraints is a key attribute of successful Teachers of Color (Banks et al., 2001; Foster, 1990, 1991, 1993; Mensah, 2009b; Moore, 2007b; Pang & Gibson, 2001). However, to date, only a handful of science teacher professional development models assist teachers in unpacking these forms of discrimination in schooling (Laughter & Adams, 2012; Mensah, 2011, 2015).

**Challenging assumptions and biases.** Second, professional development that engages science teachers in critical consciousness building helps them become aware of and challenge their assumptions and biases about Students of Color in the sciences. Young (2010) suggested that “well-intentioned educators need to thoroughly examine how their hidden biases may undermine the value of culturally relevant pedagogy and how they may inadvertently sabotage the theory’s effectiveness in classroom instruction” (p. 257). Similarly, Moore (2008a, 2008c) documented the use of a book club to foster multicultural science teacher development. The findings from this study showed that as the teachers read a critical text, the collective discourse led them to “Aha!” moments that helped them unveil their own biases and assumptions about teaching science to diverse learners.

**Book Clubs as Models for Multicultural Teacher Professional Development**

One of the most impactful methods of opening teachers’ eyes to inequities in a professional development space is through the use of collective dialogue based on a critical text. Numerous studies have documented the beneficial use of book clubs to enhance the knowledge of teachers about issues related to multiculturalism. Flood et al. (1994) presented a book club composed of administrators and teachers who learned about diverse cultures through reading
multicultural children’s literature. Similarly, Florio-Ruane (2001) presented the findings from a book club attended by White teachers who read a variety of multicultural texts while also writing personal autobiographies. In the Harlin, Murray, and Shea (2007) study, teachers in two different geographic locations read fiction texts as a way to develop their conceptions of racism. Moreover, Smith et al. (2001) used multicultural texts as a way to encourage a diverse group of teachers to discuss issues related to racism in their personal experiences.

The literature mentions the beneficial use of book clubs to help teachers unpack their biases and prejudices. Catherwood-Ginn (2015) also used a book club to help a group of White teachers develop race consciousness. Taken together, these studies point to the following key components of a successful multiculturalism-based book club: (a) the need to create safe spaces; (b) the potential benefit of inter-dialogue between teachers of dominant and multicultural, multiracial backgrounds; and (c) the value of complementing book club discussions with other modalities to explore issues of diversity. Altogether, the literature points out that the use of a book club, along with autobiography creation, can jointly facilitate teacher learning about issues related to diversity (Catherwood-Ginn, 2015; Florio-Ruane, 2001). To this end, the present study utilized a book club as a professional development space to foster teachers’ critical consciousness building by structuring their critical reflection on their experiences in science via analysis and reflection on critical texts.

**Teacher Identity Development**

Identity-based research is rooted in the understanding that “learning changes who we are” (Wenger, 1988, p. 5). To elaborate, Wenger (1998) asserted that “because learning transforms who we are and what we can do, it is an experience of identity” (p. 215). Identity-based research focuses on the ways professional development has the potential to change how teachers view
themselves and their role as teachers. Teacher identity has been conceptualized in a variety of ways, including how teachers view themselves (Gee, 2000); the communities by which teachers develop (Wenger, 1998); their gender (Carlone & Johnson, 2007); and through their positionality (Moore, 2008; Rivera-Maulucci, 2013). Within this genre of research, only a handful of studies have analyzed the ways personal history and social markers such as race and gender shape who teachers are and how they approach teaching science (Avraamidou, 2014; Moore, 2008a; Rivera Maulucci, 2013). Altogether, the research on science teacher identity is a powerful lens by which to view and study how teachers learn and develop (Avraamidou, 2016).

**Defining Identity**

One key approach science teacher educators take to foster the critical consciousness of science teachers is via models of teacher identity development. Specifically, these studies focus on the ways professional development has the potential to guide a teacher to deeper understanding of the ways that categories of identity, such as race, gender, and socioeconomic status, influence how a teacher learned science and the approaches the teacher takes to teaching science. Implicit in the way critical consciousness building is articulated above is an understanding that derogatory social constructs such as racism and sexism are at the core of structural inequities and biases that negatively impact Students of Color. The constructs operate through in a multidimensional manner—via ideologies, systems, institutional practices, and individual people—to selectively enable the success of certain individuals in the sciences over others. Therefore, if teachers were to engage in an identity-based professional development that builds critical consciousness, they should gain a deeper understanding of the role of categories of identity, such as race and gender, on their experiences of studying and teaching science. Further, teachers should build a stronger awareness of the impact of structural inequities and negative
assumptions and biases about their own experiences of studying science and their approaches to teaching science.

A conceptualization of identity that acknowledges the role of structural inequities, such as racism and sexism, and racially gendered biases on one’s life history will be needed as a baseline to drawing close connections between identity-based development leads and critical consciousness building. To this end, Mensah (2012) contended that current models of identity fall short in this regard by naming that “many researchers . . . use definitions of identity with little or no discussion of how race, class, gender, and other social markers intersect and interconnect in the development of identity and their interaction with students” (p. 106). Instead, Mensah (2012) called for a definition of identity that considers the “sociocultural, sociohistorical, and sociopolitical dimensions of who a person is, how a person chooses to define self, and eventually how the person teaches” (p. 106). To this end, the following paragraphs address this call by clarifying the way identity is conceptualized in this study.

To start, identity in this study is anchored in critical theory, with an understanding that one’s identity is “mediated by systems of inequity such as classism, racism and sexism” (Lather, 1992, p. 87). Even more, the definition of identity is derived from the idea that the identity of the oppressed, or those disadvantaged by social constructs such as racism and sexism, is often misrepresented by “regimes of truth” or dominant narratives (Foucault, 1980). According to Foucault (1982), there is no such thing as objective identity; instead, identity is the result of how someone is labeled by power or individuals in power. Therefore, identities are the outcomes of structures and systems of influence that have authority to name identities as objective truths. For the purpose of this study, power is collectively realized as dominant logics or the “hegemonic (ideas, cultures, and ideologies), structural (social institutions), disciplinary (bureaucratic
hierarchies and administrative practices), and interpersonal (routinized interactions among individuals) playing fields upon which race, gender, class, and other categories or traditions of difference interact to produce society” (Hancock, 2007, p. 74). Thus, identity is oftentimes constructed for an individual in a manner that maintains structures of power meant to reinstate and perpetuate subjugation of the one identified. This leads to a variety of inequitable outcomes.

**Identity is contestable.** First, when structures or individuals in power determine identity, this often leads to competing stories of what constitutes someone’s true identity. In fact, Foucault (1982) named that the oppressed subject “struggles against the privileges of knowledge . . . [and] opposition against secrecy, deformations, and mystifying representation imposed on people” (p. 781). Similarly, Hall (1993) added that identity is “the unstable point at which the ‘unspeakable’ stories of subjectivity meet the narratives of history and of a culture” (p. 135). To this end, challenging power and developing consciousness involve understanding the contestable nature of identity. Fook (2002) elaborated that challenging power is “the identification or labeling of both the existence and operation of discourses and that which is hidden, glossed over, or assumed” (p. 95). What is more, because individuals are at times misrepresented by those in power, the subjugated at times have “double vision,” or more complete knowledge of their social positioning that those positioned in power because the subjugated must live in their own niches while also navigating the dominant society (Collins, 2009; hooks, 2000; Reed, Newman, Suarez, & Lewis, 1997; Suarez, Newman, & Reed, 2008). In sum, those in power often have authority to work in covert and overt ways to diminish, distort, and denigrate the viewpoint and experiences of those being ruled over by the powerful.

**Identity unveils inequities.** Fundamental to Foucault’s notion of identity is the belief that identities derive from social processes rather than distinct labels or characteristics. This
understanding allows for a focus on the social processes that create inequitable experiences. Taken from Foucault’s (1982) viewpoint of the subject and power, identity is conceptualized in this study as a footprint of the intertwined, enmeshed, and discriminatory working of dominant logics.

Identity incorporates agency. Teacher identity development is based on the belief that professional development has the potential to transform the way teachers view themselves and their role as teachers. Implicit to this belief is an understanding that identity is more than a rigid structure determined by external factors and other people. Instead, identity reflects fluidity via a “dialectical relationship between agency and structure” (Rivera Maulucci, Brotman & Fain, 2015, p. 557). Essentially, this characteristic implies that teachers have the capacity to make decisions when teaching that actively work against and eradicate oppressive structures that impede their success and that of Students of Color. However, the key to a teacher enacting agency towards equity is sense-making or awareness building (Rivera Maulucci, 2013). Beijaard, Meijer, and Verloop (2004) state that “agency is central, which refers to the need of teachers being active in the process of professional development” (p. 122). This key tenet is essential to seeing the potential and power of professional development to transform a teacher’s mindset and practice towards equity. Otherwise, identity is limited to an impossible entanglement of hierarchies that cannot be overcome or remade towards empowerment and equity.

Positional identity. The primary way identity was defined in this study is through positional identity, a conceptualization stemming from positionality. Positionality was defined by Mensah (2012) “in terms of multiple social markers (i.e., race, ethnicity, economic status, gender, religion, and age) and how views of self through these social markers influence the ways in which teachers talk about teaching and science teacher identities” (p. 106). Positional identity
also refers to “how one is socially located (or positioned) in relation to others” (p. 106) or “a sense of relative social position” (Holland, Lachicotte, Skinner, & Cain, 1998, p. 132). When considering the definition of positional identity as a whole, this conceptualization of identity brings to the center the “contextual and relational factors [such as race, gender, and socioeconomic status] as crucial for defining not only our identities but also our knowledge as teachers . . . ” (Maher & Tetreault, 1994, p. 165). Furthermore, positional identity is defined in terms of the inequitable hierarchies, such as racism and sexism, from which one’s identity originates. To elaborate, positional identity may be defined as “the-day-to-day and on-the-ground relations of power, deference and entitlement, social affiliation and distance” (Holland et al., 1998, p. 127). Numerous researchers have theorized about the identities and identity development of science teachers from a positional identity standpoint (Blackwell, 2012; Mensah, 2012, 2016; Moore, 2008a; Rivera Maulucci, 2013; Rosa, 2013).

The current study utilized positional identity as the conceptualization of identity and leveraged this viewpoint to explore the intersectionality of four science teachers. Positionality and intersectionality are not contrasting or competing theories of identity, but instead are rather complementary (Anthias, 2008). Haritaworn, Lin, and Klesse (2006) noted that “positionality is crucial to theorizing intersectionality” (p. 517). Positionality implies that a person’s particular identity plays a role in how one is positioned relative to others. This also implies that some individuals are positioned to a lesser authority, while others are positioned to more authority or more power. Intersectionality views lived identities from their intervening spaces, or at the intersecting point of social processes such as race and gender. Positionality is that space: the interstices or the “space at the intersection of structure (social position/social effects) and agency (social positionality/meaning and practice)” (Anthias, 2008, p. 15). Therefore, both theories of
identity allude to the power dynamics at play in identities. As a teacher engages in identity development and develops critical consciousness, he or she should be able to view his or her own identity from the ways it is entangled in and ruled by dominant logics in a webbed fashion. Indeed, intersectionality resides at a dialectic – by acknowledgement of the way one’s identity is formed by the confluence of identity markers while emphasizing one’s agency to eradicate injustice. To this end, Mensah (2016) noted that considering both positional identity alongside intersectionality allows for the “merging of multiple markers mak[ing] the discussion of them nuanced and connected” (p. 50).

**Theoretical Frameworks**

I operate from a “raced-gendered epistemology” and come into critical pedagogy by use of critical race theory or CRT and intersectionality (Delgado Bernal, 2002, p. 107). Chapter IV uses critical race theory as a lens to analyze the personal histories of the Teachers of Color in the book club. In Chapter V, intersectionality informs the structure of the book club as well as the analysis of the findings.

**Critical Race Theory**

Critical race theory (CRT) is a central theoretical framework that informed this study. Originating in Critical Legal Studies, CRT emerged from the scholarship of activists during the Civil Rights movement in the 1960s as a manner of discourse to challenge the “inferiority paradigm, characterized by its fluidity and dynamic nature […]” that perpetuates stereotypes that stigmatize African Americans as insubordinate and intellectually inferior (Tate, 1997, p. 199). Essentially, CRT exposes the oppressive social, political, economic structures and laws that manifest the misidentification of Black people as lazy and underserving, while recognizing
White people as superior in intellect and diligence. CRT is built on the understanding that racism is embedded in the law, policies, structures, and psychology of both the oppressed and the oppressor (Solorzano & Yosso, 2002).

Tate (1997) pushes researchers of CRT to consider “how [hegemonic] traditional interests and cultural artifacts serve as vehicles to limit and bind the educational opportunities of Students to Color” (p. 234). CRT is a powerful lens for revealing and describing structures of oppression and exclusion related to differential access to education based on race.

**Professional development of Teachers of Color.** CRT was utilized in this study was to theorize about the life histories of the Teachers of Color participants and how race influenced their coming into and understanding of science. The identity-based book club was designed with an attempt to honor the experiences and needs of the Teachers of Color in light of their attributes and needs being overlooked in the literature on multicultural teacher professional development. To this end, Chapter IV focuses on the way Teachers of Color in this study developed racial literacy while unpacking inequitable structures and racial biases that affected their experiences of studying and teaching science. Expanding on the framework proposed by Mensah (2015), this study analyzed how science Teachers of Color developed racial literacy during a book club. Racial literacy, defined by Sealey-Ruiz (2013), is “... the ability to read, discuss, and write about situations that involve race or racism” (p. 386). The findings from Chapter IV provide a deeper context for the ways racism influenced the teachers’ coming into an understanding of science. Teacher professional development has historically alienated Teachers of Color by providing limited support for their personal well-being, pedagogical practice, and professional development (Foster, 1990, 1993; Kholi, 2016; Lau, Dandy, & Hoffman, 2007; Moore 2008). This is especially true in multicultural teacher preparation that often takes a one-size-fits-all
approach that narrowly focuses on the perspectives and needs of the most dominant subset of teachers, White female teachers (Agee, 2004; Gay, 2000; Knight, 2002; Milner, 2006; Zeichner, 1992). In all, the literature calls for models of professional development tailored for Teachers of Color (Achinstein, Ogawa, Sexton & Freita, 2010; Goodwin, 1994; Lau et al., 2007; Milner, 2006; Philip, 2011). Such studies should both affirm the attributes and experiences that Teachers of Color bring to the professional development space and support Teachers of Color in unraveling their own biases and prejudices that—if unaddressed in teacher preparation settings—may circumvent their success in teaching Students of Color (Gay, 2000; Mensah, 2009b, 2015; Sheets, 2001; Villegas & Irvine, 2010).

**Critical race feminists.** Race is a singular factor among many at play when considering the hegemonic forces in education. Other identity markers such as gender and social class must also be considered to paint a full landscape of the structures of privilege that affect science lived experiences (Wing, 1997). With this understanding, Critical race feminists challenge the notions of CRT that isolate or prioritize racism over other systems of oppression. Black feminists call for the expansion of theories on oppression to consider more comprehensively the overlapping, compounding systems of oppression that Women of Color face because of their race and gender. Only when considering other categories of identity with race will we best understand how race dictates one’s access and entitlement. If you cannot fully conceptualize the complexity of identity in this way, then you cannot fix it. Therefore, when defining identity, there is a need for an additional frame to allow us to see how social problems impact all of the members of a social group (Crenshaw, 2016). Otherwise, some experiences (such as those of Black women) will go unnoticed. The frame or prism used in this study to fully see this inequity is intersectionality.
Building on CRT, intersectionality acknowledges that systems of hierarchy do not operate singularly, but instead in a matrix-like fashion, exhibiting an additive manner sometimes likened to “double jeopardy” due to intersecting forms of oppression (Collins, 2009; hooks, 2000; Sheldon, 2004; Thomas, 1999). From a Black feminist standpoint, intersectionality emerged as a framework to affect more thoroughly the multifaceted intersections of one’s identity. Although the theories of critical race feminists emerged in the fields of education and legal studies in the 20th century, the origin of this viewpoint dates back to the writings and ideas of Black female writers of the 19th century (May, 2015). Intersectionality aims to bring to the forefront the intellectual contributions of these Black feminist theorists who derived this framework, but are often overlooked and underplayed in academia.

**Intersectionality**

According to Zamudio, Russell, Rios, and Bridgman (2011), intersectionality is a central feature of CRT analysis. In their own words “there is nothing essential about one’s race” (p. 37). In this study, critical race theory and intersectionality work together like a superimposed lens. The theory of intersectionality supports the claim that even though one’s identity may be grouped into categories, one identity marker has the potential to affect other identity markers. Therefore, identity is more accurately depicted using a “matrix model that approaches lived identities [such as race, gender, ethnicity, sexuality] from their interstices, from the nodal point where they hinge or touch . . . ” (May, 2015, p. 2). This matrix orientation helps to explain many consequences for those whose positional identity falls in more than one nondominant group, such a Women of Color. Essentially, because Women of Color exist at the intersection of multiple forms of oppression, they often experience compounded forms of oppression. This orientation also accounts for the fact that an individual may have conflicting experiences of both privilege
and oppression if one’s identity markers reflect a combination of dominant and nondominant characteristics.

Intersectionality proposes that identity acts as footprints of the intertwined, enmeshed, and discriminatory working of discrimination. This framework not only alludes to the complexity of one’s identity, but also the underlying system of privilege and oppression that shape one’s identity and life experiences. To this end, MacKinnon (2013) corroborated that identities “are the ossified outcomes of the dynamic intersection of multiple hierarchies, not the dynamic that creates them. They are there, but they are not the reason they are there” (p. 1023). Similarly, Cho, Crenshaw, and McCall (2013) insisted that “intersectionality helps reveal how power works in diffuse and differentiated ways through the creation and deployment of overlapping identity categories” (p. 797). Moreover, Tomlinson (2013) asserted that identity may create windows into understanding the concealed power structures that create power and powerlessness.

Recent literature in science teacher education has acknowledged the importance of building theories to discuss teacher identities and how this shapes science teaching and learning (Avraamidou, 2014; Blackwell, 2012; Brand, 2014; Mensah, 2013; Moore, 2007). The literature in science teacher identity development offers two areas where intersectionality has the potential to complement and expand the conceptions of identity theorized by positionality. First, intersectionality is complementary to positionality in the way it states that socially constructed categories, such as race, gender, and class, collectively form one’s identity as relatively privileged or disadvantaged. The intersecting characteristic of identity has already been hinted at in the literature on science teachers’ positional identity. For instance, when defining the positional identity of science teachers, Moore (2008b) stated that “science teachers construct
science identities and develop orientations to science teaching from being positioned within multiple social structures” (p. 685). Additionally, Moore (2008d) described positional identities as the “relative positioning the teachers occupy, such as race, ethnicity, class, gender, age and religion, among many others, intersect in multiple ways” (p. 687). Moore further articulated that positional identities are the result of “systems of interlocking oppression, privilege, and power that are experienced simultaneously and have a cumulative effect on teachers and the meanings they give to their lived experiences” (p. 700). In sum, the use of intersectionality coincides with the use of positionality; both are theoretical standpoints that argue that a complete picture of a teacher’s identity comes into full view only when considering the intersections of multiple identity categories.

The second way intersectionality builds on positionality is by its potential to help teachers better understand dominant logics or hierarchical structures of privilege in the sciences. Indeed, this work has already begun with positionality-based studies. After studying the positionality of teachers who participated in a book club, Blackwell (2012) commented, “While some teachers used their positional identity to allow them to empower their students, others positioned themselves as superior . . . allowing little opportunity for interaction between themselves and their students” (p. 110). What this means is that the book club meetings did not unlock for the teachers a deeper understanding of the intricate relationship between identity and dominant logics so they could examine and refine their approaches to teaching science. Suarez, Newman, and Reed (2008) explained what happens when one lacks this understanding by noting that the “failure to investigate how our multiple identities intersect and influence our worldview, and how they privilege and oppress us, may render us accomplices in the perpetuation of oppression and not allow us to recognize the connections with and differences from others” (p.
To this end, intersectionality was the theoretical framework used to guide the methodology of this study with the hope that it would provide a theoretical foundation to help science teachers unveil discriminatory dominant logics at play in the sciences, thus facilitating the development of critical consciousness.

The aim of this study was to share the findings from an identity-based professional development model in terms of how the teachers reported the ways their race, gender, and other social markers worked together to impact their coming into and understanding of science. The matrix orientation proposed by intersectionality has the potential to expose the systems of power and privilege implicit in one’s positional identity and personal history. Chapter III next presents the methodology utilized in this study to make sense of the experiences and positional identity of the four inservice secondary science teachers who engaged in the book club.
Chapter III
METHODOLOGY

Research Design

Case Study

The purpose of this case study was to provide a detailed account of how in-service science teachers (ISTs) deepened their knowledge of their intersectionality as they reflected on their science lived experiences while reading selected chapters from *Black Feminist Thought* (Collins, 2009). In particular, this case study relied on numerous data sources to provide a rich description of what the participants learned about themselves and their Students of Color (Appendix A). Using a multiple case study approach allowed the findings to capture the unique intersectionality and science life history of each participant.

Narratives played a key role in this case study by shaping the structure of data sources and the presentation of the findings. The literature points to the benefit of having teachers write and reflect on their personal narratives as a way of learning about discrimination in schooling that goes widely unnoticed. In particular, numerous studies in teacher education have highlighted the benefits of having science teachers write critical and racialized autobiographies as a way to develop their critical consciousness (Mensah, 2009a, 2013; Rivera Maulucci, 2013). This study implemented the same approach to learning by asking participants to write formal narratives (or stories of self) related to science and also asking them to relate the texts read in the book club to their personal experiences. Mensah (2013) expanded on this approach when stating:

Part of understanding institutional and structural forms of discrimination was making the connection between social justice and critical learning through stories and narratives of their personal experiences in learning science. For example, the personal reflections on
past experiences . . . revealed to many of the preservice teachers the overt and covert nature of who can do science and how women, in particular, were often not seen as a part of those who can do science. Not just in individual writings, but also in whole class discussions, opportunities to share personal narratives related to gender were commonplace. (p. 326)

Moreover, narratives provide beneficial context to help participants develop a stronger sense of self, thus supporting teacher identity development (Habermas & Bluck, 2000). To this end, Rivera Maulucci (2013) agreed that “a focus on teachers’ autobiographical reasoning, or the ways in which they use their narratives to link the past to their present and establish a coherent sense of self” (pp. 474-475). The findings in this study were presented in a narrative format to increase the validity of the study by keeping themes closely aligned to the authentic words and experiences of each participant. What is more, new knowledge often emerged from the stories participants shared with the group: When participants shared stories from their experiences in the sciences, it illuminated the thinking of their peers and brought out the theories discussed in the book club in a new and often more nuanced manner (Winter, 1989).

Field Settings and Participants

The book club meetings were held during the weekly science department faculty meeting time at an inner-city, charter public high school in New York City. The neighborhood surrounding the school is home to a large Afro Caribbean community. Of the roughly 450 students enrolled in the school, 94% are African American, 4% are Latino American, and 2% are Asian American, with over half of the student body closely associating their ethnic identity with a country in the Caribbean as the place of their family’s origin. With 70% of students qualifying for free or reduced lunch, it is common to hear students talk about how their family was forced to move from one apartment to another due to rising rent and the forces of gentrification in the borough. Compared to the ethnically diverse makeup of the student population, over 80% of the
school staff members were White. The majority of non-White staff members occupied non-teaching roles at the school. In all, during the year the study was conducted, there were only three Black teachers, only one of Afro Caribbean descent, which represents less than 10% of all staff members. This racial disparity was also evident in the leadership team or supervisors at the school. Of the five supervisors on staff, three were White males, with only one supervisor of Color.

This school is part of a larger charter network of more than thirty schools. In the few years before the book Club, the charter organization’s executive leadership openly acknowledged the grave racial disparity between the mostly White teaching staff and mostly Black student population. In addition, as a pilot program, the network hired a Director of Diversity to facilitate diversity training sessions at a few schools, but the goals of these trainings were unclear. The school site for this study was one of the pilot locations for the diversity training. As part of this training, the entire staff at the school had already participated in two 3-hour long diversity training sessions leading up to the start of the book club. Awareness of the need for the training, the teacher participants in this study were grateful that the network was attempting to engage the topic of diversity. However, there were four major shortcomings of the diversity training.

First, the readings and focus of the diversity training was geared primarily towards developing awareness of White teachers on issues related to racism, which often left the Teachers of Color feeling like the sessions did not honor their contributions or highlight the challenges they faced teaching in urban schools. Second, the trainings only occurred two or three times a year, which did not build a consistent space for teachers to continuously think about issues related to racism and other relevant hierarchies of oppression between meetings. Third, the goals and theoretical framework underpinning the diversity training sessions were unclear. This
led to inconsistent follow up conversations. Fourth, the diversity trainings discussed racism, sexism, and other forms of oppression as separate and unlocked entities. The framework of the training sessions did not allow the teachers to see the multifaceted and intersecting ways hierarchies of oppression permeate racism.

Even as the network supported the diversity trainings, the classroom structure challenged these efforts towards equity and appreciation. Science classes at the high school were run in a didactic and systematic fashion, providing few opportunities for students to engage in hands-on labs. Students sat in rows and learned mostly from paper handouts. All teachers used a physical timer to orchestrate student movements in class, such as student entry, exit and dissemination of papers. The high school used a rigid discipline policy to manage student behavior. Students were given an ongoing numerical score for their behavior called a merit count and earned demerits anytime this count was lowered due to a breach in conduct. Demerits were issued for actions as small as not tracking a teacher with eyes or passing papers too slowly. When a student earned three demerits in one class they would be sent to the school suspension room until the teacher was free to debrief with them. Although most students at the school successfully passed the high school state science tests, very few were prepared for rigorous college science courses. The college readiness department of the school kept detailed records of how alumni performed in college science classes. The school annually announced to families 100% of students graduated and moved on to college. However, the science achievement results were underwhelming, with a large percentage of students attending 2-year colleges after graduation. Even more, during the year of the study, only 71% of alumni who enrolled in a college science class passed the course, with an average GPA of 1.75 or a C- grade.
Aware of the high school’s science education statistics, the book club was created to provide an inclusive space where teachers could challenge their notions about biases and oppressive structures in science classrooms. To accomplish this goal, the book club’s goals and structure were intentionally distinct from those of the school wide diversity trainings. During the first session, the goals of the book club were clearly presented to participants and the researcher named the ways that the book club was different than the schoolwide diversity trainings. The book club met in an isolated and locked room on a non-teaching floor of the building to ensure school staff could not interrupt meetings or overhear what participants shared. These decisions were made to create a space for teachers to feel comfortable sharing their perspectives and personal experience with the hope that they would ultimately challenge their notions of hierarchies of oppression. Also, meetings took place on a different floor than the school’s classes to enable the participants to separate this space from the daily tasks and frequent interruptions of the school day. Four participants in this study brought a diversity of experiences in terms of their race, gender, and teaching experience (Table 3.1). There was only one science teacher at the school who did not participate in the study due to maternity leave. Pseudonyms were used for all participants to ensure confidentiality.
### Table 3.1

**Participant Background and Years of Teaching Experience**

<table>
<thead>
<tr>
<th>Name</th>
<th>Degree</th>
<th>Years of Teaching Experience</th>
<th>Gender</th>
<th>Race</th>
<th>Grade Level/Science Discipline Taught</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audrey</td>
<td>B.S. Psychology</td>
<td>3</td>
<td>Female</td>
<td>White American</td>
<td>11&lt;sup&gt;th&lt;/sup&gt; Biology</td>
</tr>
<tr>
<td>Bianca</td>
<td>B.A. History</td>
<td></td>
<td>Female</td>
<td>First-generation Black Guyanese American</td>
<td>10&lt;sup&gt;th&lt;/sup&gt; Grade Chemistry Laboratory</td>
</tr>
<tr>
<td>David</td>
<td>B.S. Biology, M.S. Secondary Science Education</td>
<td>10</td>
<td>Male</td>
<td>Caucasian American</td>
<td>12&lt;sup&gt;th&lt;/sup&gt; AP Biology</td>
</tr>
<tr>
<td>Winnie</td>
<td>B.S. Biology, M.S. Secondary Science Education</td>
<td>6</td>
<td>Female</td>
<td>First-generation Chinese American</td>
<td>9&lt;sup&gt;th&lt;/sup&gt; Grade Conceptual Physics/Mechanics</td>
</tr>
</tbody>
</table>

*Note.* Includes the school year in which the professional development occurred.

During a regular 5-day instructional week, teachers receive roughly 4 total hours of professional development broken down evenly into a 1-hour grade-level team meeting, 1 hour one-on-one coaching meetings, 1-hour all-staff meetings, and 1-hour science department meetings. The book club took place during the weekly science department meetings on Friday afternoons. The book club meetings convened weekly from the last week of January until July.
when the school year ended. During a typical session, participants completed prework in the form of a reading reflection of a chapter of a critical text. At the start of the book club, participants completed a prewrite question that asked them to reflect on a key quote related to the critical text they read. Then, the participants spend the remaining time of the book club discussing the reading reflection questions. In addition, some weeks were set aside for participants to use the book club sessions to write or revise their critical autobiography. During these weeks, the participants did not read new critical texts or complete reading reflections. Book club members also committed additional time in August to continue book club discussions for one week after the school year ended.

Role of Researcher

Researcher as Participant

My role as the researcher was one of a scholar activist, or “having one foot in the academy and one in the community” (Calderón, Delgado Bernal, Perez Huber, & Malagon, 2012, p. 534). With intention, as the researcher, I took on the role of participant observer by assuming two roles: “an observer [and] a genuine participant [who had] a stake in the groups’ activity and the outcome of that activity” (Guba & Lincoln, 1981, pp. 189-190). I completed all prewrites as a full participant and answered the questions from my background and perspective as a chemistry teacher in the school setting. In preparation for book club discourse, as the researcher-participant, I completed all journal entries by answering the questions. Then, prior to discussions, I revisited the prompts and wrote annotations about what the group should focus on during the upcoming meeting. Taking on this dual role provided a safe space where participants felt comfortable sharing their authentic expressions of self (Dillard, 1994). As I noted in one
memo, “I constantly reminded myself that I am the thermostat so that when the conversations become theoretical and removed from personal experience or feelings, I directly prompted others to share personal accounts and express their emotions” (Researcher Memo, November 11).

Granted, this blending of roles created the likelihood that my personal bias could be infused into the data collection or analysis of the readings. However, as purported by Black and Latina feminist scholars, the blending of roles was chosen to produce a communal atmosphere where participants felt like equal partners in the discovery of the texts along with the researcher.

**Planning and Facilitating Thorny Conversations**

Teacher educators must plan for potential detours teachers may take when thorny issues such as racism, sexism, and other systems of oppression are discussed during professional development (Alexakos et al., 2016; Mensah, 2016). There are three intentional ways that I facilitated conversations about hierarchies of oppression. First, I conducted research on detours and used this research to drive the questions I asked participants in my methodology (see Appendix B-E). Before the book club, I reviewed literature and kept a cheatsheet of common detours that individuals take when discussing issues related to racism and other systems of oppression (Milner, 2010). I constantly referred back to this cheatsheet as I read participant responses during the book club to inform the reflection questions I asked participants in subsequent weeks during the study. Based on this research, I included questions and activities throughout the pre-reading and prewrites that asked participants to reflect on detours they had taken before or during the book club when discussing thorny issues. To respond to detours I observed, I intentionally extended the discussion that occurred during week 6 of the book club to week 7 (see Appendix E). During week 6, each participant wrote a reflection on this question and then shared their response in the group. Before the discussion ended during week 6, I shared two
versions of my response to this question, where my second response exposed biases and
privileges implicit in my first response. During the subsequent week, participants reflected on
this question again and then shared the ways they had taken detours in their first approach at
answering the prompt.

The second way I facilitated thorny conversations was by aligning the group on core
definitions and ways we would speak about oppression in science. These core definitions are
highlighted in Chapter 1. Out of the six months the book club convened, the first six weeks were
devoted to exposing the participants to critical texts reflecting many multicultural perspectives.
Each text was selected to highlight a key tenet of critical pedagogy to build the participants’ use
of language and comfortability with speaking opening about issues of racism, sexism, and other
forms of oppression. Participants read Ahmed (2009) to understand the way people use nice
words like diversity as a decoy for openly naming and discussing thorny issues such as racism
and sexism. After discussing the text, I challenged the group to not use the word diversity in their
writing or group discourse. The aim was to push them to define in more expressive terms what
they meant by “diversity” whenever they had the urge to use the word.

The participants read the first two chapters of Pedagogy of the Oppressed to reflect on
ways individuals assume relative positioning as either oppressor or oppressed. Participants also
read McDermott (1997) to assist them in seeing the multidimensionality of hierarchies of
oppression rather than to blame individuals for oppression. It was intentional that participants did
not engage with Black Feminist Thought (Collins, 2009) until these three precedent tenets were
read and discussed. When the participants read the introductory chapter of Black Feminist
Thought (Collins, 2009), they were also asked to write a definition for intersectionality. Their
definitions were shared and the whole group was pushed to clarity on a shared definition that was
often referenced during the remaining weeks of the book club. Altogether, the critical texts participants read and reflected on were sequenced to build the participant’s vocabulary to speak more openly about thorny issues. This sequencing also built the group’s collective understanding of CRT and intersectionality so that they could actively engage with each other in book club conversations.

Third, I made conscious decisions on when to call out versus when to hold back when detours arose in discussions. I called out the group when discussions became academic-focused and removed from personal experience. In addition, I called out the group when individuals were not abiding by agreed upon norms such as using diversity as a cover-up for discussing racism, sexism, and other forms of oppression.

However, for the most part, when I noticed an individual taking a detour, I wrote it down in a researcher journal and allowed myself time between weekly book club sessions to rewrite subsequent prewrite questions and redesign book club activities to address the detours. For example, during the first week of the book club, I noticed that when Winnie and Audrey discussed their list of ten identity markers, they placed more emphasis on their identification with nondominant categories of identity. I could have “called them out” in the moment for not acknowledging the privileged aspects of their identities. Instead, I responded by planning an activity that occurred during a future week when I asked all participants to separate the ten ways they identified themselves in week one into two subcategories: oppressed or oppressor. From this activity, Audrey and Winnie began to critically think about how they viewed themselves in terms of their privilege. The findings chapter shows that although this activity of sorting your identity factors occurred in March of the book club, Audrey and Winnie did not fully come to acknowledge their privilege, in terms of their racial identities, until July or even the year after the
study was complete during the member check. Zooming out, there were many times when I had
to bite my tongue and refrain from sharing my personal perspective. Instead, I challenged myself
to patiently honor the process each participant went through to deconstruct their own identity in
the study. My role as a participant-facilitator should not be mistaken as passive; on the contrary,
I was consistently implementing facilitator moves that would bring to light detours rather than
make me look “right” as the researcher or expert in the room.

My Researcher’s Bias

Undeniably, as an African American woman, the intersections of my own identity
markers greatly influenced my desire to carry out this case study and defined the role I played in
the book club. First and foremost, I am the granddaughter of two African American nurses and
the daughter of a college-educated Black woman; therefore, I have instinctual, ancestral, and
personal knowledge of the intellectual potential of Black women. I was raised in a middle-class
family in a large city in California where my parents prioritized saving their money to send me
and my sister to the best Catholic school they could afford in order to bypass the subpar public
school system in my historically Black neighborhood. I was always first in my science and
mathematics classes at the mostly White, exclusive, private, all-girls middle and high school I
attended. In engineering school, I excelled. I was always the only Black female pupil in class. As
I realized later, the only problem with this was that I did not see the oppression hidden in this
oneliness (Harper et al., 2011). In my earlier teaching years, I wore this oneliness as a proverbial
medal of honor, but in reality I was a victim of “tokenization” (Harper, 2013). I was the only
Black woman in my undergraduate engineering program, the only Black chemistry teacher in my
Teach For America cohort, the only Black teacher at my initial placement school in New York
City, and the only Black teacher in my preservice teaching program. My oneliness status in my
science lived experiences was truly a manifestation of structures that excluded People of Color from science professions. My onlyness left me with few peers and mentors to lean on as I navigated through my first years of teaching. It is the onlyness that fuels my desire to investigate and uncover methods to support the professional success of science Teachers of Color as well as female science Students of Color. I shared this narrative of my experiences in science openly with the members of the book club to model the process of critically reflecting on one’s life history and making sense of the ways racism and sexism permeate one’s experience learning science.

As a Black female science teacher and Black feminist teacher educator, I openly shared my own science lived experience with the participants. In addition, while applying a constructivist grounded theory approach to the data analysis, I also believe that “theory depends on the researcher’s views; it does not and cannot stand outside of it” (Charmaz, 2014, p. 239). Simultaneously, I was constantly mindful of “whose story [was] being told, the researchers or the researched (or someone else’s), and for what purpose” (Cole, 2009, p. 571). If the researcher is not aware of her bias, the participants’ stories can be retold in a way that compromises their intentions (Butt, Raymond, McCue, & Yamagishi, 1992; Clough, 2002; Denzin, 1989). To circumvent my bias as a researcher, I relied on triangulation of data to validate emergent themes, peer debriefing, and communication with my dissertation advisor. In addition, I constantly reflected on how my subjectivity may have affected the lens through which I observed the participants.
Data Collection Methods

As mentioned by Creswell (2007), “the data collection in case study research is typically extensive, drawing on multiple sources of information, such as observations, interviews, documents, and audiovisual materials” (p. 75).

Reading Reflections

Participants wrote weekly journal entries on the texts assigned that represented “individuals’ written first-person accounts of the whole or parts of their lives or their reflections on a specific topic or event” (Taylor & Bogdan, 1984, p. 113). These written reflections were uploaded to the book club Google blog prior to book club discussions. Each participant was asked to write his or her initial reflections on questions that would be discussed during book club discourse. The book club questions (Appendix B) were given in advance of the meeting to give participants a format to formalize their reading reflections.

Autobiographies

At three strategic points in the study, participants wrote their personal history studying and teaching science or their science stories of self (SSOS). The literature includes numerous examples of the use of critical and racialized autobiographies to explore sociocultural consciousness (Banks, 2001; Cochran-Smith, 1995; Hollins, 1990; Johnson, 2002; McIntyre, 2002; Schmidt, 1998, 1999; Xu, 2000). A few studies have collectively examined teachers’ critical autobiographies in conjunction with their immersion in underserved communities (Hartsock, 1987; Schmidt, 1998, 1999; Xu, 2000). In addition, the literature has recognized autobiographical approaches for investigating an individual in an educational setting (Butt & Raymond, 1987). On occasion, the book club discussions were suspended to give the ISTs time
to revise their SOSS. Participants were given a chance to rewrite their stories twice as a formal way to articulate how the conceptions of their identity evolved over time. In addition, these revisions provided me with valuable insight into how the teachers conceived and revised their understanding of themselves (Rivera Maulucci, 2013).

**Interviews**

The interviews in this case study focused on going beyond the “what?” to investigate the “how?” and the “why?” behind the ISTs’ science educational trajectories (Merriam, 1998). Each Woman Teacher of Color (WTOC) participated in at least one semi-structured interview in which she discussed her educational background and how the book club readings, reflections, and discussions influenced her thinking about her science lived experiences. The semi-structured interviews were structured based on the framework proposed by Albas and Albas (1988). Appendix D presents the interview protocol for each member check session. The guiding questions for each interview were purposefully open-ended to allow each participant the space to share ideas that emerged in the moment. All eight 60-minute interviews were audiotaped and extensive notes were taken during and after the interviews as researcher field notes.

**Prewrites**

The study used and adapted the prewrite protocol established by Mensah (2015) as a way to open up dialogue at the beginning of each book club discussion. After 5 minutes of silent reflection, all participants posted their responses to the Google site and elaborated on their responses during a short discussion. Generally lasting about 50 minutes, the first 5 minutes were reserved for teachers to comment in writing on the same prewrite question (Appendix E). Due to the limited duration of each meeting, there was a weekly prewrite but no postwrite. Most often,
the prework prompt mentioned a key quote from the previous week’s reading assignment. Appendix E contains the prewrite protocol. Participant responses were submitted in real time on a Google blog and usually referenced a quote in the week’s prereading. The remaining minutes of the book club were used for teachers to discuss the book club discussion journal questions (Appendix B) that they reflected on before the meeting.

**Book Club Discussions**

Audiotaped book club discourse was a critical source of data in this case study. The discussions in this book club purposefully centered on the perspectives and reflections of critical theorists and Black feminist scholars (Collins, 2009; May, 2015). During these sessions, the teacher participants were challenged to make connections between the texts and their science lived experiences. The literature supports the value of teachers critically reading texts to promote multicultural and critical paradigms (Mensah, 2009a).

**Questionnaires**

Participants completed two questionnaires for the study to give me as the researcher a richer understanding of their science lived experiences. Questionnaire questions were largely adapted from the work of Knight (2002) and Mensah (2009a). The first questionnaire was completed at the beginning of the study and asked participants to describe their primary and secondary schooling, college, and employment environments in terms of race, class, gender, and other important identifying factors. The second questionnaire prompted the participants to reflect on how their identity markers impacted their teaching of science. Appendix H details the questionnaire protocols.
**Researcher Field Notes**

Following each book club meeting and semi-structured interview, I took time to write reflections on the emergent themes and key comments made by the participants. All of these notes were eventually uploaded to NVivo as memos that were analyzed along with the data. This practices supported my process of elevating open codes to axial codes and building my explanation of the data.

**Data Analysis**

The findings from this case study were analyzed using constructivist grounded theory (Charmez, 2014). Specifically, a grounded theory approach was used to generate the themes from the data. In the end, a rich description emerged from the individual and collective lived experiences of the ISTs. I developed categories in the open coding phase, singled out a central phenomenon, conducted selective coding, and ultimately theoretically coding the emergent categories to find relationships between categories (Creswell, 2007). During the open coding phase, I read all artifacts twice, wrote codes, and comprised memos in NVivo(2012) to describe the essence of the artifact as well as the connections between the artifact and the primary research questions (Bogdan & Biklen, 1982).

Codes were written in the form of gerunds, or noun forms of verbs, to focus on both the process and action that each line of text described (Charmaz, 2014). When developing a code, I constantly asked myself “‘what is actually happening in the data?’ ‘what category does this incident indicate?’ and ‘what is the main concern being faced by the participants?’” (Glaser, 1998, p. 140). Examples of the code generated from the data are available in Appendices F and G.
Memos were written to raise new questions and ideas about the connection between codes, to raise codes to the theoretical level by mentioning connections to existing theoretical frameworks, and to determine the focus of the literature review (Bryant & Charmaz, 2007). During the open coding phase, I relied on “feedback from the field, [to] redefine research questions as [my] understanding of the culture [deepened], and [I noted] meanings that participants [attached] to things” (Goetz & LeCompte, 1984, p. 165). Specifically, as I engaged in open coding, I took note of the key themes that emerged from the data. These emergent codes were written about in memos and were subsequently used to revise the research protocol by changing the prewrite and reading reflection questions asked in the upcoming weeks. This iterative process gave me a chance to zoom in and elevate codes as I collected data that either affirmed or negated my initial findings.

Selective coding followed and enabled me to narrow down my findings to focus on a few core categories. This occurred by looking for codes that “occur and reoccur” and finding expressions that help to organize similar codes under a main code or core category (Bogdan & Taylor, 1975, p. 83). Subsequently, core categories were pressure-checked against additional incidents in the data, which were recoded to better make sense of the categories.

Lastly, during theoretical coding, I looked for concepts and theoretical frameworks that could explain core categories and the connection between core categories (Locke, 2001). I constantly noted emergent discoveries from selective and theoretical coding in the form of NVivo memos. Examples of key memos that guided the study are found in Appendix I.
Reliability, Validity, and Rigor

A variety of research techniques, including triangulation of data, prolonged engagement, and member checking, were utilized to establish the credibility of the findings. Triangulation of data requires at least three diverse sources of data to validate findings, and this case study drew from six sources of data to allow for a rich understanding and knowledge of the ISTs (Guba & Lincoln, 1981). Prolonged engagement enhanced this study as I developed close relationships with the participants as their colleague and facilitator during the study (Lincoln & Guba, 1985). As a former chemistry teacher in the school setting, I knew David for 4 years, Winnie for 2 years, and Audrey and Bianca for a half-year. The study was designed to provide the ISTs with an inclusive environment to explore their science lived experiences while protecting their anonymity and confidentiality. Though I served as the researcher and a teacher in the school setting, I was not responsible for rating or conducting formal observations of the teachers to evaluate their overall job performance. Member checking occurred in formal and informal points throughout the study when, during book club discussions and semi-structured interviews, I intentionally asked follow-up questions to verify my findings (Guba & Lincoln, 1981; Merriam, 2009). During the moments when member checking occurred, I would say to the members: “The theme that is emerging is . . . How does this resonate with you?”

Ethical Considerations

Intentional planning was used to protect the identity and reflections that book club members shared during the study. This was important to ensure that any information participants provided did not affect the rating of their job performance and job security while also honoring their willingness to share very personal reflections about their lived experiences. Therefore,
pseudonyms were used and the findings in the study were revised in a way to remove all information that could be linked back to the individual participants. Book club discussions were held on a different floor of the school building in a locked room with blinds closed to eliminate other staff from hearing or seeing the nature of the discussions. Furthermore, the Google site was only made public to the four book club participants. All data from the study were stored on a password-protected computer.

**Organization of Chapters**

The remaining chapters highlight the findings, implications, and conclusions drawn from the study. The upcoming chapter, Chapter IV, begins by discussing the findings of this study from a critical race theory standpoint. This first findings chapter explores the ways the Teachers of Color in this study developed racial literacy in the book club; this development was facilitated by their reflection on the way racial stereotypes influenced their coming into and understanding of science. In Chapter V, the findings show how participants’ experiences in science were influenced by the unique intersections of their identity categories, especially their race and gender. Finally, Chapter VI offers implications based on the findings for multicultural science teacher education as well as recommendations for future research.
Chapter IV

USING PERSONAL HISTORIES TO DEVELOP RACIAL LITERACY WITH SCIENCE
TEACHERS OF COLOR: A MULTIPLE CASE STUDY

Abstract

This study described an approach for developing the racial literacy with Teachers of Color who taught predominantly Students of Color in an urban, public school in New York City. This case study presents the ways two Teachers of Color deepened their conceptions of the role of racism on their experiences of learning science and teaching science after applying reflections from a reading of critical texts to their lives. The findings show the ways racial stereotypes, propagated by many experiences—including images of scientists, relationships with teachers, and expectations of peers and family— influencer their educational pathways in the sciences. A professional development model is offered as an affirming way to develop science Teachers’ of Color race literacy through constructions of critical autobiographies using a methodology that is iterative, interdisciplinary, inclusive, and identity-based. Implications are aimed at strengthening approaches to multicultural science teacher professional development and urban science education overall.

Key words: racial literacy • Teachers of Color • science teacher professional development • stereotypes
Introduction

The Need

Numerous studies found that knowledge of racism and its impact on the learning of racially diverse students is a vital attribute of successful teachers (Ladson-Billings, 1998; Mensah, 2009a; Wallace & Brand, 2012). However, the literature suggests that the majority of teachers leave preparation programs with incomplete understanding of discrimination and racism in schooling (Avery & Walker, 1993; Bryan & Atwater, 2002; Furman, 2008; Gay & Howard, 2000; Mensah, 2009a, 2011; Rivera Maulucci, 2013). In the literature, this knowledge is often codified and coined as racial literacy, defined by Sealey-Ruiz (2013) as “. . . the ability to read, discuss, and write about situations that involve race or racism” (p. 386). When teachers lack this knowledge, they are likely to reenact systems of oppression in their own classrooms (Borges, 2016; Young, 2010; Zeichner, 1992). In response to this, the literature calls for models of professional development that allow teachers to critically reflect on their own beliefs and become aware of their own racial prejudices, especially science teachers (Johnson, 2007; Mensah, 2009a; Young, 2010).

The professional development of racial literacy for science Teachers of Color is largely unexplored in the literature. The majority of teacher development studies aimed at closing this gap are narrowly catered to the needs and deficits of White teachers (Agee, 2004; Gay, 2000; Knight, 2002; Milner, 2006; Zeichner, 1992). Even more, there are only a handful of models that discuss approaches to multicultural professional development tailored to the needs of science Teachers of Color (Kholi, 2008; Mensah, 2016; Moore, 2009a; Torres, Santos, Peck, & Cortes, 2006).

1 The phrase racially diverse students is intentionally used in replacement for common terms that describe Students of Color such as minority and underrepresented. This classification recognizes the diversity in positional identity and intersectionality of among all students, especially among Students of Color.
2004). The underemphasized dialogue about racism and discrimination in teacher preparation leaves science Teachers of Color underprepared to approach science teaching in responsive ways. Zooming out, this underdevelopment in the literature reflects the historical inattentiveness to the professional development and upward mobility of Teachers of Color (Foster, 1990, 1993; Kholi, 2016; Lau et al., 2007; Moore 2008).

Current literature largely overlooks the deficits in knowledge and experiences that Teachers of Color also have about issues of discrimination and schooling, though these deficits are different in nature than those of their White counterparts. This gap in the literature perpetuates two wrong assumptions: (a) that Teachers of Color do not need development to teach racially diverse students, and (b) that Teachers of Color should receive the same form of development as their White colleagues. Gay (2000) asserted that this grave misrepresentation of the needs of Teachers of Color represent “professional racism” (p. 205). Specifically, Gay asserted:

> it presumes that membership in an ethnic group is necessary or sufficient to enable teachers to do culturally competent pedagogy. This is as ludicrous as assuming that one automatically knows how to teach English to others simply because one is a native speaker. (p. 205)

Similarly, Sheets (2001) asserted Teachers of Color “may not necessarily be better prepared than White teachers to succeed with children from their own or with children from other Groups of Color” (p. 28). Moreover, Villegas and Irvine (2010) stated, “[w]e need to learn more about how best to prepare teacher candidates of Color to use their cultural expertise to support student learning” (p. 188). Addressing this need has the potential to improve the professional mobility, retention, and overall job satisfaction of science Teachers of Color (Blackwell, 2012; Kholi, 2016; Maulucci, 2013; Mensah, 2016; Moore, 2007).
The professional development of racial literacy must be responsive to both the strengths and deficits that Teachers of Color possess. When Teachers of Color participate in spaces for inclusive development, they are more apt to share their perspective and experiences with their colleagues (Knight, 2002; Mensah, 2009a). Investing in the professional development of Teachers of Color has the potential to garner more responsive teacher development and more equitable classroom spaces. While most public school teachers identify as White women, statistics reveal that Teachers of Color make up a far greater percentage of those who choose to teach in schools that serve predominantly Students of Color. For example, the 2011-12 National Center for Education Statistics survey shows that Teachers of Color make up a far greater percentage of teaching staff in public schools where the percentage of racially diverse students is greater than 75%, especially among the subset of teachers with 5 or less years of teaching experience (see Figures 4.1-4.3). People of Color are more likely to select teaching positions in difficult-to-staff urban schools and tend to stay longer teaching in these settings (Elfers, Plecki, & Knapp, 2006; Scafidi, Sjoquist, & Stinebrickner, 2007). Moreover, Students of Color benefit academically when exposed to a teaching force that is racially and ethnically representative of the student population (Hess & Leal, 1997; Klopfenstein, 2005). Altogether, the literature calls for new methodologies for professionally developing racial literacy with Teachers of Color, especially novice teachers of racially diverse students.
Figure 3.1. Teacher statistics by race for all public schools (NCES, 2012)

Figure 3.2. Teacher statistics by race for all public schools where 75% or more of students are of a racial/ethnic minority (NCES, 2012)

Figure 3.3. Teacher statistics by race for all public schools where 75% or more of students are of a racial/ethnic minority. This data is filtered for teachers with 5 or less years of experience, accounting for the year they began teaching (NCES, 2012)
Racial Literacy Development for Science Teachers of Color

Several studies have used methods to specifically develop the racial literacy of Teachers of Color who teach mostly Students of Color. In some current models for developing racial literacy of Teachers of Color, they allow teachers to weigh new and diverse experiences from peers and critical academic texts with their personal histories. For instance, Mensah (2007b) offered that teachers would benefit from exposure to texts representing multiple critical perspectives, including feminist pedagogy, culturally relevant, and culturally responsive pedagogies. Additionally, Mensah (2008) suggested that Teachers of Color be provided access to multiple perspectives and chances to re-interpret their personal history while deepening awareness of oppressive and inequitable social structures. The use of autobiographies in professional development facilitates and also builds an environment of comfort and trust often missing in traditional models of multicultural teacher development.

Current teacher professional development atmospheres often shut down Teachers of Color, isolating and alienating their voices and contributions (Knight, 2002; Montecinos, 1994). In contrast, Dillard (1994) shared findings from a professional development with Teachers of Color where “a bond of trust and solidarity began to develop . . .” when a space was provided to share personal histories (p. 13). Similarly, Kholi (2008) documented a professional development model for Teachers of Color where the sharing of personal histories created “a space of comfort . . . genuine interactions . . . [where Teachers of Color] were able to trust each other enough to candidly express their experiences, feelings and thoughts . . . about race and racism” (p. 87). Altogether, a variety of studies agree that writing and revising autobiographies is one method of helping Teachers of Color grapple with and learn about issues of diversity (Mensah, 2015, 2016; Rivera Maulucci, 2013).
Theoretical Framework

Critical Race Theory

Critical race theory (CRT) is the theoretical framework used in this study to unpack and counteract racism. Originating in Critical Legal Studies, critical theorists developed CRT in the 1960s due to an undertheorization of the experiences and positioning of People of Color (Ladson-Billings & Tate, 1995). Thus, CRT emerged from the scholarship of activists during the Civil Rights movement as a manner of discourse to challenge the oppressive and racist structures embedded in everyday systems such as the educational system (Tate, 1997). From a CRT standpoint, the experiences and positioning of People of Color are distinct from and far more bleak than the realities of other “minority” classifications, such as those who are White and underclassed or White and female. This is because one’s race is socially constructed and non-neutral rather than objective. Race has no scientific basis or articulation and is rather a “social construct and signifier” (Ladson-Billings, 1998). As elaborated by Morrison (1992), race is “a way of referring to and disguising forces, events, classes, and expressions of social decay and economic division” (p. 63). Therefore, racism is an intentional system executed to the benefit of Whites to control and assert power over People of Color in society. In this same vein, this study ascribed to Wellman’s (1977) definition of racism as “culturally sanctioned beliefs which, regardless of the intentions involved, defend the advantages Whites have because of the subordinated positions of racial minorities” (p. xviii). At its core, the aim of CRT is to expose camouflaged racism that undermines the intellect, well-being, and success of People of Color.

According to CRT, there are often conflicting stories in academic discourse—the majoritarian viewpoint and the perspectives and experiences of People of Color (Delgado, 1989; Solorzano & Bernal, 2001). The ingroup’s stories structure social reality through a prevailing
mindset that places dominant identities on top and nondominant identities on the bottom. The ingroup portrays this social reality as natural, equitable, and commonplace. To counter this, the personal histories of People of Color have the power to highlight and challenge forms of discrimination and racism (Saavedra & Perez, 2012; Solorzano & Bernal, 2001). Moreover, the narratives of People of Color “create . . . a space where unjust systems and processes are identified and interrogated” (Maddison, 1998, p. 280). To this end, in this study, the Teachers of Color wrote and revised critical autobiographies as a way to apply reflections from critical texts and dialogue readings. The biographies enabled them to see the ways racism operated in their personal histories, especially in their experiences studying and teaching science.

**Stereotypes.** Stereotypes represent one form of the majority’s narratives that subordinate and limit the educational progress of People of Color, especially in science. CRT theorizes that stereotypes are constructed in order to maintain normative images of Whiteness as the intellectual ideal (Kao & Thompson, 2003; Solorzano & Yosso, 2001). For this study, a stereotype is defined as “an exaggerated belief associated with a [racial] category” (Allport, 1979, p. 191). With Whiteness as the intellectual ideal, the majority has displayed many negative stereotypes of People of Color, many of the stereotypes focused on the mediocrity and subordination of People of Color. The labeling of People of Color as inferior via stereotypes accentuates and upholds the correctness of Whiteness by producing a false, inferior juxtaposition. Collins (2009) adds “[o]thers’ of society who can never really belong [ . . . ] are simultaneously essential for its survival because those individuals who stand at the margins of society clarify its boundaries . . . by not belonging, emphasize the significant[ce] of belonging” (p. 70). Ladson-Billings (1998) called educators to name and challenge this paradigm when clarifying that the dominant narrative in education sensationalizes “Whiteness as school
achievement, . . . middle classness, . . . maleness, . . . beauty, . . . [and] science . . . and denigrates Blackness as . . . gangs . . . welfare recipients . . . basketball players . . . [and] the underclass” (p. 9). Essentially, stereotypes are to racism as yen is to yang: denigrating People of Color via stereotyping is a natural requirement and manifestation of racism.

**Stereotypes in the sciences.** This concealed yet disparaging part of racism is present in the culture of science via the false perception that science is culture-free and success in science is solely merit-based. In science education literature, scholars have unmasked the illusion that science and goals of science literacy are “culture-free” and unbiased (Basile & Lopez, 2015; Mensah, 2015; Mutegi, 2011; Rodriguez, 1997). Many critical theorists have corroborated Chinn’s (2002) assertion that mainstream viewpoints in science “fail to come to grips with the issues of gender, ethnicity, language, and power that maintains the exclusionary, patriarchal discourse in science” (p. 333). Others have noted the hidden yet lopsided origin of science course curricula that heavily emphasizes Eurocentric works and knowledge (Chinn, 2002; Mutegi, 2011). Anyon (1981) appropriately summed up the covert racism in the sciences when stating that science has an explicit curriculum, science facts and concepts, as well as a hidden curriculum, or messages indicating social norms and roles that often reinforce a hegemonic perspective.

In the sciences, Whiteness is characterized as prototypical, thus leading to racial stereotypes assigned to People of Color. The prototypical image of a scientist as a White male is reinforced by the predominance of Caucasian males in science careers. The most common image most people think of when asked to draw a scientist is a Caucasian male. For more than four decades, researchers have documented the predictably consistent results of the “Draw-A-Scientist Test” where students of all races repeatedly sketch a White man cloaked in a lab coat
(Chambers, 1983). Additionally, university science education has been criticized for having a “history of exclusion and bias” (Johnson, 2007, p. 819) and being an “approved way to induct young men into adult fraternities of science, mathematics and engineering” (Seymour & Hewitt, 1997, p. 259). The dominant narrative of the ideal scientist, being a male Caucasian scientist, supports that any other gender or race of a scientist is inferior because they diverge from the ideal scientist. The dominant narrative asserts that People of Color are less represented in the sciences because they are intellectually inferior, less disciplined, and therefore less successful. This negatively impacts the confidence and persistence of People of Color in the sciences. This occurs when People of Color: (a) are not made aware of successful Scientists of Color (Ovelton, 1990); (b) lack mentors who are People of Color (Jordon, 1999); and (c) experience the low expectations set by their teachers (Malcolm, 1976). Brown et al. (2016) added “racial inequality as a binding theme in their examination of Black scientist and science students that created ‘racially produced stress’” (p. 170). This monocultural tradition in science creates a Eurocentric worldview of exclusivity that portrays People of Color as outsiders and misfits (Aikenhead, 1996; Atwater & Riley, 1993; Kincheloe, 2005). Altogether, stereotypes negatively impact racially diverse populations at every stage of the STEM pipeline: from the impressions elementary school children have about the image of scientists, to People of Color participating in STEM professions.

Model Asian minority stereotype. The model Asian minority stereotype is a racial stereotype that suggests “Asian Americans are high-achieving model minorities” (Lee, 1996, p. 120). This stereotype is especially predominant in STEM and science-related professions (Chinn, 2002). The portrayal of certain Asian Americans as model minorities illustrates the way stereotypes tend to create discriminatory structures of hierarchies both within and between
minority races. Lee asked the question: “What could be wrong with being characterized as industrious, smart, and successful?” (pp. 141-142). Well, what is wrong is that the model minority stereotype silences structures that limit the academic success of other People of Color because it produces an illusion that there is “equal opportunity for all because some minority groups have ‘made it’” (Kao & Thompson, 2003, p. 432). The act of labeling some minorities as successful and smart “served as a wedge between Asian Americans and other People of Color” (Lee, 1996, p. 120). This stereotype is even personally damaging to the racial minorities that it benefits because some “fail to live up to the standards of the stereotype” (p. 120). Still others become so engrossed in this merit-based stereotype that they lose track of the other important and positive aspects of their cultural identity; they “just lose [their] identity . . . lose being [themselves]” (p.142). Altogether, this positive stereotype is set up by the racial majority to elevate some People of Color while keeping all People of Color below the White ideal. Cha (1993) warned that this partial embrace or love is not genuine; “one cannot reasonably expect the architects truly to care about the health and well-being of the model minority” (p. 203). In essence, Lee calls this “racist love” (p. 137).

**Research Questions**

This study built off previous studies exploring how to develop science Teachers of Color to successfully teach racially diverse students (Knight, 2002; Kohli, 2008; Mensah, 2015; Moore, 2007b; Rivera Maulucci, 2012). When science Teachers of Color reflected on and retold their science-related life histories, open coding revealed that the role of science, specifically racial stereotypes in science, was a common thread in their experiences, thus shaping the theoretical framework for the study. This theme addresses the call in the literature for extended research on the ways stereotypes—mediated by scientists and science teachers—impact the persistence and
success of People of Color in the sciences (Chinn, 2002; Finson, 2002; Hanson, 2004; Johnson, 2007; Mensah, 2009a). Mutegi (2013) elaborated on this need, stating “future research should explore the degree to which admission decisions, internship appointments, mentoring relationships, and other interactions between aspiring scientists and practicing scientists are shaped by the images of African Americans as inferior others” (p. 97). This study, in corroboration with the literature, proposed that when Teachers of Color are reflective on the ways discrimination played out in their lived experience, they are better able to navigate and respond to the complex spaces in the science classroom. To this end, the research questions guiding this study were:

1. What are the racial experiences of the Teachers of Color while learning and teaching science?
2. In what ways do the words and writings of the Teachers of Color reflect their development of racial literacy during the book club?

**Methods**

**Research Design and Rationale**

The background literature beckons teacher educators to explore and codify successful methods and underlying theories of practice for preparing Teachers of Color to teach a racially diverse student population. The purpose of this case study was to synthesize multiple sources of data to provide a rich description of what the Teachers of Color in this study shared and learned as they explored their personal histories and evaluated their approaches to teaching science to Students of Color via a book club (Creswell, 2007). At its core, this approach is anchored in the belief that “people come to know the world and its power relations through story” (Rivera Maulucci, 2012, p. 590).
Setting and Participants

This case study was conducted during the weekly science department meetings at a public high school in New York City. This high-needs school serves mostly Black students, as the student demographics are 94% African American, 4% Latino American, and 2% Asian American, with 70% qualifying for free or reduced lunch. In contrast, the school staff racial representation is very different: 85% of the school staff identifies as White. This case study selectively analyzed the experiences of the two Teachers of Color who participated in a book club. The participants were Bianca, an Afro Caribbean female and Winnie, a Chinese American female. They were both raised and attended primary and secondary schools in the same New York City borough (Table 4.1). Pseudonyms replaced teacher names to conceal their identities.

Data Sources and Procedures

Data sources in this study were used to capture the Teachers’ of Color personal histories of studying science and teaching science. Most importantly, the high frequency of data collection met a need to capture the ways the Teachers’ of color conceptions of their personal histories evolved throughout the study after reading a variety of texts. This case study drew upon a robust source of data, including semi-structured interviews, reading reflections, autobiographies, and book club transcripts. Altogether, these sources of data represent the critical autobiographies teachers constructed during the study. As mentioned by Creswell (2007), “the data collection in case study research is typically extensive, drawing on multiple sources of information, such as observations, interviews, documents, and audiovisual materials” (p. 75). All the data sources were reviewed on an ongoing basis throughout the study to identify the moments when the Teachers’ of color understanding of racism evolved and deepened.
Table 4.1

Participant Background and Years of Teaching Experience

<table>
<thead>
<tr>
<th>Name</th>
<th>Degree</th>
<th>Years of Teaching Experience</th>
<th>Gender</th>
<th>Race</th>
<th>Grade Level/Science Discipline Taught</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bianca</td>
<td>B.A. History</td>
<td>1</td>
<td>Female</td>
<td>First-generation Black Guyanese American</td>
<td>10th Grade Chemistry Laboratory</td>
</tr>
<tr>
<td>Winnie</td>
<td>B.S. Biology, M.S. Secondary Science Education</td>
<td>6</td>
<td>Female</td>
<td>First-generation Chinese American</td>
<td>9th Grade Conceptual Physics/Mechanics</td>
</tr>
<tr>
<td>Researcher</td>
<td>B.A. Biomedical Engineering, M.S. Secondary Science Education</td>
<td>7</td>
<td>Female</td>
<td>African American</td>
<td>10th Grade Chemistry</td>
</tr>
</tbody>
</table>

Semi-structured interviews. Each TOC participated in two to four semi-structured interviews where they shared how the book club readings and discussions influenced their thinking about hierarchies of oppression in science and their science life histories (Appendix D). The guiding questions for each interview were purposefully open-ended to allow each participant to share ideas that emerged in the moment. All interviews were audiotaped and extensive notes were written during and after the interviews as researcher field notes.

Reading reflections. Participants prepared for the book club discussions by writing weekly participant journals. These written reflections were uploaded on a weekly basis to the
book club Google blog prior to book club discussions. The Google blog page was set up at the beginning of the study. However, each week, the Google blog page was updated with new reading reflection questions well as prewrite questions (Figure 4.4). The book club questions were provided in advance of the meeting to give participants the space and time to think critically about the topics prior to the meeting. The questions also provided a format for the participants to formalize their reflections about the readings.

![Home page of the book club Google blog](image)

**Figure 4.1.** Book club Google blog home page

**Critical text analysis.** Participants reflected on a variety of texts representing multicultural perspectives via reading reflections and pre-writes. These two methods gave participants an opportunity to write down their understanding from each text. The reflection
questions challenged participants to describe how the theories discussed in the texts resonated with their personal histories studying and teaching science.

**Prewrites.** The book club structure was adapted from that proposed by Mensah (2015). At the start of book club meetings, all participants logged onto the secure Google blog and reflected in writing about a pivotal quote that related to the pre-reading or discussion topic. Participants reflected silently for 5 minutes, officially posted their response, and then voluntarily shared their thoughts with the group. The participants’ oral and written responses allowed the Teachers of Color to make new discoveries each week about how the readings resonated with their personal experiences in the sciences.

**Autobiographies.** Participants constructed and revised autobiographies or science stories of self (SSOS) at three strategic points throughout the study. Appendix E contains the SSOS protocols. The SSOS included each IST’s personal account of her science lived experiences. During weeks 7 and 11, the book club sessions were suspended to give each participant time to revise their autobiography.

**Book club transcripts and pre-reading.** Each supplementary text was assigned to the participants of the book club to scaffold their understanding of the complexity of racism in schooling. Participants read the Preface and Chapter 1 of *Pedagogy of the Oppressed* (Freire, 2000) to help teachers look at systems in education and their classroom from a critical perspective that exploits the oppressed and privileged duality. Next, participants read *Achieving School Failure* by McDermott (1997) as a framework to understand how individual actions and larger systems work together to perpetuate patriarchal, hierarchical systems of oppression. Participants also read further texts to expose them to additional examples of how oppression operates in education and schooling (Ahmed, 2009; Chinn, 2002; Collins, 2009; Moore, 2008;...
Mutegi, 2011). Book club audio recordings captured discussions where participants shared weekly reflections on the readings. This approach supports the literature on the usefulness of reading and discussing critical texts with Teachers of Color. When analyzing the process of transformation and development for a female Teacher of Color during a preservice course, Knight (2002) added:

. . . a book on transgressing dominant cultural worldviews from a former working class African American woman influenc[ed] [ . . . ] individual transformation [of a Woman Teacher of Color]. As a preservice teacher engaged in understanding how social justice educators bring about personal, educational, and societal transformations, [the female preservice Teacher of Color] critiques relationships of power and self-oppression through an understanding of the connections between her speaking-writing voice intellect and pain. (pp. 217-218)

Data Analysis

A grounded theory approach was used to generate themes from the data (Charmaz, 2014). I as the researcher developed categories in the open coding phase, singled out a central phenomenon, conducted selective coding, and subsequently, theoretically coded to find relationships between categories (Creswell, 2007). First, during the open coding phase, I read all artifacts twice, wrote codes, and comprised memos in NVivo (NVivo 10 for Mac, 2012) to describe the essence of the artifact as well as the connections between the artifact and the primary research questions (Bogdan & Biklen, 1982). When developing a code, I constantly asked myself “‘what is the data a study of?’ ‘what is actually happening in the data?’ ‘what category does this incident indicate?’ and ‘what is the main concern being faced by the participants?’” (Glaser, 1998, p. 140). Memos were written to raise new questions and ideas about the connection between codes, to raise codes to the theoretical level by mentioning connections to existing theoretical frameworks, and to focus the literature review (Bryant & Charmaz, 2007). The data were reviewed and coded multiple times to narrow in on the themes or
core categories. I relied on weekly reading reflections and participant comments in the book club transcript to “redefine research questions as [my] understanding of the culture [deepened], and [noted] meanings that participants [attached] to things” (Goetz & LeCompte, 1984, p. 165). Selective coding followed which enabled me to narrow down the list of themes to produce a few core categories and themes. This occurred by looking for codes that “occur and reoccur” and finding expressions that helped to organize similar codes under a main code or core category (Bogdan & Taylor, 1975, p. 83). All open codes, selective codes, and themes may be found in Appendix E.

Subsequently, core categories were pressure-checked against additional incidents in the data, which were recoded to make sense of the categories. Lastly, during theoretical coding, I looked for concepts and theoretical frameworks that could explain core categories and the connection between core categories (Locke, 2001). I always jotted down emergent discoveries from selective and theoretical coding in the form of NVivo memos. The entire process—open coding, selective coding, and theoretical coding—was repeated twice to ensure that the themes were generated from in vivo codes or the actual words of the participants. The central code or phenomenon that emerged was how the Teacher of Colors were racially stereotyped. This core code motivated the researcher to juxtapose the experiences of Winnie and Bianca in order to find similarities and differences in the ways they were influenced by racial stereotypes.

**Role of the Researcher and Researcher Bias**

As I noted in one analysis memo, “I constantly remind myself that I am playing the role of thermostat so that when the conversations become theoretical and removed from personal experience or feelings that I directly prompt others to share personally and with emotions” (Researcher memo, November 11). This often looked like sharing my subjective realities and
science lived experiences with the participants. As a Black female science teacher and Black feminist teacher educator, I intentionally highlighted the ways that I was oppressed in science classes. In addition, to support the openness and critical introspection for the Teachers of Color, I also shared moments when I unknowingly oppressed my Students of Color to model this for the participants.

Granted, this blending of roles creates the likelihood of embedding personal bias into the data collection and analysis of the study. However, the literature states that African American teachers often feel comfortable sharing their subjective realities with African American teacher educators and Asian American teachers often feel more comfortable exploring their identity in settings with other People of Color (Mensah & Jackson, 2012; Sheets & Chews, 2002). Therefore, my multiple roles likely created a comfortable atmosphere where participants felt like mutual partners in the discovery of the texts and were open to sharing their perspective without fear of judgment.

Reliability, Validity, and Rigor

A variety of research techniques, including triangulation of data, prolonged engagement, and member checking, were utilized to establish the credibility of the findings (Merriam, 1998). In this study, findings were drawn from a triangulation of semi-structured interviews, reading reflections, the autobiographies, and book club transcripts to convey a rich understanding and knowledge of the Teachers of Color (Guba & Lincoln, 1981). The validity of this study was enhanced by prolonged engagement, as I developed close relationships with the participants as their colleague and the facilitator during the study (Lincoln & Guba, 1985). In addition, I conducted member checking during every semi-structured interview in the form of questions to verify the validity of emerging codes (Guba & Lincoln, 1981; Merriam, 2009). The semi-
structured interviews occurred during the latter part of the study during weeks 13 through 18 of the study.

Findings

The Case of Bianca

Theme one: No affirming images in science. The first major theme in the case study was that Bianca never saw affirming images of herself—as an African American woman—successfully pursuing careers in science. In her words, “I never saw myself as part of this science world . . . because in science, Black girls are typically not seen” (Bianca, semi-structured interview, June 29). As a young child, Bianca recalled her passion for scientific exploration; however, this interest was not sustained during her later school years primarily due to a lack of role models:

I loved science—like everything science, like Discovery Channel. . . . But never once did I even consider the possibility of going into science. . . . I never put the two together . . . it never crossed my mind I could study science. . . . It was just something I did on the weekends, I watched TV . . . Discovery Channel. . . . And then I also thought about the fact that I never had a Black science teacher in my life, male or female. And maybe that was potentially the reason I couldn't see myself there. (Bianca, book club transcript, May 15)

Bianca’s science schooling experiences, her teachers, peers, and the curricula, were devoid of affirming images of People of Color in science. When recalling her secondary schooling, her teachers “didn’t look like [her]. And they definitely didn’t tell [her] about people [in science careers] that looked like [her] so [she] didn’t see it as a possibility” (Bianca, semi-structured interview, March 13). Similarly, Bianca recollected “how the number of students who went on to study STEM [was] not great at all. [She knew] this one girl who’s studying to be a doctor out of the entire graduating class” (Bianca, semi-structured interview, July 7).
Furthermore, Bianca mentioned that her teachers “made absolutely no effort to get to know [her] as a person” (Bianca, prewrite, April 17).

Bianca missed out on mentors, role models, and encouragement. This left her feeling like she lost chances to make intellectual contributions and fully participate in science classes. Instead, “we [her and her classmates of Color] were all limited or not exposed to STEM as a possibility. It was just like here’s a class, you have to take it to graduate and move on . . .” (Bianca, semi-structured interview, July 7). She felt like an “empty vessel” in science class because “knowledge [was] being poured into [her], but like not from [her] . . . because [she’d] never seen someone that looked like [her] in that field” (Bianca, semi-structured interview, June 29). Altogether, Bianca described her experience as alienating. She shared:

Not being able to see it[racial diversity in science], you cannot imagine yourself there, . . . and when you can’t see yourself in your lessons or in the construction of your classes, you tend to feel, like, you know, what is my point, what is my purpose here, like, they[People of Color] don’t do this[science], this doesn’t exist in our world . . . and just how alienating that could be. (Bianca, semi-structured interview, June 29)

This void fueled her desire to become a teacher of Black students:

I became a teacher of mostly Black children so I can be that symbol that I never saw but longed for. . . . I’m not saying that your teacher has to necessarily always look like you, but if you see an example of this success, then you are more likely to aim for that and I wanted to be that symbol. (Bianca, prewrite, April 17)

One month before the journal club convened, the African American chemistry lab instructor at the urban high school was fired. Following this, Bianca was elevated from teacher in residence to full-time instructor and asked to take over the chemistry lab teaching position. At this moment, Bianca was faced with both her greatest hope and greatest fear: she could finally become the role model teacher for her Black students, though she would have to confront the disempowering experiences she had while learning science in primary and secondary school. Indeed, Bianca’s story shows that in the absence of role models, encouragement, and examples
of success, she was not affirmed as an African American science student. Consequently, she hesitated to assume the position as a science teacher because she still had early learned insecurities that science was an academic discipline that she was taught and shown she did not belong to.

**Theme two: Out of place.** The second major theme was that Bianca felt out of place as a science student and a science teacher. Bianca walked into the teaching position “very timid, very much like a pushover, very quiet, very fearful . . . [with] very much self-doubt . . . [saying to herself] . . . I have no idea essentially what I’m doing” (Bianca, semi-structured interview; June 29; semi-structured interview, July 29; semi-structured interview, October 6). At the root, this trepidation stemmed from feeling inept; in her words, she stated:

> I’m this Black woman who teaches science for the first time and all these people are so experienced and they know what’s going on and I have no idea what I’m talking about. . . . I did feel very like out of place in the very beginning. . . . I couldn’t see myself being a part of this [the book club] conversation because I didn’t fit here. (Bianca, semi-structured interview, June 29)

Delving deeply, Bianca said her shaky confidence was in part due to her belief that she could not live up to a certain norm or expectation for science teachers; she felt like “a statue in front of the class [and her science teaching] was robotic . . . [in her attempt to embody] . . . how it [science teaching] was supposed to be done” (Bianca, semi-structured interview, October 6). This disempowering experience had a ripple effect on her students:

> I guess I was the problem because yeah, some students in class didn’t feel empowered. But I didn’t feel empowered like standing up there. So I didn’t give them that space to feel empowered at that point because I wasn’t feeling empowered and not until later on when I started to think about imaging and I started to think about why didn’t I ever in my younger years, why didn’t I feel empowered to teach STEM or to study STEM? Well, I didn’t feel empowered because I didn’t see myself there. (Bianca, semi-structured interview, July 7)
Altogether, Bianca felt out of place in science and in the science classroom because she did not feel she could exemplify the archetypes of the typical science teachers; nor did she want to. When reflecting on the lab position, Bianca noted, “I can certainly draw parallels to the messages of the book and my current teaching experience. For starters many of the roles I have been assigned are nurturing and picking up the pieces” (Bianca, BFT C4 reading reflection, May 20). She came to believe that she was not set up to succeed; instead, her role was to fill a gap.

Feeling out of place, Bianca was confronted with two contrasting realities—how she viewed herself and feeling of disempowerment as a science student:

I’m navigating between two separate worlds . . . trying to figure out like how I can become comfortable with my authentic self in all spaces. . . . And understanding . . . who I am outside of the world of academia is not bad . . . there’s no reason to be ashamed of that . . . the actual problems and the system that has created . . . stereotypes of what you’re supposed to be like. (Bianca, semi-structured interview, July 29)

Indeed, these findings show that negative stereotypes played a detrimental role in Bianca’s experiences learning and teaching science. Because Bianca did not fit the White male archetype of a scientist, she felt unwelcomed and unsupported when learning science, unfit to fill a science teaching position, and unnatural in her approach to teaching science.

Theme three: A system ruled out science for me. The third major theme was Bianca’s belief that—as an African American women—careers in science were ruled out for her. In her words, “schooling was not setting [her] up or grooming [her] to go into the STEM field. . . . My trajectory in science has felt out of my control” (Bianca, semi-structured interview, July 7; BFT C4 reading reflection, May 20). For Bianca, this feeling “dates back to her secondary school years” and was attributed to “[her] ignorance of the many roles Black women have in STEM . . . [and] a lack of images of [her] within STEM” (Bianca, BFT C4 reading reflection, May 20; semi-structured interview, July 7).
In general, Bianca realized that her experiences of being excluded from science were due to a system rather than individual acts. She understood that “it’s bigger than that person . . . that the teaching of science goes beyond the content as a singular thing but rather as a holistic concept and historically the Black voice has been excluded from science” (Bianca, semi-structured interview, July 7). What is more, she reflected, “The school system is not designed for Women of Color, the curriculum and its narrative does not place People of Color at the forefront and objective” (Bianca, BFT C5 reading reflection, June 5). Additionally, she shared:

It’s not the individual; it’s the larger system. So like even at Borough High School we create a whole staff [of People of Color] . . . that doesn’t mean that the system is now correct, right? Because the systems . . . holds those barriers . . . they are still there. (Bianca, semi-structured interview, July 29)

With this newfound understanding, Bianca began to conceptualize how she would “create a space where Students [of Color] can live above the system that is designed for their failure” (Bianca, BFT C9 reading reflection, June 17).

From the beginning of the journal club to its end, Bianca’s awareness of the impact of stereotypes on and in science teaching evolved. In the beginning, when Bianca was asked how her experiences in science were shaped by her racial and gendered identity, she replied:

I struggled to really answer this question . . . I have not placed a great deal of thought into oppression and science. As a participant of this meeting I would love to learn from those who have been a part of this work and try to conceptualize my understanding better. (Bianca, POTO reading reflection, February 27)

In comparison, as the end of the journal club, Bianca stated:

This book club has opened the door to a conversation that I never really considered. Although, as a child, I was very aware of the racial differences between students and teachers, I did not look at it through a microscopic lens . . . I am now able to really see how Black women are minority groups in the STEM field. This reality has helped to shape my story and my overall understanding of myself in the context of my career and trajectory beyond these walls. (Bianca, prewrite, May 1)
As reflected above, the journal club catalyzed Bianca’s critical reflection about her experiences learning to teach science as well as her path to teaching science. Due to an absence of affirming images of People of Color in science, early into her education Bianca felt that she did not belong in science and never considered a career in STEM. Even though Bianca ultimately found herself as a science teacher, her early science educational background created fearfulness, as she took on the chemistry lab instructor position when a colleague was fired mid-year. Bianca’s journal club reflections and discussions illuminated the cumulative experiences and interactions of the absence of affirming images, encouraging teachers, role models, and responsive curricula that together represented the oppressive system which almost ruled out a science career for Bianca.

The Case of Winnie

Theme one: Defined for me. The first major theme was that Winnie felt her success in science had been “defined for [her]” (Winnie, semi-structured interview, July 29). A culmination of factors—encouragement from teachers, extracurricular science activities, and images of Asian Americans in science—together set her up for a career in the sciences. In her own words, her decision to pursue the sciences

... was kind of like a definition that was defined for me as opposed to me going—yes—I encompass a scientist that’s why I want to do this, that’s like my raging passion... Not until this book club have I really questioned my ‘natural’ tendency towards science. (Winnie, semi-structured interview, July 29; prewrite, May 1)

A second-generation immigrant, Winnie was constantly reminded of her foreign heritage in school except for in science classes. “It was made very obvious to [her] at a young age [she was] other, aka [she was] Chinese” (Winnie, member BFT reading reflection C5, June 4). For example, she recalled bringing sandwiches for lunch instead of leftovers from home to avoid derogatory comments from peers. However, science class was different. She mentioned, “I got
the Asian-math/science jokes ALL the time. I must be good at math because I am Chinese” (Winnie, POTO reading reflection, February 26). “Othering probably pushed [her] into [her] science educational trajectory. . . . The world was telling [her] and showing [her] that one of the few things Asian Americans can be successful at is science” (Winnie, BFT reading reflection C5, June 4).

Winnie’s peers and teachers “believed in her science and math abilities [because they] assumed she was good at math and science . . . ” (Winnie, BFT C3 reading reflection, May 15; semi-structured interview, May 27). This encouragement spurred her resilience to “grit through [her] educational career firmly believing that [she] was just good at math and science . . . ” (Winnie, semi-structured interview, July 29). She added, “being Asian American, I was always told I was good at math and science. . . . The effects of what people feed you are amazing . . . that helped paved the road to my interest and my enjoyment in science” (Winnie, BFT C3 reading reflection, May 15; Winnie, semi-structured interview, May 27).

Winnie remembered, “growing up [she] only saw Asians successful in math or science . . . that may or may not have been possible without being fed these ideas and images” (Winnie, semi-structured interview, July 29). As a result of this constant encouragement, Winnie “[felt] like the epitome of a scientist” (Winnie, SSOS1, May 8). She “always saw [herself] as a scientist . . . ” (Winnie, BFT C3 reading reflection, May 15). Additionally, one way she described her tendency toward science was her feeling successful in it and then it became part of [her] identity” (Winnie, semi-structured interview, May 27).

In summation, the comments made by Winnie’s classmates, the encouragement of science teachers, and affirming images of Asian Americans in science together represented the “multiple writers writing her story,” who defined and ensured her success in science (Winnie,
prewrite, May 1). When probed, Winnie could not remember “anyone outright saying [she] was a natural at science, but [she] always felt it” (Winnie, semi-structured interview, May 27).

**Theme two: Privileged in science.** The second major theme was Winnie’s acknowledgement in the journal club that as an Asian American, she was “privileged in science” (Winnie, semi-structured interview, July 29). Being Asian American, “[she] felt that [her] racial identity was an advantage in terms of [her] science education” (Winnie, prewrite, July 23). She added, “. . . the first things that came to my mind are the areas in which I am in a nondominant group—Asian, Chinese, female, and immigrant came first . . . not often enough do I acknowledge the privileges I do carry as well on a daily basis” (Winnie, POTO reading reflection, February 26).

The journal club provided Winnie an opportunity to learn about the perspectives and experiences of other People of Color in academia—in particular, African American experiences. From this, Winnie began to juxtapose her science education and career trajectory to that of her mostly Black students; what she found was that:

> People of Color have generally been absent and invisible when I think about my own learning of science. . . . Until book club, I wasn’t able to fully recognize how exactly being Asian in science has been a privilege. . . . I’ve mentioned but never fully recognized what that specific identity marker meant in terms of learning science. (Winnie, prewrite, July 30)

Throughout the journal club, Winnie realized that stereotypes had influenced her career choices. In particular, her teachers and classmates internalized the belief that Asian Americans are gifted in the sciences. Winnie stated:

> I always liked science but—as I am uncovering through this [journal club]—it may have just been like stereotypes that made me believe I should be heading into science . . . now as I am uncovering maybe a stereotype pushed onto me by society . . . for science. (Winnie, prewrite, April 17; book club transcript, April 17)
Winnie grappled with the model minority stereotype (Chinn, 2002) when she stated, “I think this form of a controlling image is not necessarily negative… it directs Asian Americans to specific fields and can be used as examples of success” (Winnie, SSOS 3, July 27). On one hand, Winnie embraced how the stereotype reflected her resilient nature: “I happily accept other labeled descriptions of myself, like that I am hard working as an Asian American, because I know that I am hard working because I am who I am, not just because I am Asian American” (Winnie, BFT C5 reading reflection, June 4). In many ways, this stemmed from Winnie’s upbringing—as she “grew up in a household with very high expectations. If [she] earned a 96 [her parents would ask] where did those four points go?” (Winnie, book club transcript, June 5).

It was a year later when Winnie fully admitted to the unjust underbelly of this *positive* stereotype; “misguided claims not only silences the reality of systematic racial injustices but also divides Asian Americans from our fellow Americans of color… I started to understand systems of oppression better, I also began to see how the model minority stereotype serves as a tool to divide and conquer oppressed populations” (Winnie, member check, Dec 8- one year later).

Winnie saw that the model minority stereotype benefited Asian Americans at the expense of concealing racism projected and experienced by other racial minorities.

Winnie realized that she was set up to be successful in science. The positive stereotype of Asians in science was an advantage that encouraged and supported her success in science. From this understanding, Winnie began to think about and compare the support she had received throughout her science education to the experiences of the mostly African American students in her physics classroom. In particular, she stated:

For sure, for sure I know that all my students can achieve success. . . .As an Asian in science, I can use my privilege to instill the confidence many people unconsciously instilled in me that allowed me to be successful in science. . . . I can do the same for my students. . . . (Winnie, semi-structured interview, July 29; prewrite, July 23)
At the same time, Winnie admitted that the academic trajectory of her mostly Black students will not be as easy as her path because her students did not have the benefit of the model minority stereotype as she had in school. The stereotypes of racially diverse students, like Winnie’s students, did not carry the positivity and encouragement embedded in the model minority stereotype.

Our education system is one of our many systemically oppressive institutions . . . the oppressed are usually silenced. . . . Through that silence the oppressors can write the stories for them and have these controlling images in the chapters we just read . . . there’s this huge giant, terrible, vicious, domino effect that becomes a cycle . . . I see that in the classroom because like we don’t have many brown and Black people in the STEM fields. (Winnie, semi-structured interview, May 27; BFT C9 reading reflection, June 15)

**Theme three: Unsure about my true passion for science.** The third major theme came as a result of participating in the book club discussions and reading reflections—Winnie realized that she was “unsure about [her] true passion for science” (Winnie, POTO reading reflection, February 26). Winnie could not delineate if her interest in science was due to an intrinsic desire or the extrinsic influence of family, peers, and teachers. Early in the book club, Winnie mentioned, “I always thought I was really interested in science but now [I’m] unsure if it’s genuinely my interest . . . or if it is internalized or like a combination of both . . .” (Winnie, semi-structured interview, May 27). Winnie grappled with this uncertainty, realizing that her career choice was largely a product of her surroundings: “I cannot pinpoint the moment I knew I loved to be digging into science all my life. Was it really just slow but continuous messages being fed to me by society or my actual love and passion for science?” (Winnie, POTO reading reflection, February 26). Further, Winnie contemplated what would have happened if others encouraged her to pursue a different career: “I wonder if I grew up seeing more successful female Asian visual modern artists; would that be something I’d pursue instead”? (Winnie,
POTO reading reflection, February 26). Overall, Winnie realized that science “has been something that makes [her] parents proud and a living breathing example of the American dream” (Winnie, prewrite, July 29). She also added:

I’m unsure about my true passions in science. I think about who I am in the context of America and how I can be successful, what success looks like, how I can be supportive to my family, and most things point to STEM fields for someone who looks like me. (Winnie, POTO reading reflection, February 26)

Winnie realized that in the midst of her families’ efforts to assimilate to America and ensure her academic success, she not only lost track of her interest in science, but also of her cultural and ethnic identity. This realization in the book club sparked Winnie’s desire to learn about her Chinese heritage.

This idea largely influenced my desire to identify with my own cultural identity by moving to China. As an immigrant to the United States, my family and I did a lot to assimilate. Through that process of trying to fit into a new country, I feel like many traditional things of Chinese value were lost. I want to be able to identify these lost pieces of myself so I can properly value them and value myself. (Winnie, BFT C9 reading reflection, June 15)

Consequently, Winnie credited the book club with inspiring her move to Shanghai to continue teaching science while also immersing herself in her Chinese heritage. “Revising [her] side of the story really made [her] think about what aspects of [her] life did [she] let be predetermined . . . [and this] really drove [her] to make this really crazy move [to China] . . . [to] actually defining [herself] for [herself]” (Winnie, semi-structured interview, July 29). Winnie moved to Shanghai to safely explore my racial and cultural identity: . . . [to fill ] a missing hole in my life as my immigrant family tried frantically to assimilate to American culture . . . [ to learn] some cultural norms I never learned . . . [to teach] girls to understand that they are way more powerful and valuable than how their society tells them they are . . . [and to] reclaim Winnie. (Winnie, BFT C5 reading reflection, June 4; semi-structured interview, July 29; SSOS1, April 10)
To summarize, during the book club, Winnie discovered that she was unsure of her genuine interest in science. Altogether, the encouragement of classmates and teachers and the pressure of assimilate as a Chinese American immigrant—facilitated by the model minority stereotype—heavily influenced her pathway to become a science career. She reported that her participation in the book club inspired her move to China to learn about her culture while teaching science. She has yet to return to the United States.

**Discussion of Findings**

This qualitative study highlighted the revelations of two novice Teachers of Color about the intersection of racism and their personal histories while studying and teaching science. In short, the findings revealed that racial stereotypes—enacted by science teachers, peers, and family—influenced the level of access each Teacher of Color had to study science, to teach science, and to identify themselves as scientists. While Winnie unpacked the ways she was privileged in science being Asian American, Bianca recalled feeling out of place in the sciences as an African American woman. These findings taken together revealed how this book club-based professional development model for Teachers of Color in science increased their racial literacy. As the Teachers of Color constructed self-reflective, critical autobiographies, they discovered and articulated the ways racial stereotypes were a detriment to the development of their identities as science students and science teachers. The discussion below elaborates on what the Teachers of Color learned about the role of racial stereotypes in the sciences as well as the methodological and theoretical approaches to the professional development that facilitated these outcomes.

Both Bianca and Winnie described how images of scientists, role models, and teachers themselves taken together influenced the level of access and interest they had in pursuing careers
in the sciences. On one hand, Bianca felt like an outsider in the sciences, due largely to the absence of affirming images of African Americans in the sciences. Her high school science teachers did not look like her, they did not expose her to People of Color in science, and all but one of her peers showed a sustained interested in the sciences. This finding reinforced the literature that documents ways African Americans feel excluded from science due to missed opportunities to learn about the contributions of African Americans in science (Ovelton, 1990; Von Sentima 1985) and a lack of mentors of the same race (Jordan 1999). Furthermore, when Bianca did not see African American science teachers or scientists, she never considered becoming one. Similarly, Finson (2002) and Parsons (1997) both found that Students of Color who drew normative images of scientists as White males were less likely to take science classes and consider science careers.

In contrast, Winnie recalled the “multiple writers of her story” or the references to Asian American scientists, the images she saw of Asian scientists, and even the racial jokes made by her peers that together made her feel like a natural in science. These factors together made her believe she was an Asian American, “high-achieving model minorit[y]” (Lee, 1996, p. 120). The juxtaposition of these two stories reveals the powerful ways racial personifications of scientists collectively shape Teachers’ of Color conceptions of their access to science and their role within science.

In addition to racial images of scientists, Bianca and Winnie stated that the nature of their interactions with science teachers shaped their pursuit of science careers. Bianca’s relationships with teachers were a key reason she did not pursue a science major, despite her childhood love for science. On the contrary, Winnie explained that she formed strong, lasting relationships with numerous science teachers and scientists. These experiences support my finding that Students of
Color need science teachers to develop relationships beyond the content of the racial stereotypes that are consciously and subconsciously learned and accepted. Hoard (2015) found that “forthrightly recognizing a child’s STEM aptitude and recommending the child consider careers in STEM was crucial to fostering the interest of Students of Color in the sciences” (p. 778).

Additionally, Johnson (2007) added that Women of Color often view interactions with science teachers as uncaring when their teachers strictly discuss science content, even leading some Students of Color to “cool out” or change college science majors due to a lack of relationship, mentorship, and encouragement. Indeed, Gay (2000) shared “elements of caring require confronting some long-held educational conventions and assumptions” (p. 52). There is a history of patriarchy and the underrepresentation of People of Color in the sciences; therefore, when science teachers neglect to form relationships with Students of Color and do not find spaces to discuss the way race, gender, and other identity factors are at play in the sciences, they are uncaring (Johnson, 2007). This is because a lack of these responsive actions falls short of confronting and challenging normative racial assumptions about People of Color in the sciences.

For the context of this study, stereotypes were defined as “an exaggerated belief associated with a [racial] category” (Allport, 1979, p. 191). Though Bianca’s science teachers did not aim to know her personally, Winnie recalled that the encouragement she received from science teachers helped her grit through college science classes. In many ways, these findings validated the challenge put forth by Mutegi (2013) that “future research should explore the degree to which admission decisions, internship appointments, mentoring relationships, and other interactions between aspiring scientists and practicing scientists are shaped by the images of African Americans as inferior others” (p. 97). Thus, the testimonies of Winnie and Bianca revealed that when Teachers of Color fail to develop relationships with Students of Color, they
are missing opportunities to steer the interest and intellect of Students of Color in the sciences—essentially reinforcing and reproducing racial stereotypes.

Additionally, the Teachers’ of Color exposure to racially affirming images and encouraging relationships with science teachers impacted the manner in which they approached teaching science to Students of Color. For example, Bianca was nervous that—as a novice African Americans teacher—she would end up reinforcing the image that African Americans are inferior in the sciences. This is significant because it reflects Bianca’s experience with stereotype threat or, as Aronson, Fried, and Good (2002) suggested, “a psychological predicament rooted in the prevailing American image of African Americans as intellectually inferior” (p. 114).

Consequently, for most of the study, Bianca taught science class at the front of the classroom in a teacher-centered manner in the traditional way she remembered learning science—thereby lacking confidence about and insight into how to utilize multicultural approaches to teaching science tailored to her mostly Black students.

Winnie, impacted by the model Asian minority stereotype, faced different barriers to teaching science to her mostly Black students. She mentioned that before the study began, she often underplayed her privilege in science as Asian American; she had difficulty understanding how the experiences of her mostly Black students were different and distinct than hers. She thought the experiences of her students should be similar to hers because she grew up in the same borough as her students. This is one of the primary ways the model minority stereotype is detrimental—by masking the inferior treatment of other People of Color compared to model Asian minorities (Chinn, 2002; Lee, 1996). As a result, during the study, Winnie discovered that her class was, in her own words, “oppressive” since she made no attempts to infuse multicultural
approaches in her physics course simply because she did not see the need to incorporate such approaches.

Therefore, the cases of Bianca and Winnie show the ways normative archetypes and racial stereotypes in science can mitigate the use of multicultural approaches in science classrooms. Bianca, feeling out of place teaching science, lacked confidence to modify the chemistry lessons to fit the needs and reflect the cultures of her students. Winnie, without knowledge of the role that the model minority stereotype placed in her life, neglected to create spaces in her physics classroom to discuss issues of gender, race, and ethnicity with her students. The teachers did not become aware of the influence of racial stereotypes on their experiences of learning and teaching science until they wrote their critical autobiographies and completed this study. This supports the literature that establishes the unconscious ways Teachers of Color may lack awareness needed to teach Students of Color (Grant & Secada, 1990; Irvine & Villegas, 2010; Knight, 2002; Mensah, 2016; Milner, 2006). Likewise, as the teachers revealed how science-specific stereotypes played out in their lives, they gained confidence and conviction to begin countering these stereotypes through their approaches to teaching Students of Color. In all, Teachers of Color enter teaching with deep scars and gold stars, with both affirming and disaffirming experiences in science that have shaped their pedagogical approaches.

The model Asian minority stereotype as well as her person identity impacted Winnie’s approach to teaching science. As the study progressed, Winnie realized that the model Asian American stereotype aided her success in the sciences, but stifled her personal racial and cultural awareness. By the end of the study, she was not sure if she became a science teacher because she desired to or because others—her parents, her teachers, her peers—influenced her to pursue science. Winnie expressed what Lee (1996) found often happens to those influenced by the
model minority stereotype: that they “just lose [their] identity . . . lose being [themselves]” (p. 142). Thus, by the end of the study, Winnie acknowledged the prominence of the model minority stereotype in her life history and made efforts to counter this form of racism in her classroom of mostly Black students. Furthermore, the study inspired Winnie to move to China the year following the study to teach science while reclaiming her Chinese heritage.

Furthermore, the narratives of Winnie and Bianca, as Women of Color, provide rich descriptions of the multidimensional, interlocking systems of oppression that uniquely face women science students and Teachers of Color (Mensah, 2016; Rivera Maulucci, 2013). For example, Bianca may not have described her taking on of the chemistry lab position mid-year as “nurturing and picking up the pieces” had she been an African American man. In the same way, Winnie’s description of herself as “being Asian, Chinese, female, and immigrant” reflected the ways her experiences in science were impacted by both her racial and gendered identity. However, Winnie’s story cannot encompass the personal experiences of all Asian American female science teachers; nor does Bianca’s experience align completely with my experience being a Black female science teacher myself. Both Women of Color mentioned their identification as first generation immigrants, which also impacted their experiences learning science in the United States. To this end, there is a need for additional descriptive studies in multicultural science teacher education that highlight the ways People of Color develop conceptions of self and science based on the intersections and cumulative impact of multiple categories of identity.

**Implications**

This research adds to the growing body of research on the need for and benefits of professionally developing Teachers of Color (Achinstein et al., 2010; Goodwin, 1994; Kohli,
2016; Madkins, 2011; Moore, 2007, 2008; Phillip, 2011). The cases of Winnie and Bianca offer a rich description of one way racism operates in a subject specific manner—via racial stereotypes in the sciences. Also, a methodology was offered for how to use critical autobiographies to develop racial literacy for all teachers, especially Teachers of Color. This reflects the body of literature that documents how writing personal narratives fosters teacher understanding of discrimination and schooling (Avraamidou, 2014; Banks, 2001; Cochran-Smith, 1995; Hollins, 1990; Johnson, 2002; McIntyre, 2002; Moore, 2008; Nee-Benham & Dudley, 1997; Rivera Maulucci, 2013; Schmidt, 1998, 1999; Ullucci & Battey, 2011; Xu, 2000). Through writing and revising critical autobiographies, the two teachers exposed acts of racism in their personal histories with science, developed more empowered viewpoints on their positionalities, and were more equipped to evaluate their approaches to teaching racially diverse students.

**Critical Autobiographies as a Methodological Approach for Developing Teacher Racial Literacy**

This methodological approach addresses the literature for transferrable and reproducible methods to educate science teachers on issues related to diversity, racism, and equity overall (Mensah, 2009a, 2015; Young, 2010). To this end, four main characteristics guided the development of critical autobiographies in this study: *interdisciplinary, iterative, inclusive,* and *identity-based.* These characteristics together offer a thorough articulation of the approach taken to develop the racial literacy of teachers in this study.

First, *interdisciplinary* is a focus where the teachers benefit from exposure to a diverse set of critical perspectives that together generate the multicultural orientation. Coined by Moore (2007), the multicultural orientation combines theoretical perspectives and includes texts from “multicultural education, feminist pedagogy, culturally relevant, and culturally responsive pedagogies” (p. 791). The aim of this study was to increase racial literacy; teachers benefited
from learning about and grappling with structures of oppression that persist along multiple identity markers, including race, ethnicity, gender, and socioeconomic status. Considering multiple intersecting forms of privilege and oppression better equips one to identify and describe oppressive structures and demystifies the operation of racism (Mensah, 2015). In all, as the teachers in this study read a compilation of texts reflecting the multicultural orientation, they became more skillful at analyzing the influence of racism on their personal histories.

Second, iterative is a focus where the teachers benefit from opportunities to create and repeatedly revise their autobiography over a 6-month duration. The Teachers of Color revised their autobiographies during three points in the study after weeks devoted to analyzing and personalizing texts reflecting the multicultural orientation. Some of the most profound learnings came when participants revised and elaborated on reflections they had previously shared. In addition, before book club session, the use of prewrites and pre-reading provided more informal opportunities for the teachers to make additional reflections on their personal histories. This approach was adapted from Mensah’s (2015) model of prewrites and pre-reading before discussion. For example, after the readings, teachers were asked how they related the texts to their science life history during prewrites and text reading reflections (Appendix B and C). Each time the teachers were asked questions related to their personal histories, their answers became more thorough and robust.

Third, inclusive is a focus where the structure and content of the professional development must be responsive to the individual strengths and needs of the specific Teachers of Color in the study. Learning about teachers as people in a thoughtful and attentive way must be part of the study. Adaptations must be made throughout the course based on feedback received from participant writings and comments, supporting Moore’s (2008b) proposal for positional
professional development. Whole group teacher development approaches have the tendency to often shut down Teachers of Color, isolating and alienating their voices and contributions (Knight, 2002; Montecinos, 1994). Therefore, Teachers of Color benefit from opportunities to share their ideas in a one-on-one setting (Knight, 2002; Mensah, 2016; Rivera Maulucci, 2013).

Likewise, I noticed that during some weeks Winnie and Bianca were reticent; they listened, but made no comments during whole group sessions. Therefore, I added additional one-on-one semi-structured interviews to the research protocol to create spaces to capture their perspectives. In addition, during some sessions, participants were purposefully separated into the White and non-White groups to promote racial affinity, a characteristic known to facilitate reflection among Teachers of Color (Kholi, 2008; Mensah, 2016). Furthermore, by focusing on personal histories, the methods of this study leveraged voice as a key strength of Teachers of Color (Brant, 1999; Knight, 2002). The study challenged the current notions of “inclusiveness” in teacher education; thoughtful consideration of the strengths and needs of Teachers of Color are imperative when designing the structure and content of professional development experiences. This approach has the potential to generate more dynamic methods of development that benefit all teachers.

Fourth, identity-focused focuses on how critical autobiographies reflect teachers’ deepened knowledge of their positionalities. The critical autobiographies should further reflect how the many categories of their identity converge, identifying different access points to power and privilege (Mensah, 2009a, 2012). Science teacher educators agree that writing and critiquing one’s own positionality from the perspective of race and gender is a way to avoid stagnancy in sociocultural consciousness (Mensah, 2015; Rivera Maulucci, 2013). This characteristic is a natural manifestation of exposing teachers to a wide variety or set of critical texts, which can challenge them to consider multiple identity factors and how they interact as forms of power and
privilege in education. More broadly, the findings in this study suggested that teacher identity development—or the act of deepening teacher knowledge of the intersections and interactions of their identity categories—fosters teacher racial literacy.

A proposal for educators of Teachers of Color is to delve similarly into literature reflective of the multicultural orientation and to continuously write and revise one’s own autobiography. This will enable teacher educators to “walk the talk” and gain a more nuanced understanding of the biases, assumptions, and values that inform their personal histories as they interact with teachers from diverse racial backgrounds (Mensah, 2009a). Without investigating personal prejudices, beliefs, and values, science teacher educators are susceptible to reinforcing and replicating racial stereotypes in teacher development settings (Mensah, 2015). The goal of this study was to highlight the importance of developing sociocultural teacher educators who make more skillful decisions fostering more inclusive professional development. Furthermore, this enabled teacher educators to model and transparently sharing their process of developing their own positional identity. The use of autobiographies also builds an environment of comfort and trust often missing in traditional models of multicultural teacher development (Kholi, 2008; Mensah, 2016). Similarly, Dillard (1994) mentioned that “as we shared what most often were very personal stories, a bond of trust and solidarity began to develop . . . sharing individual autobiographies allowed us to see the common struggles we all faced, as People of Color” (p. 13). This may require facilitators to challenge the traditional facilitator-participant duality and instead assume a role as participant-observer. Even more, this process has the potential to dismantle formality, creating a space that supports teachers embracing and unpacking issues related to racism.
Conclusion

The narratives of the Teachers of Color in this study demystified the ways in which racism operates in the system of education to limit the academic success of People of Color, especially in the sciences. The findings in this study reinforced the fact that race is a “social construct,” maintained and structured from images, interactions, and institutions that denigrate the intellectual promise of People of Color (Ladson-Billings, 1998, p. 8). The findings reflected the myriad ways in which racial stereotypes—that played out via interactions with teachers, peers, and family members—maintain the White prototype in the sciences by negatively impacting the life histories and career pathways of two science Teachers of Color. As Winnie and Bianca expressed their awareness of this phenomenon in their words and writings, they developed knowledge of the way racism operates, thus deepening their racial literacy.

Essentially, this study highlighted the personal histories of two Students of Color who grew up and became Teachers of Color. To this end, this study draws stronger connections between research in multicultural science education and science teacher education, supporting the reality that the two factions are very intertwined. This requires developing all science teachers, including Teachers of Color, to recognize and articulate the impact of race and racial stereotypes in their own personal histories, so that teachers are equipped to see the ways racism plays out in their interactions with students and approaches to teaching. Thus, long-term efforts towards equity in urban teacher development must continue to build thoughtful methodologies aimed at both, making the experiences of Students of Color and the career trajectories of Teachers of Color more equitable.
Chapter V

MOVING TOWARDS THE MATRIX: IDENTITY DEVELOPMENT OF SCIENCE TEACHERS VIA A BLACK FEMINIST BOOK CLUB

Abstract

This study presents a book club as a professional development model aimed at helping four teachers of diverse backgrounds explore their intersectionality. The study’s findings showed the ways teachers discovered how the interplay of their race and gender influenced their success in their science careers and their overall experiences of learning and teaching science. Even more, as teachers learned about the multidimensionality of their identities, they recognized discriminatory structures of power that disadvantage their Black female science students. With this newfound knowledge, the teachers reported enacting agency by attempting more student-centered approaches to teaching science. This study suggests the usefulness of intersectionality as a theoretical framework to inform multicultural teacher education and teacher identity development.

Key words: intersectionality • positional identity • book club • science teacher identity development
Introduction

Multicultural science teacher education is defined as methods to prepare teachers to “acknowledge, appreciate, value, and promote diverse perspectives in the science classroom” (Mensah, 2009a, p. 1045). Multicultural science teacher education emerged in the literature as a set of approaches, theories, and models for equalizing the discriminatory practices that provide some students differential access to science at the expense of others (Kincheloe, 2005). There are a multitude of descriptions of what multicultural science teachers do and what multicultural science classrooms look like, but insufficient frameworks for how to develop the underlying awareness that facilitates these outcomes. In particular, there are very few scholarly articulations of how to assist science teachers with developing the necessary critical consciousness to confront biases and assumptions that impede the successful implementation of multicultural practices in science classrooms with Students of Color (Blackwell, 2012; Borges, 2016; Mensah, 2009a; Rivera Maulucci, 2013; Young, 2010). We know that multicultural science teachers have an awareness of multicultural education, but lack the knowledge of how they gained this familiarity. Furthermore, science teacher educators caution against heavy-handed approaches to preparing teachers for relevant and responsive teaching with strict protocols. Strict protocols will not build the teachers’ decision making to respond to the unique needs and strengths that each student brings (Brand, 2014; Buxton, Lee, & Santau, 2008; Irvine, 2010; Ladson-Billings, 1995).

Moreover, models of multicultural science teacher professional development flatten the dynamic interplay of racism, sexism, and other forms of oppression that together work against efforts to provide equitable approaches and outcomes for science Students of Color (Mensah, 2009a). This knowledge requires that teachers have knowledge of the “sociocultural, sociohistorical and sociopolitical dimensions” that influence and interrupt the success of the
Students of Color in science (Mensah, 2012, p. 106). To address this need, multicultural teacher 
educators have shown the benefit of having teachers critically reflect on their personal history as 
an effective approach to achieving critical consciousness (Mensah, 2009a, 2015; Rivera 
Maulucci, 2013). As science teachers begin to recognize the multiplicity of factors that have 
influenced their experiences of learning and teaching science, they should also develop 
consciousness of the diverse perspectives of their students and power structures in their 
classrooms.

**Multicultural Science Teacher Identity Development**

Teacher identity development is an appropriate framework for fostering teacher 
development of multicultural practices because it “focus[es] our attention on examining the 
pathways through which teachers form their identities—the processes of identity development” 
(Avraamidou, 2014, p. 166). Indeed, using a teacher’s personal history as a means of helping him 
or her to analyze intersecting structures of race, gender, socioeconomic status is not new to the 
field of teacher education (Knight, 2002; Montecinos, 1994; Zamudio et al., 2011). In fact, this 
approach to multicultural teacher development is also well planted in the literature in 
multicultural science teacher education and preparation (Moore, 2008a; Parsons & Mensah, 
2010; Rivera Maulucci, 2013). Within this subset of literature, the most well-articulated and 
most commonly used theory of identity construction that considers the impact of race, gender, 
and other social markers on one’s identity and experience is positionality. There is a large body 
of literature on the use of positionality to unpack the identities of science teachers supporting 
their self-awareness and preparation for teaching racially and ethnically diverse students 
(Blackwell, 2012; Mensah, 2009a, 2012, 2016; Moore, 2008a; Rivera Maulucci, 2013; Rosa, 
2013; Pringle, West-Olatunll, Brkich, Archer-Banks, & Adams, 2012). This study built off this
growing body of literature by presenting the results from an identity-based professional development model aimed at garnering science teachers’ awareness of their intersectionality.

**Defining Identity**

It is important to offer a working theorization of identity that acknowledges the role social constructs such as racism and sexism play in one’s experience. Identity, as conceptualized in this study, has three key characteristics:

**Subjective and contested.** Foucault’s (1982) notion of identity is rooted in the understanding that there are often two competing ways to characterize someone—one theory is put forth by the idea or person in power and the other is based in the viewpoint of the person being ruled over—thus leading to the understanding that there is no objective way to label or identify someone. Foucault (1982) mentioned that any resistance of forms of power involves “struggles against the privileges of knowledge . . . [and] opposition against secrecy, deformations, and mystifying representation imposed on people” (p. 781). Essentially, forms of domination can at times mislabel individuals as a form of control, thus producing two contradictory stories—the story told by those in power and the story told by the subject. Identity itself is the incriminating evidence that this wrongdoing has occurred. Therefore, identity is “the unstable point at which the ‘unspeakable’ stories of subjectivity meet the narratives of history and of a culture” (Hall, 1993, p. 135). This study supports the belief that power and those in power at times work in covert and overt ways to diminish, distort, and denigrate the viewpoint and experiences of those being ruled over by the powerful.

**Unveils inequities.** When surveying scholarly definitions of teacher identity, Mensah (2012) brought attention to the fact that “[m]any researchers . . . use definitions of identity with little or no discussion of how race, class, gender, and other social markers intersect and
interconnect in the development of identity” (p. 106). Her statement reinforced the belief that identity cannot be divorced of the dominant logics—such as racism and sexism—that put individuals into categories and label these socially constructed representations as truth. For the purpose of this study, dominant logics are:

- hegemonic (ideas, cultures, and ideologies),
- structural (social institutions),
- disciplinary (bureaucratic hierarchies and administrative practices), and
- interpersonal (routinized interactions among individuals) playing fields upon which race, gender, class, and other categories or traditions of difference interact to produce society. (Hancock, 2007, p. 74)

This study aimed to create closer links between identity theory and teacher professional development. It proposed that teachers can better recognize and understand the enmeshed hierarchies that produce discrimination and inequity in schools by analyzing their own identity. Additionally, Tomlinson (2013) asserted that identity can create windows into understanding the concealed dominant structures that create power and powerlessness. From a Black feminist theorist, identity is conceptualized in this study as a footprint of the intertwined, enmeshed, and discriminatory working of dominant logics.

**Incorporates agency.** Without the key tenet of agency, identity may be misconceived as an impossible entanglement of hierarchies that cannot be overcome or remade towards empowerment and equity. Instead, identity reflects fluidity via a “dialectical relationship between agency and structure” (Rivera Maulucci et al., 2015, p. 557). Agency is the key to transforming yourself and those around you to accomplish equity. According to Hays (1994), “agency explains the creation, recreation, and transformation of social structures…” (p. 62). When enacted, “structurally transformative agency creates new structures” (Rivera Maulucci et al., 2015, p. 547). Moving in the world towards equity requires constant awareness of hierarchies of oppression along with the resolve to dismantle these structures via intentional action.
**Positional identity.** The primary way identity is defined in this study is through positional identity. Positionality was defined by Mensah (2012) “in terms of multiple social markers (i.e., race, ethnicity, economic status, gender, religion, and age) and how views of self through these social markers influence the ways in which teachers talk about teaching and science teacher identities” (p. 106). Additionally, positional identity was defined as “how one is socially located (or positioned) in relation to others” (Mensah, 2013, p. 106). The current study utilized positional identity as the conceptualization of identity and leveraged this viewpoint to explore the intersectionality of four science teachers.

It is important to point out how exactly intersectionality and positionality converge in and relate to one another. Intersectionality views lived identities from their intervening spaces, or at the intersecting point of social processes such as race and gender. Positionality is that space: the interstices or the “space at the intersection of structure (social position/social effects) and agency (social positionality/meaning and practice)” (Anthias, 2008, p. 15). Therefore, both theories of identity allude to the power dynamics at play in identities. As a teacher engages in identity development and develops critical consciousness, he or she should be able to view identity from the ways it is theorized as entangled in and ruled by dominant logics in a webbed fashion. Furthermore, the literature in science teacher positionality directly points to the webbed and interlocked way in which a teacher’s categories of identity overlap to form his or her experiences of learning and teaching science (Blackwell, 2012; Moore, 2008a, 2008b, 2008d, 2012; Rivera Maulucci, 2013). For instance, Moore (2008a) pointed out that “individuals are not the construction of just gender, or just race, but have multiple positions that intersect and create for them their perception of the world” (p. 699). The definition of positionality exhumes the same interlocking sentiment of intersectionality. In sum, intersectionality and positionality are
complementary identity-based lens; both are theoretical standpoints that argue that a complete picture of a teacher’s identity comes into full view only when considering the intersections of multiple identity categories.

**Theoretical Foundation**

**Intersectionality**

Intersectionality, the analytic lens for this study was defined as a “matrix model that approaches lived identities [such as race, gender, ethnicity, sexuality] from their interstices, from the nodal point where they hinge or touch . . . ” (May, 2015, p. 2). Though May (2015) warned that definitions tend to “flatten its complexity,” intersectionality has several distinct and defining characteristics (May, 2015, p. 18), as follows.

**Rejects single-axis frameworks.** Intersectionality acknowledges that systems of hierarchy do not operate singularly, but instead in an additive manner sometimes like a “double jeopardy” intersecting different forms of identity (Collins, 2009; hooks, 2000; Sheldon, 2004). To elaborate, this framing conceives categories of identity such as race, gender, and sexuality, not as distinct but always permeated by other categories, created by power dynamics (Cho et al., 2013, p. 795). Therefore, intersectionality is a “multidimensional ‘matrix’ orientation” (May, 2015, p. 1) that rejects single-matrix viewpoints of oppression such as racism and sexism in isolation simply because separately these *isms* do not convey the full picture of privilege and oppression. Bailey (2009) added, “race and gender should be conceptualized not as ‘race + gender,’ instead they should be thought of in terms of gendered racism or how gender is racialized” (p. 17). To summarize, as hierarchies of oppression always operate in an overlapping and interconnected manner, characterizations of identity must mirror this same approach if efforts to theorize about identity are to be complete and most accurate.
**Relative privilege and oppression.** This key tenet emerges out of the rejection of all dualities. Fundamental to intersectionality is the belief that myriad overlapping interconnected facets of one’s identity translates into constantly shifting hierarchies of power and privilege. Even more, the multidimensionality of one’s identity means that an individual can inhabit spaces of privilege and oppression at the same time. Essentially, “both marginalization and privilege play out simultaneously” across dominant logics and within an individual’s own identity (May, 2015, p. 22).

**Rooted in Women of Color theorizing.** Intersectional theorizing dates back to the 19th century literary contributions made by Black female writers (May 2012). In fact, Kimberle Crenshaw’s (1989) naming of intersectional perspectives in Critical Legal Studies represents a re-emergence of this theory. Stemming from Black women’s personal encounters with intersecting hierarchies of oppression, May (2015) described this analytic lens as a valuable tool for dismantling “habits of mind that have long impeded both feminist and anti-racist thought and politics” (p. 9). What is more, implicit yet paramount to intersectionality is the intrinsic value attached to the intellectual property and scholarly contributions of Women of Color, thereby also emphasizing appreciation for Black women as scholars, authors, and creators who are valuable to both academia and society at large (Collins, 2009).

**Reified through socially just practices.** Black feminist theorists operate under the assumption that simply theorizing without action is both inadequate and unproductive. May (2015) added that intersectionality is purposed to “craft collective models for change” (p. 20). Therefore, intersectionality was authored to expose, expel, and exchange dominant logics for more equitable thinking and practices.
Book Clubs and Multicultural Teacher Professional Development

The literature well documents the characteristics of book clubs that garner teacher learning about issues of diversity in science teacher education (Moore, 2008a, 2008b) and teacher education in general. First, the literature points out that teachers learn best when book clubs reflect racial, gendered, and other forms of diversity. For example, Catherwood-Ginn (2015) conducted an extensive book club study to support the racial identity development of White teachers using African American children’s books. The findings in this study reflect the limitations of same-race groups; namely a “lack of discussion around White privilege and a larger focus on ‘othering’” (p. 136). Others have agreed that book club discussions best challenge dominant logics when harnessing a diversity of perspectives across racial lines (Jacobs, Assaf, & Lee, 2011; Mensah, 2009a; Mosley & Rogers, 2011; Sleeter, 2011). Second, participants are able to act on and contextualize their new discoveries about issues of diversity when presented with authentic contexts or the combination of reading scholarship and trying out pedagogical approaches (Mensah, 2009a; Mosley & Rogers, 2011). Third, participants learn best when the facilitator creates a trusting and safe environment (Mensah, 2016). Though book clubs have become increasingly popular as a platform to discuss multicultural approaches in science teacher education, the methods taken to implement this approach are often difficult to replicate due to vague accounts of the exact portions of texts read and questions asked to participants (Blackwell, 2012; Young, 2010; for an exception, see Mensah, 2009a). The current study hoped to build on the literature on book clubs by providing a rich discussion of the methodological approach such as the exact texts read by participants; the questions asked to participants before, during, and after the meetings; and additional activities incorporated into book club sessions to facilitate their learning. Overall, this study aimed to add to the deep body of literature that
acknowledges the use of book clubs as a means of helping teachers challenge dominant logics in their personal history and teaching practices.

**Research Questions**

The participants in this study read selected chapters of Patricia Hill Collins’s (2009) book *Black Feminist Thought* in the context of a book club. Over six months, the teacher participants engaged in cross-racial interdialogue (Kohli, 2008) and critical reflection on dominant logics related to their experiences learning and teaching science. A space was created for participants to engage with Black feminist theories as they constantly reflected on their conceptions of science teaching and their own identity. The research questions for this study were:

- How do science teachers discuss their intersectionality in the book club?
- How do the teachers reflect on their approaches to teaching their Black female science students?

**Methods**

**Case Study**

Case study is a well-known methodology that uses a small sample size to provide a “rich, holistic account of a phenomenon” with no intent of generalizability across a larger unit of analysis (Merriam, 2009, p. 51). McCall (2005) stated:

> Many feminists who are trained in social science methods and who are interested in intersectionality use the case study method to identify a new or invisible group—at the intersection of multiple categories—and proceed to uncover the differences and complexities of experience embodied in that location. Traditional categories are used initially to name previously unstudied groups at various points of intersection, but the researcher is equally interested in revealing—and indeed cannot avoid—the range of diversity and difference within the group. (p. 1782)
Therefore, the case study was intended to unveil the “differences within the group”—how the complex science lived experiences of the Women of Color participants compared to their peers in the book club who identify with dominant intersections of race and gender.

The phenomenon at the center of this case study was the intersectionality of the four inservice science teachers and their science lived experiences. The purpose of this case study was to provide a thick description of how the inservice teachers conceptualized and contextualized intersectionality during the course of a semester-long book club in which they participated as a form of professional development. They reflected on how their identity markers, including their race and gender, related to their science lived experiences. At its origin, intersectionality was intended to highlight the additive and emergent forms of oppression experienced by Black women. Crenshaw (1989) expanded by stating:

Because the intersectional experience is greater than the sum of racism and sexism, any analysis that does not take intersectionality into account cannot sufficiently address the particular manner in which Black women are subordinated. (p. 140)

The intentions of this study were no different. As a researcher, my goal of this case study was to uncover the unique and complex ways that identity markers arise and affect the science lived experiences of the case study participants. Simultaneously, the case study demonstrates how the participants acknowledged identity markers while uncovering the intersectional oppression they experienced as Black women in science. The text *Black Feminist Thought* was intentionally selected for the book club readings to support the participants’ knowledge of the lived experiences of Women of Color (Collins, 2009). As the book club developed, participants were asked critical questions about ways in which their science lived experiences were similar to or different from the experiences of the Black women depicted in the text. The book club
included the actual book club conversations, reading reflections, and informal conversations that occurred outside of the science department meetings.

The setting. This case study was conducted around the book club discussions of a science department at a charter public high school called Borough High School in New York City (pseudonym). This high-needs school serves mostly Black students, as the student demographic is 94% African American, 4% Latino American, and 2% Asian American, with 70% of all students qualifying for free or reduced lunch. By contrast, the school staff dynamic is completely opposite: 85% of the staff is composed individuals who identify as White. At the time of this study, the science lessons were organized in a traditional framework that afforded students few to no opportunities to engage in lengthy classroom discussions or guided inquiry. The protocols in lab were all predetermined lists of steps for students to follow.

The teachers. All five members of the science department volunteered to participate in the intersectionality-based book club, although one teacher departed mid-year for maternity leave. The remaining four participants in the book club represented a diversity of identity markers and shared very different science lived experiences based on their unique intersectionality. Included in this study was a second-generation Afro Caribbean, female chemistry teacher; a first-generation Chinese American physics teacher; a Caucasian, female biology teacher; and a Caucasian, male biology teacher (see Table 5.1).
Table 5.1

**Participant Background and Years of Teaching Experience**

<table>
<thead>
<tr>
<th>Name</th>
<th>Degree</th>
<th>Years of Teaching Experience</th>
<th>Gender</th>
<th>Race</th>
<th>Grade Level/Science Discipline Taught</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audrey</td>
<td>B.S. Psychology</td>
<td>3</td>
<td>Female</td>
<td>White American</td>
<td>11(^{th}) Biology</td>
</tr>
<tr>
<td>Bianca</td>
<td>B.A. History</td>
<td>1</td>
<td>Female</td>
<td>First-generation Black</td>
<td>10(^{th}) Grade Chemistry Laboratory</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Guyanese American</td>
<td></td>
</tr>
<tr>
<td>David</td>
<td>B.S. Biology, M.S. Secondary</td>
<td>10</td>
<td>Male</td>
<td>Caucasian American</td>
<td>12(^{th}) AP Biology</td>
</tr>
<tr>
<td></td>
<td>Science Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winnie</td>
<td>B.S. Biology, M.S. Secondary</td>
<td>6</td>
<td>Female</td>
<td>First-generation Chinese</td>
<td>9(^{th}) Grade Conceptual Physics/Mechanics</td>
</tr>
<tr>
<td></td>
<td>Science Education</td>
<td></td>
<td></td>
<td>American</td>
<td></td>
</tr>
<tr>
<td>Researcher</td>
<td>B.S., Biomedical Engineering, M.S., Secondary Science Education</td>
<td>7</td>
<td>Female</td>
<td>African American</td>
<td>10(^{th}) Grade Chemistry</td>
</tr>
</tbody>
</table>

*Note.* Includes the school year in which the professional development occurred.
**Data sources and procedures.** This case study drew upon a robust set of data that included audiotaped book club discourse, participant journals, prewrites, semi-structured interviews, and revised science-based autobiographies. The method of data collection built on the approaches taken by Knight (2002), who conducted an in-depth case study of the intersectionality of Lynn, a Black female teacher, throughout her preservice teacher preparation at a PWI (predominantly White institution). This book club-based professional development was based on three themes: (a) **Crucial questioning**—using questions to help teachers learn about intersectionality; (b) **Personalizing**—presenting opportunities for teachers to personalize theories discussed; and (c) **Rethinking**—fostering teachers’ habit of reflecting and building on their book club contributions.

In this study, the researcher intentionally planned critical questions that introduced teachers to the concept of intersectionality and developed their lens to analyze their science lived experience using intersectionality as an interpretive lens. Many of the crucial questions challenged the participants to personalize the theories they read about to their own experiences. This supported Knight (2002), who explained that “transformations as social justice educators occur as preservice teachers acknowledge, learn to critique, and act upon social differences and oppression in their personal lives as well as in educational and societal institutions” (p. 214).

Multiple book club activities encouraged participants to reread and rethink their previous contributions during the book club. Appendices A through E chronologically detail the comprehensive protocol teachers followed when participating in interviews and completing journal entries, prewrites, questionnaires, and their science stories of self (SSOS).

**Ordering identity markers activity.** Adapted from Mensah’s (2012) card sort activity, participants in this study named the 10 major ways they identified themselves at the beginning of
the study (see Figures 5.1-5.2). This prompt was kept vague to not constrain the way teachers categorized themselves. This list was revisited twice during strategic points in the book club, allowing teachers to re-evaluate the priority of their list as well as categorize their identity markers as either oppressed or privileged. Two months later, the participants took these identity markers and further categorized them as either privileged or oppressed. If they were torn between these two categories, they were encouraged to select the one they most identified with. During the last book club session, exactly six months from the beginning of the study, the participants wrote a new list of identity factors and compared their new list to their old list.

The purpose of the Identity Markers Activity was to uncover changes in their thinking about the major categories of their identity as well as how they perceived the connections among their identity, intersectionality, and the privileged/oppressed binary. The list provided a jumping-off point for teachers to see themselves as a combination of multiple categories of identity and to consider which identities they most associated with. As the book club progressed, participants used intersectionality as a lens to describe and conceptualize how these identity categories work together to shape their science lived experiences.

**Book club texts and readings.** In addition to reading Black Feminist Thought (Collins, 2009), book club participants read a collection of other texts to build their understanding of intersectionality and to relate this theory to other critical theories in education (Collins, 2009). Each supplementary text was assigned to participants at a strategic point in the progression of the book club as a way to scaffold their understanding of the complexity of intersectionality or to support teachers with comparing the theories of Black feminists with other critical theories. Participants journaled about each reading during the week prior to the discussion of the text in the book club and submitted their reflections to the book club website.
First, the texts in the study were organized to provide a roadmap to intersectionality. For Week 2, participants read the introduction and Chapter 1 of Freire’s (2000) *Pedagogy of the Oppressed* to build an understanding of looking at systems in education and their classroom from a critical perspective that exploits the oppressed and privileged duality. During the book club, they were asked to categorize their original identity markers as oppressed or oppressor. This approach helped teachers relook at their identity through the lens of privilege and oppression and begin to see the implicit power structures hidden in identity. Also during week 2, the teachers read *Achieving School Failure* by McDermott (1997) to sink into the multidimensional layers or dominant logics of oppression implicit in education. For weeks 3 and 4, they read *Embodying Diversity* by Ahmed (2009) as an introduction to the writings and perspective of Black feminists. More specifically, if not deconstructed from a nondominant lens, this text discusses how language may unknowingly be used to support dominant paradigms. This text challenged participants to think introspectively about whether they used “diversity” as a cop-out or nicety to conceal the experiences and reality of “others” whose reality lines up with a nondominant paradigm.

For weeks 5 through 15, participants read the Preface and Chapters 1-5 and 9 of *Black Feminist Thought* by Collins (2009). This text was meant to ground them in the traditional mooring of this framework – in the lives and intellectual thought of Black female theorists. Towards the end of the study, participants read Mutegi’s (2011) article to learn practical ways to implement responsive and relevant approaches to teaching science and a context with which to compare the critical race theory lens to Black feminist theorizing.

Lastly, each participant was given an individualized text to read during the last week of the book club as a way for them to explore further the intersections of their identity in the context
of educational literature (Cherner, 2015; Chinn, 2002; Moore, 2008a; Rivera Maulucci, 2013). Together, these texts helped teachers take gradual steps into the matrix, making sustainable and feasible progress in developing their critical lens over time through relating the scholarship they read to themselves and their students. This study offered one tangible method for sequencing texts to prepare teachers to dissect and understand the multidimensionality and complex nature of intersectionality. Below is the outline of the critical texts read for the book club (Table 5.2).

Table 5.2

List of Critical Texts

<table>
<thead>
<tr>
<th>Book Club Week</th>
<th>Citation</th>
<th>Critical Text Title</th>
<th>Abbreviation Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>McDermott (1997)</td>
<td>Achieving School Failure</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Freire (2000)</td>
<td><em>Pedagogy of the Oppressed</em>—Chapter 1</td>
<td>POTO C1</td>
</tr>
<tr>
<td>5</td>
<td>Collins (2009)</td>
<td><em>Black Feminist Thought</em>—Preface</td>
<td>BFT Preface</td>
</tr>
<tr>
<td>8</td>
<td>Collins (2009)</td>
<td><em>Black Feminist Thought</em>—Chapter 1</td>
<td>BFT C1</td>
</tr>
<tr>
<td>9</td>
<td>Collins (2009)</td>
<td><em>Black Feminist Thought</em>—Chapter 2</td>
<td>BFT C2</td>
</tr>
<tr>
<td>12</td>
<td>Collins (2009)</td>
<td><em>Black Feminist Thought</em>—Chapter 3</td>
<td>BFT C3</td>
</tr>
<tr>
<td>13</td>
<td>Collins (2009)</td>
<td><em>Black Feminist Thought</em>—Chapter 4</td>
<td>BFT C4</td>
</tr>
<tr>
<td>13</td>
<td>Mutegi (2011)</td>
<td>The Inadequacies of “Science for All” and the Necessity and Nature of a Socially Transformative Curriculum Approach for African American Science Education</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Collins (2009)</td>
<td><em>Black Feminist Thought</em>—Chapter 5</td>
<td>BFT C5</td>
</tr>
<tr>
<td>15</td>
<td>Collins (2009)</td>
<td><em>Black Feminist Thought</em>—Chapter 9</td>
<td>BFT C9</td>
</tr>
<tr>
<td>15</td>
<td>**Moore (2008b)</td>
<td>Positional Identity and Science Teacher Professional Development</td>
<td></td>
</tr>
</tbody>
</table>

Note. During week 15, all participants read Chapter 9 of Collins (2009).
*Read only by Winnie
**Read only by Bianca
**Data analysis.** The findings were analyzed using constructivist grounded theory (Charmaz, 2014). The constant codes that emerged from open coding were acknowledging privilege and oppression; reenacting oppression; oppressed oppressing; Women of Color excluded in science; activism; awareness of intersectionality and changes in awareness, emotion, language, and action. During selective coding the themes of “empowering students” and “helping students find voice” emerged as ways to describe the new approaches participants took to teaching science. In the end, a rich description emerged from the individual and collective lived experiences of all teachers. During this study, the researcher discovered that each participant developed an understanding of how their identity markers worked together to impact their experiences of learning science and teaching science. After the themes emerged, the researcher revised and selectively coded the data again in order to refine the themes by ensuring that they came from the exact words of the participants. The summary of codes for this study may be found in Appendix G.

**Role of the researcher and researcher bias.** As a participant-observer, I transitioned between sharing my reflections as a member of the school community and directing the book club conversations as the researcher (Guba & Lincoln, 1981). At times this meant stepping away and not interjecting my thoughts. Depending on the flow of the discussions, at times I allowed the group to sit in the discomfort of silence, and at other times I jumped into the conversation to share my perspective and move the book club dialogue towards a more personal perspective. The book club discussions were mostly based on the journal prewrite questions that I wrote and participants answered before the session (Appendix E). I read participants’ responses before book club sessions and directed the ISTs to spend more time on questions that elicited more thoughtful answers in the prewrite and journal entries.
My approach to facilitating the book club was grounded in my identity as a Black female science teacher and science education researcher. During the book club sessions, I openly shared my experiences of being one of the only Black female engineering students during my undergraduate education and the only Black female science teacher in almost all of my preservice and inservice teaching trainings. In many instances, I purposefully shared my personal narrative to model vulnerability in the book club space and to connect my personalized experiences with the theories in the assigned readings. Sharing my science lived experience often prompted other ISTs to share their personal narratives. My personal narratives where also shared to inspire and move the ISTs to reflect on and enhance their approaches to teaching science.

What is more, I carefully watched for who dominated the discussion, who listened, and who was quieter in the study (Orner, 1992). Midway through the book club, I realized that the Teachers of Color, specifically Bianca, were silent during the majority of discourse. This prompted me to find alternative ways to capture Bianca’s reflections on the book club material. I conducted four semi-structured interviews with Bianca compared to one semi-structured interview with Audrey and David. During my additional interviews with Bianca, I asked her to revisit her reflections on the previous weeks when she was less vocal during the book clubs. I discovered that Bianca did not always feel comfortable sharing her ideas with the entire group because she was new to teaching science and slightly self-conscious that as a Black woman, she was not knowledgeable about theories of Black feminism. These additional member checks allowed me to understand more fully Bianca’s science lived experiences and her reflections on the texts.

**Elements of rigor.** The methods of rigor utilized to account for validity and reliability in this study were triangulation, prolonged engagement, member checking, and thick descriptions.
(Merriam, 2009). The study leveraged book club transcripts, prereading reflections, prewrites, and revised autobiographies to produce triangulation. As a full-time teacher in the school setting and a 4-year veteran teacher at the school, I was immersed in the school culture and developed authentic relationships with the participants, thus reflecting prolonged engagement. Member checking occurred throughout the semi-structured interviews when I shared with the participants the themes that emerged and asked if those themes resonated with them. Lastly, the method of data collection was designed to capture thick descriptions of the participants’ experiences as shown in the findings.

Findings

This case study reports findings from written reflections and conversations with four science teachers about their science identity and science teacher identity. First, I discuss how the teachers’ understanding of their intersectionality evolved during the book club. Second, I describe the revelations each teacher had about the limitations to their pedagogical approaches for teaching their Black female students and the steps they took to reform these methods during the study.

Relational Privilege in the Sciences

All science teachers realized that aspects of their identity—especially their race and gender—operated in an interconnected manner to shape their experiences of learning and teaching science. In addition, the results from the Identity Markers Activity showed that at the end of the book club, all members placed a greater emphasis on race and gender as aspects of their identities (see Figures 5.1-5.2). As teachers began to see the interconnections between their identity markers, they also noticed how their identity afforded them more or less access to
science. Taken together, the teachers’ discussions about their intersectionality together conveyed a relational structure of power and oppression that operates across dominant logics in the sciences.

Figure 5.1. Identity Markers Activity Findings: Reverse Ranking of Gender

Figure 5.2. Identity Markers Activity Findings: Reverse Ranking of Race
Bianca’s background. Bianca, a 23-year-old woman, considered herself Black American. Her most vivid childhood memory was the first day of kindergarten. This was the first time she was taunted by her peers and criticized by her teachers because of her Black Guyanese accent. On the first day of school in New York City, “words became her enemy . . . [when she] came across the words ‘accent,’ ‘foreigner,’ ‘immigrant.’” This experience stayed with her: “I was not aware that years later I would be silent in public spaces, hide behind my thoughts in fear that I would not be understood or rather tantalized because to my peers I had an accent and therefore was a foreigner, someone to speculate and place in the realm of inferiority” (Bianca, SSOS #1, April 17). Although Bianca remembered loving science as a child and faithfully watching science-related TV shows, she never thought about majoring in science in college. Bianca joined Borough High School as a teacher-in-residence with hopes of becoming a full-time teacher during the following year. Unexpectedly, halfway through the school year, Bianca was pulled into the principal’s office and offered a promotion; she was asked to fill in as the chemistry lab teacher mid-year when the African American male instructor was fired due to his inability to manage the behavior of his mostly Black students. As a history major in college, Bianca thought she would be teaching history or English, but not a science class.

The case of Bianca: Oppressed in both instances. Throughout the book club, Bianca realized that—as an African American woman—the disempowerment she experienced studying and teaching science was amplified by the interconnectedness between her race and gender. Initially, Bianca named her naïveté: “I have not placed a great deal of thought into oppression and science. . . . I would love to conceptualize my understanding better . . .” (Bianca, POTO reading reflection, February 27). The book club allowed her to “question everything” and gave her “language to vocalize exactly what [she was] feeling” (Bianca, SSOS#3, June 16, semi-
structured interview, July 29). What she learned was that she “relate[d] to this idea of the ‘other’ in instances where the conversation of race and gender are questioned. Intersectionality happen[ed] to place [her] as the oppressed in both instances” (Bianca, BFT C5 reading reflection, June 5).

Looking back on her science schooling, Bianca recalled feeling inferior to and excluded from science: “I am more aware of the oppression I faced during my secondary and postsecondary education. . . . It never occurred to me that Black women existed in science; I never felt empowered or capable of belonging in this field.” She added, “in science, Black girls are typically not seen” (Bianca, semi-structured interview, July 7). Consequently, Bianca never considered pursuing a career in the sciences: “I was highly fascinated with the world of science but saw very rare representations that would have allowed me to feel as though this was a path I was capable of embarking in” (Bianca, SSOS #3, June 16). In college, Bianca noted, “at Saint University [pseudonym], [. . .] once again, the color of STEM did not hint that Black women were a part of that world” (Bianca, SSOS#3, June 16). This experience of feeling subordinate and unqualified in science carried over when Bianca accepted the job as the full-time chemistry lab instructor.

Moreover, Bianca felt out of place teaching science because she did not feel she could adequately exemplify the archetypes of science teachers, nor did she want to. When reflecting on the lab position, Bianca stated: “I can certainly draw parallels to the messages of the book and my current teaching experience. For starters many of the roles I have been assigned are nurturing and picking up the pieces” (Bianca, BFT C4 reading reflection, May 20). She believed she was not set up to succeed; instead, her role was to fill a gap. This further reinforced how she felt her appointment to the science teaching position mid-year, without proper training and professional
mentorship, again reflected her interlocked racial and gendered identity. She added: “I have uncovered that when we do step foot in these ‘forbidden territories,’ we are usually placed in positions that directly represent stereotypes that have been used to characterize Black women for many years dating back to slavery . . .” (Bianca, SSOS#3, June 16).

The book club facilitated Bianca’s “awakening” to the interconnectedness of her gendered and racial identities (Bianca, semi-structured interview, July 29). In the Identity Markers Activity, Bianca placed race as second and gender as sixth on her list of categories at the beginning of the study and elevated these qualifiers to first and second on her list on at the end of the study (see Figures 5.1-5.2). Formerly, she did not associate with feminism in the monocultural, White sense, but she felt excluded from it. She admitted, “I silenced my gender and sexuality prior to the book club—gender because I felt as though it served as a second importance behind race . . .” (Bianca, prewrite, July 30). These findings reflect the changes in Bianca’s conceptions of her identity and openness to Black feminist theorizing; Bianca shared:

My voice, my journey, my story is part of Black feminism, it’s not exclusive to it . . . as Black women we’re not the colored version of a White women. We have our own lens and our own identities and our own experiences, and that is what should create the conversation around Black feminism and define what Black feminism is. (Bianca, semi-structured interview, July 7)

Thus, the book club opened Bianca’s eyes to the interlocking forms of racial and gendered discrimination she witnessed firsthand in the sciences as well as the interconnectedness between her educational trajectory and the historical exclusion of Women of Color from academia.

David’s background. David, a 32-year-old White man, traced his love of science back to the days when he used to wander through the woods near his rural home in Connecticut located a mile away from the neighborhood homes. His memory of science classes in high school and college was mostly “textbooks . . . talk . . . and some cookbook labs” (David, SSOS #1, April
Shortly after college, David moved to New York, and after a few months as a research lab assistant, he realized that the profession was not for him. Soon afterwards, David taught biology at an inner-city high school with only 4 weeks of formal training. After 2 years, David transferred to Borough High School, and within 2 years he was named the science department chair.

The case of David: My identity intersects at one junction . . . privilege street. When reflecting, David mentioned, “Only recently have I begun to look at the various aspects of my identity from the perspective of how they intersect, overlap, and impact each other” (David, BFT C1 reading reflection, April 15). He found that he had a two-fold advantage; in his words, “I have been supported and told that as a male, I was good at science. My maleness and Whiteness have been affirmed in every aspect of my studies” (David, BFT Journal Chapter 3, May 15).

This experience of advantage dated back to his years of schooling. For example, it was easy for David to succeed in science classes because there were ever-present, affirming images of role models around him that shared his gender and race: “The books I read were full of White males. My doctors were White males. I have seen my face in every aspect of my path. I have been told that since I was male, I was good at science and math . . . ” (David, BFT C3 reading reflection, May 15). His teachers even bolstered his confidence in science classes despite his lackadaisical approach to studying:

. . . science always seemed to be represented by people who looked like me, a White male that made me feel that despite a lack of effort on my part . . . I could continue pushing forward. . . . As much as I didn’t feel like my teachers pushed me to do more, they never came across as feeling like I didn’t belong there or was incapable of doing more. I got to know my professors and they became friends. They seemed to push me and care about my success in a way I didn’t feel before. (David, SSOS #1, April 17)
These constant-affirming messages fueled David’s commitment to succeed in science classes: “My mediocre grades became excellent. I excelled in some of the harder courses for my degree.”

Looking back, David also noticed that as he progressed through college, the demographic of his classes became increasingly White. It was David’s seemingly normal experiences that together implicitly reinforced his feeling of belonging in science.

David realized the interconnected privilege of his race and class largely by considering and juxtaposing the perspectives of the Black feminist texts with his own story. He noted, “If I was not a White male, that outcome for me may have been very different” (David, SSOS #2, May 8). In many ways, David discovered a hierarchy in science that placed him at the top and rendered those who do not share his race and gender underneath. “Science is seen as a White, male-dominated profession and unless presented otherwise will have consequences for those who are not that” (David, BFT C4 reading reflection, May 20). Acknowledging his privileged perspective, David recognized that his experiences as a White male are only one, narrow viewpoint.

We only see what we know. . . . For most of my life I’ve only known the methods and stories of the oppressor. . . . I also didn’t wonder or ask questions, I made a lot of assumptions that what I knew was truth. . . . I can open my eyes to even more ways that intersections of identity and the matrix of domination impact and influence what I do and my students. (David, BFT C3 reading reflection, May 15)

The results from the Identity Markers Activity show that David elevated his ranking of his racial identity from ninth to fifth and rearranged his gender identity from eighth to sixth during the study (see Figures 5.1-5.2). Thus, the book club amplified David’s awareness of how his gender and race intertwined to play a significant role in his identity and experiences of studying and teaching science.
**Audrey’s background.** Audrey, a 25-year-old lesbian, White woman, exuberantly spoke about her love of the typically “gross” things in science. Her first memory of science class was packing her shoebox with worms to bring to show and tell in elementary school. From elementary to middle school, Audrey’s schooling experiences varied significantly. Unlike her affluent elementary school, Audrey attended high school at a low-income school with mostly Latino American students. Though at the top of her science classes in high school, Audrey found herself at the bottom of the totem pole when she enrolled in freshman biology at a prestigious Ivy League university. In her words, “the students who surround me attended New Tier, Berkshire, and other top high schools. Their lab reports are detailed and follow a formula that apparently I was supposed to learn, but never did” (Audrey, SSOS#1, May 6). Following college, Audrey taught in rural Mississippi for 3 years where she was awarded district teacher of the year. When the book club started, Audrey was still getting acquainted to her move to Borough High School. In addition, this was her first year she openly shared that she was a lesbian with her students.

**The case of Audrey: Less empowered as a woman . . . privileged by my Whiteness.** As a White, lesbian woman of lower socioeconomic status, Audrey’s personal history was interwoven with both privileges and oppressed experiences in the sciences. On one hand, she “recognized growing up with a shortage in female scientist role models. . . . The lack of these role models made [her] feel less empowered as a woman to seek a STEM career” (Audrey, BFT Journal Chapter 5, June 4). On the other hand, she admitted, “I am not a Person of Color and do not face the oppression of People of Color in STEM” (Audrey, BFT C3 reading reflection, May 15).

When transitioning from an inner-city high school to an Ivy League university, Audrey’s sense of belonging in science changed drastically, largely because of the interconnections
between her race, socioeconomic class, and sexuality. For example, in high school, Audrey was awarded many academic honors, including an award for being the top chemistry student in her school. Her identity as a successful science student was challenged when she enrolled in the freshman biology class at an Ivy League University. Her more affluent peers had taken more AP science coursework and were more prepared to tackle complex, rigorous science coursework. She remembered, “I felt completely out of my league, as if I had stepped into a universe where everyone knew a secret that was withheld from me” (Audrey, SSOS, April 1). Audrey did, however, admit that she hid her lack of preparation in science classes and nondominant sexuality behind the socially accepted interplay of her racialized gender as a White woman:

I felt like I could also blend in as a White female, I was no different than so many students around me. My Whiteness gave me extreme privilege once I got to college. No one ever questioned my ability in a science class based on my race. Additionally, as a lesbian I could also hide my identity, only disclosing to those closest to me my true self. (Audrey, SSOS #2, May 6)

Her experience of power in science shifted yet again when Audrey decided to join Teach for America; she explained:

I realized how loaded in privilege my decision to begin teaching was. I felt comfortable clicking “no preference” on my TFA application because as a White woman I knew that there were few places I wouldn’t feel safe. I also knew that I could hide my sexuality if it was not accepted where I was placed. (Audrey, prewrite, April 24)

As Audrey explored the intertwined nature of her identity, she also uncovered detours she took when grappling with issues of discrimination in her personal history. There were times when she embraced the oppressed aspects of her identity more so than her racial privilege. Though she struggled in college science classes due to her subpar preparation tied to her relatively lower socioeconomic status, she recognized that her Students of Color would have a different, more difficult pathway than hers.
My thoughts do very quickly go to how I can relate readings and experiences to my sexuality. However, part of this book club and my own racial development is continuing to recognize situations and keeping at the front of my mind how my own experience would differ if I were a Person of Color, and how to be a White ally. In this same vein, I know that I have taken detours in my story by not explicitly mentioning when my privilege has benefited me, and how my experience was shaped by my Whiteness. This awareness in itself would give my story context that is not currently there. I don’t even know, thinking back to it, if I mentioned I was White in my story. (Audrey, BFT C2 reading reflection, April 22)

Similar to David and Bianca, Audrey also rearranged her identity makers by prioritizing her emphasis on gender and race; specifically she moved White from fifth to fourth and gendered identity from tenth to first. Audrey shared, “I have found so many nuances in my own experience that are ridden with privilege, and so many times where intersections of my identity were not the norm” (Audrey, BFT C3 reading reflection, May 15). As reflected above, Audrey recognized that her experiences of success in science related to the compilation of multiple categories of identity and differed by the social context surrounding her at different points in her education and career.

**Winnie’s background.** Winnie, a 27-year-old Asian American female, grew up in the same New York City borough as her mostly Black students. Her family moved to the United States from China when she was just 1-year-old. She recalled attending racially diverse schools and living a life filled with both “Chinese and American things and traditions” (Winnie, SSOS #1, April 10). Her first memory of school was how her teachers replaced her Chinese name with an American nickname. Though she was sometimes teased in her school for her Chinese heritage, she found a safe haven in the sciences. This led her to pursue an Animal Science major in college. When Winnie attended her liberal arts-focused college in the northeastern United States, it was the first time she was surrounded by mostly White peers. Though she initially hoped to become a veterinarian, she soon realized that as a vegetarian she did not philosophically
support certain animal treatment practices. After college, Winnie joined Teach For America and spent 3 years teaching in a Latino community in the Southwest. She was excited for the opportunity to join Borough High School as a physics teacher as it gave her a chance to teach in the same borough of New York City where she was raised.

*The case of Winnie: Racial identity was an advantage . . . but being a woman is a disadvantage in science.* As an Asian American woman and a first-generation Chinese immigrant, Winnie negotiated experiences of advantage and disadvantage while learning science and teaching science. For example, Winnie recalled growing up in a small apartment in New York City where there was often just enough food to go around. This meant that she had a difficult time feeling like she belonged in her community of very affluent White peers at her university; she explained:

> Most of the student population waited for their all season ski/snowboard pass. . . . I spent many months thinking about why these winter sports weren’t for me. . . . A large part of it was the money. I definitely did not grow up being able to spend hundreds of dollars on a family vacation at a ski resort. (Winnie, SSOS#2, May 8)

Not only were her peers more financially well off than she was, but they were also more prepared for college science classes due to their education at elite schools. Consequently, Winnie “questioned [her] own abilities and realized how so many of [her] peers had many science APs [Advance Placement courses] under their belts when [she] only had two” (Winnie, SSOS#2, May 8). The racial and socioeconomic divide between Winnie and her peers made her feel “distant from [her] fellow classmates” (Winnie, SSOS#2, May 8). In many ways, Winnie’s racial identity and socioeconomic class together created a barrier to her developing supportive peer relationships in her college science courses.

When Winnie began teaching, her relative social positioning and science identity drastically shifted because of the racial difference between herself and her Students of Color. She
changed from not feeling included in the science community at her college to singlehandedly representing “science” as the “stereotypical” Asian American science teacher at the urban schools where she was employed. However, Winnie was initially unaware of her positioning in science, compared to her Students of Color. When Winnie was asked how she valued the culture of her students, she replied, “I don’t really feel that pressure here I guess because we are . . . you know . . . urban New York City kids and like I grew up very similarly also and there was no language barrier . . . we are so similar that you know I haven’t been like reaching out as much to do that” (Winnie, book club Transcript, March 27). This response indicated that Winnie initially believed she carried a shared experience with her Students of Color primarily because they all grew up in the same borough in New York City.

As the book club progressed, Winnie acknowledged that her Asian American identity provided her with more access to science than her students due to images and interpersonal experiences that affirmed her science identity in grade school: “Being Asian American, I feel that my racial identity was an advantage in terms of my science education” (Winnie, prewrite, July 23). Later, Winnie admitted to this blind spot. It was a blind spot because Winnie did not recognize the strong role that race played in her success in science education and teaching. She stated, “. . . the first things that came to my mind are the areas in which I am in a nondominant group—Asian, Chinese, female, and immigrant came first . . . not often enough do I acknowledge the privileges I do carry as well on a daily basis” (Winnie, BFT C2 reading reflection, April 22). She further confessed to glossing over the racial differences between her students and herself when stating, “There are so many ways my privilege has allowed me to make this choice to teach science to predominantly Black students . . . but I make excuses for myself—like I’m already from [the same borough], but I teach around here, it’s part of my
community, etc.” (Winnie, BFT C2 reading reflection, April 22). To this end, Winnie’s reflections demonstrated how she reevaluated her formerly narrowed viewpoint of her racial identity and its relationship to her science identity.

Finally, Winnie also reexamined how her gendered identity intertwined with her racial identity to shape her experiences learning and teaching science. Initially, Winnie ranked her identity as a woman as sixth and placed “small” as fifth. In many ways, her identification as “small” was associated with more than her slender physique, but also with her identity as a woman and an Asian American woman. At the end of the study, she ranked “women” as second and removed “small,” showing that the ways she conceptualized her gendered identity shifted during the study (see Figures 5.1-5.2). These findings pointed to the ways Winnie came to view her identity as a woman in an empowering way during the book club. She elaborated:

As an Asian American woman in the U.S., the dominant image of me is a passive, submissive, weak, girl who’s really good in math. I see myself as a passionate, dedicated, persistent, and strong woman, who’s actually quite terrible with math. So when people get to know me and learn about my strict training schedule and how I lift weights, . . . it sometimes comes as a surprise to them. These are things I am more aware of after being in the book club . . . some labeled descriptions of me contradict my actual being, I am more unapologetic about it. (Winnie BFT C5 reading reflection, June 4)

As an Asian American woman, many decisions, including her decision to pursue a career in science, were made for Winnie by external forces. She stated, “Through this book club, I realized there were no exact moments in which I can pinpoint why I decided to pursue science” (Winnie, C5 reading reflection, June 4). On the contrary, during the book club she gained a new confidence to direct her own career trajectory. Before the end of the book club, Winnie had applied, been accepted, and was on her way to teaching in China. She made a strong, independent career decision against the racially sexist identity placed on Asian American women who are often characterized as “passive, submissive, weak” (Winnie BFT C5 reading reflection,
June 4). The book club provided Winnie with a chance to decipher the ways “gender is racialized” (Bailey, 2009, p. 17) by delving into her path in science and making moves to counter this common narrative.

**Noticing My Black Female Science Students**

The second major theme is that the teachers started to notice their Black female science students because the Black female students were the most reserved in class. They recognized the ways their Black female students were overlooked in the science classrooms and the factors that contributed to this silence. Specifically, all teachers noticed that their Black female students’ voices were underrepresented in their classroom discussions. David mentioned, “. . . they spoke softer in the room . . . are hesitant . . .” (David, BFT C3 reading reflection, May 15). Audrey added, “I have heard far more of my female students vocalize that they either don’t like science, or that it is not for them” (Audrey, BFT C3 reading reflection, May 15). Bianca stated that the “feminine voice . . . has been silenced in my classroom” (Bianca, prewrite, July 30).

Reading *Black Feminist Thought* (Collins, 2009) provided a lens for the teachers to look beyond the actions of their Black female students to the causes for their reticence. David noted that the book club gave him a new lens:

I’ve never considered the intersecting layers of oppression that female Students of Color face. I feel like I’ve been more aware of gender or race at different times but never together. Given this, I need to make more of an effort to empower my female students to find their voice in science. (David, BFT Journal Chapter 3, May 15, 2015)

Audrey pieced apart the additive, degrading ways her female students’ race and gender worked against them; she elaborated:

Evaluating the impact of these stereotypes allowed me to further question how my classroom reinforced social constructs. The book club gave me the space to learn more about the interconnectedness of race and gender, and shift my pedagogical practices to affirm students in their identities, and push against the dominant narrative of what success looks like in science. (Audrey, semi-structured interview, July 28)
To her surprise, Winnie remarked, “The accounts of oppression from the young girls [in Black Feminist Thought (Collins, 2009)] were jarring to me because I thought immediately of my students as Black 14-year-old girls” (Winnie, BFT C2 reading reflection, April 22). Moreover, David noted the ways he acted on these biases in his approaches to teaching Black female students: “Science has not been a welcoming place for People of Color and especially for Black women. . . . I have been a product of such an environment and created similar environments of learning . . . and now am hoping to change that” (David, SSOS #3, July 27). Similarly, Audrey admitted that the book club “made me analyze my own archetypes of my students and what success looks like” (Audrey, C4 reading reflection, May 20).

Beyond stereotypes, the teachers also reflected on the structures and practices in their science classroom that negatively impacted their Black female science students. For example, Bianca stated, “I am also aware of my own classroom norms that may have reinforced stereotypes that are attributed to Black girls in regards to expected norms” (Bianca, prewrite, July 30). Additionally, when looking back at her reflections about her mostly Black students in the book club, Audrey acknowledged, “I did not call them women. I called them girls. And I did not call them boys, I called them men. Like already attributing more strength to the male gender than the female gender, which is insane” (Audrey, semi structured interview, July 28).

Together, the findings showed how the teachers related the behaviors of their Black female science students to racially gendered stereotypes about Women of Color in science. To this end, Bianca declared, “It is important that we present narratives that allow young Woman of Color to explore STEM as an option and world where they can be accepted” (Bianca, C3 reading reflection, May 15). The teachers also reported a new openness to incorporate different approaches to teaching their Black female students. For example, David suggested:
There needs to be something different we’re offering to our African American students, our Black students, our brown students . . . how does intersectionality play a role in that? . . . I was thinking of like not only just Black females . . . what about Latina or Hispanic? . . . there might be subtle differences for them when thinking about how to construct a curriculum that addresses all. (David, book club transcript, May 29)

The book club prompted the teachers’ introspection about why their Black female students remained silent in class. Upon reflection, the teachers acknowledged the existence of negative stereotypes of Black women in science and noticed how some of their classroom routines and discussions reinforced these stereotypes.

A More Student-centered Classroom

The third major theme is that all of the teachers reported taking steps during the book club to make their classrooms more student-centered. To provide examples, Audrey mentioned that her classroom became “driven by students”(Audrey, prewrite, May 15); Winnie stated that she “re-centered [her] lessons so that most of the heavy lifting came from students” (Winnie, prewrite, May 15); and Bianca said her class “became way more student-friendly, student-voiced towards the end” (Bianca, semi-structured interview, October 16). David reported building a case-study aligned curriculum with statistics and data about environmental and health-related issues in New York City to allow students to use “science to challenge the status of their communities” (David, semi-structured interview, August 26).

The teachers realized that they had singularly positioned themselves as the source of scientific knowledge in science class. For instance, Bianca mentioned, “in the beginning, like I said, it was way more teacher-voiced. It was way more like the banking system like here I’m giving you this information” (Bianca, semi-structured interview, October 16). Similarly, Audrey admitted:

The biggest take-away from these discussions is that I did not take the steps necessary to urgently walk towards becoming a more culturally relevant teacher. . . . I will continue
to work away from teaching in the “filling empty buckets” method discussed . . . and towards a more inclusive and less oppressive pedagogy. (Audrey, BFT C2 reading reflection, April 22)

The four teachers reported that they were motivated to take action to reverse the silence of their Black female students that reinforced the historical positioning of Black women. From this standpoint, in order to elevate the status and value the contributions of their mostly Black students—especially their Black female students—the teachers needed to embrace teaching practices that more equitably distributed power in the science classroom. For example, Winnie added, “[I]f students aren’t seeing a diverse source of where our apparent knowledge is coming from, it is difficult [for them] to see success in science . . . instead everyone should have a voice and they should listen to everyone” (Winnie, semi-structured interview, July 29, 2015).

Thus, during the book club, they reported taking action by making their lesson structure more student-focused. In Bianca’s chemistry lab, she added, “Toward the end of the year . . . I had students do their own research and then report[ing] back to the group and sharing knowledge . . . [and the class] just became more student-led” (Bianca, semi-structured interview, July 29). David mentioned that he revamped his teacher-centered biology curriculum by “using broad case studies where students criticize fictitious or real events and use science to come to a proposal” (David, semi-structured interview, August 26). In addition, Winnie mentioned:

I re-centered my lessons so that most of the heavy lifting came from students. For 4/5 of my lessons this week, I had a similar structure: a demo/framing questions, discussion time to help students make personal connections to the content, reading to learn from a text, and some practice problems for application. I made this change because I really believe that teachers are just facilitators of knowledge. I want my students to learn from each other and their resources instead of thinking that I have all the knowledge. (Winnie, prewrite, May 15)

Thus, all of the teachers in the book club reported shifting their approaches to teaching science by redistributing power in their classroom routines, curriculum, and discourse.
Discussion

The findings from this study described the reflections and revelations of four science teachers who analyzed how their intersectionality tied to and influenced their experiences learning and teaching science in a book club. The findings focused on three core themes: (a) the teachers’ perceptions of their intersectionality revealed relational privilege in the sciences; (b) the teachers began noticing their Black female science students; and (c) the teachers reported that their classrooms became more student-centered. These three themes promote the effectiveness of the book clubs and the utility of intersectionality as a theoretical framework to invoke deepened critical consciousness. The discussion below connects the findings to the overall theoretical framework for the study. The points below underscore the usefulness of science teacher identity development to gather methods of multicultural education; as the science teachers examined their experiences in the sciences via analysis of their intersectionality, they developed a more nuanced understanding of their Students of Color and reported implementing more student-centered teaching practices.

Bianca

Bianca’s racially gendered experience in science did more than mitigate her access to science; a compilation of factors crossing multiple dominant logics stifled her success as both a science student and science teacher. Culturally, Bianca was not exposed to role models, professionals, or images of African American scientists. Structurally, she noticed only a handful of her Black female peers successfully study and graduate with a professional degree in science. Interpersonally, Bianca was not encouraged by teachers to study science or they did not take steps to make science meaningful or relevant for her. Bianca’s experience in science compounded race and gender, showing that truly “there is no such thing as a single-issue struggle
because we don’t lead single-issue lives” (Lorde, 1984, p. 183). Altogether, Bianca’s story reflects the way Black women—existing in the interstices of oppression—have positional identities that are ideologically, structurally, and interpersonally inferior in the sciences. Bianca drew strength from reading and reflecting on the writings of Black female scholars. Reading *Black Feminist Thought* provided her with language to reinterpret her personal history in the sciences and to exert agency through her role as a science teacher. Her revelation also reflected the way “marginality is also considered a potential source of strength not just tragedy” (Collins, 1998, p. 12).

**David**

By contrast, David realized that the role models, teachers, and student body in his science classes—being mostly White males—reflect the interpersonal, dominant logics that woven together nurtured his success in science. David’s decision to study and pursue careers in the sciences may be traced to small, significant instances: the brief words of affirmation from science teachers, seeing faces that looked like him in science classes, and jokes with college professors willing to look beyond his mediocre study habits. Here, David realized that what he considered commonplace in his life was actually situated in privilege, thus reinforcing the fact that “subjection and dominance operate, sometimes subtly” (May, 2015, p. 4). Unlike Bianca, David’s positional identity was characterized by layer upon layer of preferential treatment that resulted in privilege in terms of his intersectionality. These affirming and nurturing experiences sustained his pursuit of science, thus reinforcing the idea that intersectionality has the potential to describe both preferential and subjugated positioning of one’s experience due to the confluence of identity markers. Thus, “intersectional approaches underscore that everyone [differently] occupies intersectional locations” (p. 124).
Audrey

Privileged in some categories and stigmatized by others, Audrey’s gender, race, socioeconomic status, and sexuality worked together to influence her experiences teaching and learning science. Audrey’s intersectionality differed from that of both Bianca and David. Bianca’s positional identity gravely limited her access to science, while David’s intersectionality led to unattenuated privilege; Audrey, however, experienced varied degrees of success in science. At times, the interplay of her identity markers translated to a privileged positional identity in science. At other times, her categories of identity led to a positional identity that limited her success in science. As a child, Audrey’s female identity hampered her ability to openly express her love for the “gross” parts of science in order to be socially accepted, while her status as a White women helped her fit in while taking college science classes. Thus, Audrey’s science lived experience reinforced a fundamental tenet of intersectionality that “both marginalization and privilege play out simultaneously” (May, 2015, p. 22). As the socioeconomic status of those in her environment changed from high school to college to teaching, she also noticed that the degree of privilege in her positioning within the sciences also shifted. On more than one instance, Audrey’s success in science was determined by the relative privilege drawn from the intersections of her identity compared to her peers. Audrey earned science awards in a community of mostly working-class Latino students at her high school, but struggled to keep up in science classes when competing against highly affluent White classmates. Therefore, Audrey’s intersectionality revealed the “variability, fluidity, and contingency of specific manifestations of subordination” (Cho, 2013, p. 385).
Winnie

Similar to Audrey, Winnie began to see the multidimensional nature and overlapping ways her positional identity mediated her access to science, sometimes limiting her sense of belonging to science communities and other times establishing her differential privilege relative to her Black students. In college, Winnie’s racial identity and socioeconomic status interconnected in ways that made her feel excluded from her community of mostly White peers. However, as an Asian American science teacher, Winnie was positioned as the epitome of science to her Students of Color. The book club provided opportunities for Winnie to understand the ways her positional identity, as it related to her experiences in the sciences, changed based on the positional identities of those by which she was surrounded, thus helping her view herself “not only in terms of multiple identities, but also in terms of location and relational power” (May, 2015, p. 38).

In sum, as the science teachers interrogated their intersectionality, they discovered footprints of the intertwined, enmeshed, and often discriminatory workings of dominant logics in the sciences. On an interpersonal level, they uncovered the routinized ways their science teachers either encouraged or dissuaded their interests in science careers. On a disciplinary level, the teachers described how the competitive nature of science coursework and the traditional, didactic, *chalk-and-talk* style of teaching may occlude the success of students, especially Students of Color. Together, the teachers investigated how the system of education selectively elevates the positioning of some students, leading to more acceptance and success in the sciences. Collectively, their stories spoke to the ways in which power operates at the interstices of racial, gendered, socioeconomic, sexuality, and other forms of identity through the creation of ideas, images, and ideologies to maintain a structure of privilege and oppression in the sciences.
By rejecting single-axis viewpoints of their identity, the science teachers gained an analytical lens to better understand themselves and their science Students of Color.

**Reflecting on Their Black Female Students**

The book club provided a space for teachers to see inequitable structures of power constructed in their own experiences of learning science as well as in their science classrooms. To be specific, the teachers laid bare the places where Black women were treated like “da mules of the world,” historically, in their personal histories and in their day-to-day interactions with Black female science students (Collins, 2009, p. 74). Essentially, the teachers learned about how Black women experience interconnected forms of discrimination due to their racial and gendered positioning in the sciences. This revelation occurred when the teachers acknowledged the ways their Black female students acted and were treated differently than their Black male students. Additionally, the teachers admitted to calling on their Black female students less often than their Black male students and assigning their Black female students nonacademic, perfunctory roles. This is significant because it showed the ways the teachers took ownership of the biases and stereotypes they carried that impacted their decision making in the classroom. Their stories highlighted the “ever-present danger that teachers may reproduce negative racial, gender, and language stereotypes with students from marginalized groups” (Chinn, 2002, p. 321).

The teachers reported that the impetus for this realization was reading and reflecting on *Black Feminist Thought* (Collins, 2009). The writings of Black female scholars in the text pushed them to interrogate their personal history, positional identity, and intersectionality from a new perspective as well as gain a newfound appreciation and regard for the intellectual contributions of Black women that have historically been silenced and stifled. This reinforced a key tenet of intersectionality, which is acknowledging “its historical moorings in Black feminist theorizing”
(May, 2015, p. viii). The process of reading and reflection of *Black Feminist Thought* (Collins, 2009) gave teachers a chance to reconsider and reorganize their conceptions of the multidimensionality of their identities in an empowering way that surfaced biases and exposed inequitable hierarchies of power in the sciences. The beneficial nature of book clubs to peel away an understanding of one’s identity while exposing one’s prejudices supported Mensah’s (2009) findings that book clubs have the potential to garner “revelation, revealing assumptions and biases about issues of diversity and teaching science” (p. 1055). *Black Feminist Thought* (Collins, 2009) served as a window into the interactive ways racism and sexism played into these teachers’ approaches to teaching their Black female science students. This key finding showed that a book club-based professional development model has the potential to address a key barrier science teachers have to embracing culturally responsive and culturally relevant practice, which is unconscious or conscious belief in the negative biases about the innate, intellectual potential of Students of Color (Mensah, 2009a; Whipp, 2013; Yerrick & Beatty-Adler, 2011; Young, 2010). When the teachers developed consciousness of the ways discrimination played out in their own life and their students, they reporting viewing their Black female students with a heightened sense of care and concern (Freire, 2000; Kincheloe, 2005; Mensah, 2015). Thus, the teachers enacted transformative agency by shifting towards socially just teaching as they “craft[ed] collective models or change” in their science classrooms. Specifically, the teachers reported trying out student-centered ways to equalize the power shared between themselves and their students as well as the power distributed among their male and female students (May, 2015, p. 20). This finding mirrored that of Capobianco (2007) who found that the science teachers who shifted their pedagogical practices to become more student-centered had a deeper knowledge of
how their “privileged experiences as a student compared with that of [their] marginalized students” (p. 27).

**Implications and Conclusion**

The findings in this study built on the robust body of literature that underscored the beneficial use of book clubs as a methodological approach to foster the identity development of teachers (Mensah, 2009a). On a granular level, the findings in this study reinforced the usefulness of literacy practices such as prewrites and text-based reflections (Mensah, 2015) as well as the Identity Markers Activity (Mensah, 2013) in helping teachers critically analyze their identities, biases, and approaches to teaching Students of Color. Furthermore, this study adds to the existing knowledge of how to guide teachers’ introspection about issues of diversity and equity through its intentional approach taken to make intersectionality the cornerstone to both the data collection and analysis. Intersectionality inspired the structure of the book club in three specific ways: (a) the selection and sequencing of the texts teachers read; (b) the nature of the questions teachers were asked; and (c) the groups and subgroups teachers were divided in during book club sessions.

First, the texts in the study were ordered in a way to provide a roadmap to intersectionality. Together, these texts helped teachers take gradual steps into the matrix, or make sustainable and feasible progress in developing their knowledge of their own intersectionality over time by relating the scholarship they read to themselves. This study offers one tangible method for sequencing texts to prepare teachers to dissect and understand the multidimensionality and complex nature of intersectionality; however, future research in professional development should help clarify how to select activities and sequence texts that are responsive to the intersectionalities of teachers.
Second, the questions asked participants to reflect as a consistent attempt to help teachers look at issues of diversity via the multilayered viewpoint of dominant logics. In particular, book club reading questions were crafted to direct each teacher’s reflections to the hegemonic, disciplinary, administrative, and interpersonal levels. Similarly, Rivera Maulucci (2013) asserted that a socially just teacher must think on the “classroom (micro), school (meso), and community/society (macro) levels” about their practice (p. 454). This allowed the teachers to build a more comprehensive view of the ways discrimination operates in the sciences and to make meaningful connections between the ways their learning of science influenced their approaches to teaching science to their mostly Black students. More research is needed to clarify how knowledge of one’s intersectionality relates to one’s knowledge of dominant logics in education and the sciences.

Third, grouping and subgroupings were flexibly constructed to be responsive to the identities of the teachers. The book club mostly occurred via whole group meetings so that the members could learn from their peers who experienced life at differing interstices of both identity and power. This approach reflected Knight’s (2002) account of the beneficial use of “dialogue across difference of power in terms of privilege, oppression, and access in shaping pedagogical practices and building coalitions among teachers” (p. 220). Mensah (2009a) similarly noted the value of combining a diverse group when stating “within the groups, differences created an opportunity for the preservice teachers to look more deeply at their beliefs and values” (p. 1051). The whole group settings allowed teachers to juxtapose their experiences in science with those of their peers in order to develop a more comprehensive knowledge of the landscape of power and privilege in science that affect individuals in differing ways, depending on their unique crossing of identity.
Though beneficial at times, the whole group setting also minimized the contribution of Bianca, whose feelings of being an outsider in science meant that she often felt like an outsider to the group and went many weeks without vocally participating in the book club talks at the beginning. Consequently, during the latter half of the book club, I invited Bianca and Winnie, as the two Teachers of Color in the study, to take part in additional one-on-one semi-structured interviews as a way of honoring the beneficial nature of affinity groups to the development of women Teachers of Color. As a Black female researcher, I found that Bianca and Winnie were often more open in sharing their reflections with me outside of the larger group. This reaffirmed the literature that discussed the benefits of affinity spaces and the presence of African American teacher educators as helpful contributors to Teachers of Color openly sharing their reflections on their personal histories (Kholi, 2008; Mensah, 2016; Mensah & Jackson, 2012). Following these one-on-one sessions, Winnie and Bianca became even more confident in sharing their narrative and perspectives with the whole group. Thus, it will be important for science teacher educators to take intentional steps to reflect on the identity of their teachers in flexible and iterative ways.

Science teacher educators should constantly reflect on who is and is not talking when issues of diversity and equity arise in professional development dialogue.

The findings of this study were aimed at proposing the use of intersectionality as a useful anchor for teacher identity development and a way to conceptualize teachers’ critical consciousness. As shown in the preceding discussion, intersectionality filled in the gaps by providing guidance on what critically conscious teachers know and how to develop this knowledge. To recap, as the teachers engaged in the book club, they deepened their knowledge of dominant logics that operated to selectively advantage certain individuals for success in the sciences. What is more, the teachers were never coached on how to change their classroom to
align with social justice approaches. However, the teachers reported enacting more agency by shifting in their classroom towards more student-centered teaching practices. This reflects the intent and heart of critical consciousness work, which is aimed at helping teachers become “initiators who develop their own tools and strategies for motivating and supporting their disenfranchised students” (Brand, 2014, p. 75). With this in mind, the use of intersectionality to promote teacher identity development has the potential to address current challenges in helping teachers implement culturally relevant and culturally responsive practices. The findings in this study showed that as teacher explored their intersectionality, they began to recognize the power structures that either helped or mitigated their success in the sciences as well as the success of their students. This directly addressed the literature that mentioned how teachers trying to implement culturally responsive and culturally relevant teaching sometimes are resistant to redistributing power in their science classrooms (Adamson, Santau, & Lee, 2013; Blackwell, 2012; Lee, 2004). Future research into the study of intersectionality can take advantage of mixed-methods approaches to expand this work by building stronger bridges between intersectionality-based teacher identity development and culturally responsive and culturally relevant science teaching practices, and the educational outcomes of students, especially Students of Color.

Finally, the findings of this study showed how the teachers’ reflections on their personal narratives assisted them in understanding the intersections of their race, gender, sexuality, and other identity markers, thus moving towards “matrix” logics. Through the process of this introspection on their intersectionality, the teachers reported becoming more aware of the implicit power structures present in the sciences. In all, the findings corroborated Moore’s (2008b) warning that when “science teachers are not aware of how interlocking and intersecting
systems of power, privilege, and oppression work in their narratives, the likelihood that they will be able to inform and teach their students is not to be expected” (p. 701). In fact, when the teachers in this study realized racial and gendered discrimination from their personal experiences in the sciences, they reported replacing their didactic delivery to the content of their science lessons with more student-centered approaches, thus creating classroom “conditions under which teachers might be willing to share power” (Blackwell, 2012, p. 113). In all, the findings reflected the intention (and burden) of intersectionality as a socially just theoretical lens that pushes beyond the realm of informative to transformative agency.
Chapter VI

CONCLUSION AND IMPLICATIONS

One of the greatest challenges facing multicultural science teacher educators is developing ways to support science teachers with unpacking the biases and assumptions that prevent them from successfully leading Students of Color to academic achievement. As articulated in Chapter II, the aim of this study was to offer a science teacher professional development model that assists teachers with developing consciousness by recognizing biases and assumptions. This understanding is needed because there are gaps in the multicultural teacher education literature on how to assist teachers with: (a) gaining awareness of the prejudices and biases that negatively impact Students of Color in the sciences (Mensah, 2009a; Yerrick & Beatty-Adler, 2011; Young, 2010), and (b) acknowledging the racial, gendered, and other socially constructed hierarchies of inequity in the sciences that selectively position individuals with certain identity markers for success in the sciences (Capobianco, 2007; Mensah, 2013; Suriel & Atwater, 2012; Wallace & Brand, 2012; Whipp, 2013). The hope is that with this heightened awareness or critical consciousness, science teachers will be open to redistributing power in their classroom by taking up more equitable approaches to teaching science such as culturally responsive, culturally relevant, and reform based approaches (Adamson, Santau, & Lee, 2013; Blackwell, 2012; Lee, 2004).

To review, the participants in this study were four secondary science teachers who taught predominantly African American students in a public charter school in New York City. The research questions for this study were:

1. What are the racial experiences of the Teachers of Color while learning and teaching science?
2. In what ways do the words and writings of the Teachers of Color reflect their development of racial literacy during the book club?

3. How do science teachers discuss their intersectionality in the book club?

4. How do the teachers reflect on their approaches to teaching their Black female science students?

I argued that models of teacher identity development offer robust theories, methodologies, and methods for developing the critical consciousness and multicultural practices of science teachers. I utilized intersectionality, a Black feminist theoretical framework, to form the structure, content, and analysis of findings for a book club-based professional development model. I then presented findings as case studies to provide a detailed account how the science teachers developed knowledge of their own positional identity and that of their students, especially their Black female students. I concluded that the teachers developed racial literacy as well as an understanding of how racism, sexism, and other forms of oppression work together to produce inequitable opportunities for success in the sciences. This dissertation documented what science teachers learned about themselves as they investigated how their coming into and understanding of science were shaped by the intersections of their race, gender, and other facets of their positional identity. The participants’ reported acknowledgment of racially gendered stereotypes in the sciences and their sharing of racially gendered experiences suggested a deepening in their knowledge of “unequal hierarchies” in the sciences (Mensah, 2013, p. 323). My hope is that this account informs and inspires future research in science teacher professional development.
Summary of Chapters

The key findings chapters of this study can be summarized as follows. Chapter IV explored how Bianca and Winnie — the Women Teachers of Color in this study — developed heightened racial literacy during the book club. The Teachers of Color each analyzed the role racial stereotypes played in their coming into and understanding of science as well as their approaches to teaching science to their mostly Black students. Both teachers admitted that before the book club, they lacked knowledge of how biases and stereotypes operated in their personal histories. During the book club, they reported coming into the knowledge of how racial stereotypes influenced their interest in pursuing careers in science.

In Chapter V, I documented how the four science teachers in this study reflected on *Black Feminist Thought* (Collins, 2009) and related the theory of intersectionality to their personal histories, especially their experiences of learning and teaching science. The science teachers shared profound connections between the intersections of their identity markers, such as race, gender, and socioeconomic status, and how these intersections mediated their access to science. This newfound understanding deepened their knowledge of and empathy for their female science Students of Color and they reported enacting agency via shifting towards student-centered teaching.

In the next section, I discuss the major findings of this study. I consider questions that arose when looking at these chapters from a holistic standpoint. Finally, I discuss the implications of these major findings for the identity development of science teachers and for science teacher professional development.
Discussion of the Major Findings of the Study

Collectively, Chapters IV and V suggested that this identity-based professional development model engaged teachers in a process of critical consciousness building. First, these chapters revealed that the book club challenged science teachers to become aware their own implicit biases. Second, this intersectionality-based book club offers a concrete model for how to assist teachers with uncovering the way racism and sexism work in an intertwined manner to create inequitable hierarchies in the sciences. Altogether, these chapters documented the stories and reflections told by the participants as they uncovered the ways their categories of identity influenced their experience of coming into science and their approaches to teaching science. The following paragraphs will draw connections between the findings and the overall purpose of the identity-based professional development, which is critical consciousness building.

Recognizing Racial Stereotypes

First, the book club enabled the participants to recognize the ways racial stereotypes shape positional identities as related to the sciences. On one hand, Winnie reported that the Asian model minority stereotype positioned her for success in science through the affirmation she received from her peers, parents, and teachers. On the contrary, Bianca reported that—as an African American of Guyanese descent—her initial love of science never translated to an interest in college science majors. Due to the absence of encouragement from her science teachers and lack of exposure to affirming images of successful African American scientists, Bianca neither viewed herself as a scientist nor took steps to pursue science careers. These findings showed that racial stereotypes—enacted via images of scientists, relationships with teachers, and expectations of peers and family—led to differing levels of affirmation and access to careers in the sciences, thus showing the ways positional identities reflected inequitable racial hierarchies.
What is more, the findings in Chapter V showed the ways stereotypes, or “exaggerated belief[s] associated with a [racial] category” were not only race-based, but also racially gendered (Allport, 1979, p. 191). Specifically, Bianca recognized the ways in which racially gendered stereotypes played out in her teaching of science. She recalled being asked to take on the chemistry lab instructor role, although she had not majored in science in college. As a result, she felt like her role was to pick up the pieces—an experience she felt was the result of being both Black and a woman. In addition, the book club allowed the participants to reflect on the ways racially gendered stereotypes played out in their classrooms. The participants realized that their Black female students assumed more perfunctory roles in the science classroom and were called on less during classroom discourse. This helped them see the concrete ways in which they were either supporting or ignoring their Students of Color, especially their Black female science students. Consequently, the teachers reported taking steps to invest, encourage, and engage all of their Students of Color in learning science via more equitable teaching approaches. These findings showed the usefulness of intersectionality as a lens that helped science teachers develop empathy for their female science Students of Color by better understanding the overlapping ways race and gender worked against their success.

**Realizing Relative Positioning in Science**

Second, as the teachers juxtaposed their experiences with those of their Black female students, they were able to see the locations of their positional identities in terms of relative privilege and oppression. The science teachers also reflected on the ways categories worked together to form their own positional identities in science. Approaching identities from their interstices is another way of describing matrix logics or intersectionality. The Identity Markers Activity showed that the teachers reoriented their categories of identity in a way that reflected a
deepened understanding of the interplay of racial and gendered forms of discrimination. They acknowledged positional identity or how they were relatively placed in terms of their access to science, compared with both their Students of Color and female Students of Color. Once they confronted their own racial and gendered biases, they were able to articulate this relative positioning in terms of relative privilege in the sciences. This opened a window for them to reflect on where their approaches to science teaching did not line up with their vision of an equitable classroom. Though no classroom data were collected, all teachers named the desire to redistribute power in their classroom to become more student-centered.

The findings from this study also showed exploring intersectionality may move teachers of color towards empowerment and agency by fostering an inclusive professional development space. As a Black woman, Bianca’s first encounter with Black feminism and intersectionality was in this book club. When reflecting on what she took away from the readings, Bianca emphatically stated, “My story is part of Black feminism . . .” (Bianca, semi-structured interview, July 7). This reflected the literature that well documented the exclusion, denigration, and overlooking of women Teachers of Color in teacher preparation and professional development spaces. As the book club progressed, Bianca’s participation in book club discussions skyrocketed. During the beginning months, Bianca made no comments during book club discussions. At the end, Bianca openly shared her experiences with the other members and even began to identify herself as a Black feminist. Her feeling of belonging in the book club gave way to her understanding the contradictory and isolating experiences she had her entire life in science classes. With this new awareness, Bianca reported being open to finding ways to circumvent this experience for her Students of Color.
Role of Racial Literacy in Critical Consciousness Building

I would be remiss not to mention the importance of racial literacy in the critical consciousness building of the science teachers in this study. As these teachers gained racial literacy, or the ability “to read, discuss, and write about situations that involve race or racism” (Sealey-Ruiz, 2013, p. 386), they were better able to confront their own biases and better understand their positional identities. Winnie and Audrey came to realize how they often overlooked the differences between themselves and their students. Previously, Winnie and Audrey admitted to overemphasizing their nondominant characteristics and underemphasizing aspects of their race and gender that afforded them acceptance to and privilege in the sciences. For the first time, Bianca put into perspective of her experience studying science into a larger context. She noticed the ways People of Color are systematically excluded from the sciences. David characterized his positional identity in the sciences as being at “privilege street,” a revelation developed first out of his acknowledgment of the privilege his Whiteness and gender afforded him in the sciences (David, POTO reading reflection, March 6). Approaches to teacher identity development related to positional identity should not be viewed as contrary or separate from developing a teacher’s racial literacy. Indeed, the findings showed that racial literacy, or the ability to write and speak about issues related to racism, is imperative to a knowledge of the intersections of one’s identity. Each teacher’s breakthrough in understanding his or her intersectionality hinged on a realization of the relative privilege or disadvantage that his or her racial identity provided each of them in his or her science life history.

The findings from this study support the need to expand the definition of racial literacy to incorporate agency. Racial literacy is more than an internal process, it is also how teachers act differently in the world as a result of a new found capacity “to read, discuss, and write about
situations that involve race or racism” (Sealey-Ruiz, 2013, p. 386). In the study, the participants all mentioned ways in which they began acting differently as a result of their engagement in the study. After engaging in critical consciousness, the participants put their new understanding into practice. The participants have demonstrated the profound ways the book club affected and inspired them individually and collectively.

For example, during the book club, Winnie was inspired to move to China to reclaim knowledge of her culture, which led her to apply for a VISA, become certified to teach English As a Second Language (ESL), and successfully seek employment a science teacher in China. At the conclusion of the study, Winnie moved to China where she currently teaches elementary school science classes. Following the book club, Audrey applied and was accepted into a graduate program to earn a Master of Science degree in Sociology and Education with the ultimate goal of earning a Ph.D. to further explore her newfound passion for social justice in education. Bianca went on to write and lead an elective course to teach her students about social movements and the African diaspora. As a college readiness teacher, Bianca continues to challenge the content in the network wide curriculum to ensure it affirms the cultural background and assets of her Students of Color. At the conclusion of the study, David moved to teaching ninth grade Biology at a different network where he designed a case study based curriculum that is based on scientific inquiry and class colloquiums. Due to the success of his approaches, he was named the Director of Science the following year. Indeed, the ways the science teachers act on their critical consciousness in practice can call attention to the way racial literacy is as much about awareness as it is about the outgrowth of that awareness.
Agency and Science Teacher Identity Development

Agency is essential to establishing a path for teacher identity development that fosters more equitable teaching practices. Nurturing science teacher identity development was the intent of the book club so that the science teachers developed refined understandings of themselves as well as their role as teachers. As the teachers in this study analyzed their intersectionality they identified oppressive structures in the sciences and reported taking steps to dismantle these structures as they taught in the classroom. The teachers in this study developed nuanced understandings of their positional identity in science. At the same time, the teachers developed a clearer road map of how to use science teaching to transform the relative positioning of their Students of Color by redistributing power in the science classroom.

Taking this together, there is a fluid dimension of identity that is crucial to intersectionality. May (2015) agrees that the goal of intersectionality is to foster agency by way of “altering the possibilities for selfhood and action by transforming the contexts and structures in which we live” (p. 46-47). In other words, one’s identity is not entirely rigid; individuals are situated at permeating hierarchies of oppression, but also may develop agency to resist those structures through action. As shown in this study, science teacher identity development has the potential to aid in a teacher’s knowledge of themselves and to expand their commitment to and practice of socially just actions as teachers; thus widening the opportunities for the success of Students of Color. Developing science teacher agency via professional development is well theorized in the literature (Moore, 2008d; Rivera Maulucci, 2013; Rivera Maulucci et al., 2015). Inden (2000) describes one’s agency as having such a ripple effect: both impacting the agent of change and the recipient of the change. Inden contends, “people do not act only as agents” but they also “have capacity to act as ‘instruments’ of other agents, and to be ‘patients,’ to be
recipients of the acts of others” (p. 23). As science teachers develop knowledge of their intersectionality and move towards more equitable teaching, their praxis has the potential to positively impact both the success and positional identity of Students of Color. To this end, there is a need to expand the conception of identity presented in this study to incorporate the fluid nature of identity that exists in agency. Even closer connections should be made between theorizing about science teacher identity development, agency, intersectionality, and praxis.

**Intersectionality is For All Teachers**

All of the teachers in this study benefited from studying and considering what Black feminist theorizing meant for their identity, regardless of whether they were Black women. This is because Black Feminist theorizing is a useful analytic framework for understanding the way oppression operates. Rather than taking on a single axis formation such as a race-only or gender-only lens, intersectionality honors and acknowledges each individual’s unique positional identity. Just as Bianca’s story is not representative of the positional identity of all Black women in science, Winnie’s personal history is not a catch-all for the positional identity of all Asian American women in science. This same logic holds true for Audrey and David. Indeed, all science students and teachers have a positional identity that needs to be brought out and discussed (Mensah, 2012, 2016). Though each teacher has a unique positional identity, all teachers reside at the intersection of hierarchies that permeate racism. Interlocking structures of oppression must be analyzed and understood by teachers in order to create classroom spaces that honor the diverse perspectives of Students of Color. To this end, the Black Feminist theorizing frame has the potential to help all teachers eliminate injustice by “revealing how power works in diffuse and differentiated ways through the creation and deployment of overlapping identity categories” (Cho, Crenshaw & McCall, 2013, p. 797). As the researcher, I did not give the
teachers any recommendations for how to alter their teaching practices. Thus, intersectionality-based identity development inspired the teachers to confront structures of power in their classrooms. They reported being open to and beginning the process of distributing power in their classroom via more student-centered learning. In sum, From the viewpoint that awareness begets praxis, the purpose of teachers engaging with Black feminist theorizing is to provide a pathway from introspection to agency – from theory into practice.

Future research should expand this work to a larger group of participants in order to further explore the science life experiences of those who share the same identity markers as the individuals in this study as well as different categories of identity. At the same time, the stories presented in this study collectively point to the common, disadvantaged experiences of those whose positional identities are located at the interstices of oppression in the sciences, especially those of Women of Color. It is important that teacher educators heed May’s (2015) warning against slippage by staying close to the intent of Black Feminist theorists who developed this analytic lens to expose and eradicate the racially gendered inequity that persists in social institutions.

**Implications and Conclusion**

In the following section, I discuss more specifically how the findings above might be applied to research in teacher identity development and multicultural science teacher professional development. Also, I make concrete suggestions for future teacher educators who may want to implement my study in new settings. I conclude by suggesting areas for future research.
Relevance of Findings for Teacher Identity Development

This book club built on the literature focused on fostering the identity development of science teachers. In many ways, this existing body of literature affirmed and pointed to the way intersecting hierarchies of oppression influence science teaching and learning (Blackwell, 2012; Mensah, 2009a; Rivera Maulucci, 2013). Black Feminist Thought (Collins, 2009) provided a context for the science teachers to learn about the intellectual contributions of Black feminists as well as develop dexterity with using the language of intersectionality to analyze their personal narratives. Engaging with the theory of intersectionality via a book club equipped the teachers to both see and write about the interconnected ways race, gender, and other forms of identity played out in their personal histories. Intersectionality, as expressed in this study, was embedded in the weekly reading reflection questions, the text selection, and the focus on personal autobiographies. This point reinforced May’s (2015) suggestion that intersectionality must be “engaged at all levels of research, from initial conceptualization, through data/textual/archival collection and analysis, to drawing conclusions” (p. 145). In this way, this book club showed a useful approach for helping the teachers put together their “pieces of theory” in meaningful ways by providing them with ample opportunities to recognize, speak, and write in the language of identity theory (Mensah & George, 2007).

The findings and approaches taken in this study both confirmed current knowledge of how to develop the identities of science teachers and also embarked on new frontiers in identity-based research. In fact, the book club structure and findings showed the key role that collective discourse and collaboration played in developing a teacher’s knowledge of his or her own positional identity (Mensah, 2009a). In other words, it is highly unlikely that the participants would have reached the same conclusions about their intersectionality, their awareness of their
biases, and knowledge of structural inequities in the sciences if they had read the texts in silos. This study showed that dialogue in an identity-based book club was most beneficial when both affinity groups and groups across lines of difference can be leveraged (Knight, 2002; Mensah, 2016). The way this study expanded the current research is in the way strategies proven to be successful in preservice teacher preparation were translated to inservice professional development. Though not without limitations, this study presents a detailed sequence of texts and questions that may be asked to inservice science teachers to push their development of racial literacy and critical consciousness. Additionally, this study continues the dialogue on the theoretical frameworks that are most appropriate to guide science teacher identity development by adding to the current ways that categories of identity such as race and gender are theorized in science teacher education. This was accomplished by forming stronger ties between positionality and intersectionality.

Implications for Multicultural Science Teacher Professional Development

When discussing intersectionality-based studies, Cho et al. (2013) stated that “scholars interested in intersectionality strike out mainly in the margins of their discipline . . . ” (p. 793). The findings suggest the need for intersectionality to play a vital role in the academic discourse in science teacher education. Furthermore, this study reinforced the crucial role that science teacher identity development plays in preparing science teachers for multiculturalism. In many ways, science teacher identity development models suggest how to equip teachers to become fishers of (wo)men in their responsiveness. Rather than giving teachers ready-made toolboxes of relevant and responsive practices, the findings from this study communicated the effectiveness of investing in the ways teachers can deconstruct privilege and oppression in their personal narratives as a harbinger to responsiveness in their classrooms. This reflects the original intent of
responsive and relevant teaching, which Ladson-Billings (1995b) distinguished as “artistry, not a technical task that could be accomplished in a recipe-like fashion” (p. 163). Future studies taking this approach should utilize CRT and intersectionality together as theoretical frameworks to draw out structures of oppression for science teachers.

**Recommendations for Professional Developers**

As teacher educators, it is imperative that we offer an “audit trail” of how to design professional development that fosters teacher identity development (Borges, 2016, p. 208). What is more important is that we share recommendations of how to create safe and productive spaces where racism, sexism, and other thorny issues are highlighted and addressed (Alexakos et al., 2016). I offer three key recommendations for teacher educators who will engage in critical consciousness with teachers.

First, as mentioned previously in the literature, in order for identity-based research to be effective in practice, science teacher educators must be willing to engage in and share their takeaways from doing this same work with the teachers they lead (Mensah, 2009a). This will require science teacher educators to reflect on their own intersectionality and how their positional identity influences their coming into and understanding of science. Science teacher educators must be willing to share these reflections openly to craft trusting spaces where teachers feel comfortable engaging in dialogue about hierarchies of oppression. Second, as teacher educators develop knowledge of their own positional identity through an iterative process of study and reflection, they must also refine and unapologetically articulate their epistemology of social justice (Rivera Maulucci, 2012). This is a necessary for science teacher educators to determine the tenets that they will stand on when developing methodologies and engaging with teachers in critical consciousness building. Third, teacher educators must build a collective
playbook of facilitator moves that successfully support teachers in acknowledging biases and deconstructing oppressive systems.

To delve into this third recommendation further, I offer a few ways that I negotiated situations when participants were resistant to or plateaued in their understanding of hierarchies of oppression in the book club. To start, before the professional development begins, the science teacher educator should purposefully plan the readings and questions that participants will engage in during the study to set a solid foundation of core beliefs and that the group will honor as norms during the collaborative dialogue. The core beliefs should imbue the teacher educator’s epistemology as it relates to social justice and equity. The core beliefs of this study may be found in key definitions listed in Chapter 1. Even when a solid foundation is set, a teacher educator will need tools to iteratively respond to unplanned tensions that arise. When resistance or tension arose in the book club, I operated on the principle that planning a thoughtful response was always better than peremptorily reacting in the moment. When possible, the teacher educator should analyze the source of the tension and then plan a future experience that will help the teacher(s) see the contradiction in their beliefs or actions. To respond in this way, I recommend that teacher educators keep a journal to constantly write down key moments and points of discussion during book club sessions in order to have a space to record and brainstorm solutions to tensions that arise in professional development spaces. Examples of iterative changes can include changing the reflection question and critical text read in the upcoming week to reflect detours or tensions that arose in previous conversations.

Journaling also gives a teacher educator time to collect trends on what participants are learning to make key decisions on how to pace discussions in order to shore up learning. For example, I decided that the group needed an additional week to discuss the prewrite from week
6. I felt that participants needed additional time to rethink and re-write their stories about how they became teachers of mostly Black students after reflecting on the detours they took in their first attempt (Appendix E). When participants take detours in sharing their reflections, a teacher educator can put the group back on track by modeling open reflection. This could entail the teacher educator sharing a personal story that responds to the prompt and pulling out the critical ways the narrative directly addresses hierarchies of oppression. Sometimes the roadblock in guiding teachers to awareness is more about the group dynamics than the content being discussed. To this end, a teacher educator should constantly make decisions on the groupings that will best facilitate the most productive dialogue, choosing at times to break teachers into affinity groups and other times putting together groups that reflect differences.

Most importantly, when a tension arises or individuals shut down, the first thought that should come to a teacher educator’s mind is to ask, what did I do that created this tension or challenge? Tensions in professional development conversations are often the vehicle to engage in movement towards critical consciousness and cannot be avoided. This requires that the teacher educator take on a participant-facilitator role and to be ready to model, step back, apologize, and change course, as needed. Zooming out, the ultimate goal is to engage in critical consciousness building with teachers rather than establishing ourselves as the “correct” one in the development space. Teacher educators should emerge with newfound knowledge of themselves and their role as teacher educators as they lead teachers into critical consciousness. The process of science teacher identity development should simultaneously occur for the teacher educator as it occurs for teacher participants.
Limitations

There were several limitations to this study. First, the researcher did not observe or collect data on science teaching. To elaborate, no data were collected to document the classroom environments of the teachers before, during, and after the book club, and no data were collected on the academic achievement of their scholars. As a result, no conclusions can be drawn about the ways the book club impacted the teachers’ approaches to science teaching other than what the teachers reported or perceived. To this end, future research is needed to draw closer connections between identity-based science teacher development and positive changes in teacher pedagogy and the academic success of students.

Second, the participants may have shared their reflections and personal histories more openly in the book club and semi-structured interviews due to my prolonged engagement in the school and relationship with each participant, which spanned 1 to 5 years. On one hand, my prolonged engagement in the school was beneficial because it allowed the teachers in the study to be more trusting and open to learning. This safe space was created by my willingness to share personal accounts and stories about times when I felt I was oppressed due to racism or sexism and times when I participated in the oppression of others. My stories in many ways modeled the openness and candor of the teachers when they reflected on their own personal histories. On the other hand, if I were an outsider to the school staff, the participants may not have been as open to reflect on such thorny issues as racism and sexism in an open forum. Future attempts to cultivate an identity-based book club for science teachers would be more successful if the facilitator takes time to engage in the school setting and if the facilitator is willing to openly share his or her personal history related to racism and sexism in education.
Third, it cannot go without saying that I held a position of power in the school setting as the science department chair. On one hand, this was a benefit of the study. When I modeled approaches to equity and multiculturalism in my classroom, other members of the book club followed suit. However, I have to acknowledge that my relative positioning of power as the science department chair is also limitation. My positioning may have swayed participants to represent their experiences in a slightly more positive or negative light. However, it is important to note that the participants were by no means compensated for their participation in the study and that I had no say over their performance assessment or teaching salary.

Fourth, during data collection, I relied on the participants’ memory of their life histories. This is a limitation because when relying on participant perceptions, the literature has shown that sometimes adults may remember the past more positively or negatively than originally experienced or reported (Kennedy, Mather, & Carstensen, 2004).

Lastly, one key premise of my study was to cultivate an affirming experience for the Teachers of Color and Women of Color participants. With no science background and no classroom experience, Bianca was not properly set up to be successful as the chemistry lab instructor or an equal partner in the book club. Therefore, when she was welcomed into the book club, her lack of experiences in the sciences shaped her feeling of belonging and positioning relative to her peers in a negative manner. Consequently, it is not a surprise that many weeks in the book club passed before Bianca felt comfortable sharing her personal experiences with the group. Future research in identity-based professional development should consider the relative positioning of the participants and their experiences that may set up positions of relative power and privilege in the professional development space. Science teacher educators must make
intentional moves to circumvent these power structures and create an equitable environment via the questions asked, activities engaged with, and texts selected.

**Future Research**

The pervasive underrepresentation of Women of Color in the sciences beckons the need for more effective multicultural teacher development models. Future research should consider how intersectionality relates to and can enhance other frameworks for multicultural teacher development. In addition, future studies should continue to parse out how positionality and intersectionality may be used together to garner science teacher identity development while understanding that these theories originate from two different fields of study. Given that all teachers in this study reported making attempts at more equitable approaches to teaching science, this study showed the potential power of intersectionality as a framework to aid teachers in enacting agency in urban science classrooms. Future research should use a mixed-methods, longitudinal approach to iteratively development science teacher identity and their responsive, relevant, and reform-based teaching practices with the ultimate goal of positively impacting the achievement of Students of Color. Studies of this nature would create additional opportunities to document and describe the impact of science teacher identity development in praxis. As well, this approach creates the potential for more fluidity between multicultural approaches in science education and science teaching and learning at large.

Future research should also consider an intersectional lens when developing approaches to multicultural science education. Indeed, only a handful of studies have examined the ways racism, sexism, and other forms of oppression conspire to limit the achievement of Students of Color in science classrooms (Carlone, Johnson, & Scott, 2015; Chinn, 2002; Parsons, 1997; Tan & Barton, 2008; Tan et al., 2013). On the contrary, most multicultural studies in science
education have taken on dualistic norms by focusing only on Students of Color or female science students. Future studies are needed to expand the literature on the ways intersections of race and gender influence experiences in the sciences. Additionally, more research is needed on the primary, secondary, and collegial levels to further tease out the ways to improve the science achievement of Students of Color via exposing interlocked, oppressive structures as a means to engender teacher and student agency.

Altogether, the findings from this study showed the potential that intersectionality and identity-based professional development have to aid in the critical consciousness building of science teachers. In particular, intersectionality as a theoretical framework unlocks the potential for science teachers to see, personally identify with, and begin to work against the racially gendered hierarchies of privilege at play in the sciences, enacted by stereotypes and realized in positional identities. What is more, this work beckons us as science teacher educators to create spaces where professional development honors the experiences and intellectual potential of those positioned at intersections of oppression, including Black feminist theorists, Women Teachers of Color, and Women Students of Color. Identity-based research may be the flywheel to further developing science teachers to make progress towards relevant, responsive, and reform-based teaching practices by providing methods of critical consciousness building. This will require us to take up identity-based frameworks such as intersectionality and positionality throughout all strands of research in science teacher education.
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### Appendix A: Overall Research Design

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<tr>
<th>Research Questions</th>
<th>Qualitative</th>
<th>Data Analysis</th>
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<td>RQ2: In what ways do the words and writings of the Teachers of Color reflect their</td>
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<td>development of racial literacy during the book club?</td>
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<td>RQ4: How do the teachers reflect on their approaches to teaching their Black</td>
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<td>Open coding of emergent themes</td>
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<td>female science students?</td>
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Appendix B: Reading Reflection Protocol

Reading Reflection #1: Pedagogy of the Oppressed (POTO)
Pre-work [2 hours]
1. Write at least two journal entries where you share your emotions related to the book club and any vivid ideas, thoughts, and memories that have emerged from our book club thus far. Bring your journal to the Friday book club.
2. Read and annotate "Achieving School Failure" (McDermott, 1997).
3. Read Pedagogy of the Oppressed Chapter 1.
4. Use both readings above to answer the questions below in a word document.
5. What quotes or arguments stand out to you when you read these works? Explain why.
6. How do these papers relate to the way you identified yourself in the "IDENTITY" post-it activity from our first session together?
7. How do these papers relate to your experience learning science?
8. How do this paper relate to your experience learning to teach science?
9. How does this paper relate to your experience teaching science?
10. What does your reflection reveal about the intersections of your identity?
11. How has your experience with “science” been shaped by the intersections of your identity?
12. Where have your consciously or consciously played the role of “oppressor” or “oppressed” with regards to learning and/or teaching science?
13. How have these readings reshaped your perspective and insights into the systems in education?
14. What would you revise about your story of self from these readings?

Reading Reflection #2: POTO C2
1. Write at least one journal entry.
2. Read the Ahmed “Diversity” text uploaded to the "Resources" page of our site.
3. Go back to your responses from last week and elaborate on them in a different colored text based on our discussions and the diversity text. Upload the changes in a new document and upload in the space below.

Reading Reflection #3: Black Feminist Thought (BFT) Preface (Collins, 2009)
1. (Personal Reactions) What were your personal reactions to this first section?
2. (Language) When you hear the words “diversity and inclusiveness,” what do you think of?
3. (Personal Reflection )What value will studying Black feminist theorizing add to our quest to know ourselves?
4. (Language) What language did Collins use to describe diversity? How does her depiction coincide with your conceptions of diversity?

Reading Reflection #4: BFT Chapter 1(C1)
1. (Personal Reactions) What were your personal reactions to this first section?
2. (Language) When you hear the words “diversity and inclusiveness,” what do you think of?
3. (Personal Reflection )What value will studying Black feminist theorizing add to our quest to know ourselves?
4. (Language) What language did Collins use to describe diversity? How does her depiction coincide with your conceptions of diversity?

Reading Reflection #5: BFT C2

PART I: Book club Reflection: Think and look back the book club post you submitted during last weeks’ science department meeting about what led you to teach science to Black kids.
1. Where are you not explicitly mentioning your privilege in making this choice?
2. Where are you not being completely truthful about your motivations and choice?
3. In what ways have you taken detours when telling this story?

PART II: Collins, Chapter 2
4. What characteristics of oppression emerged from reading about oppression?
5. In what ways would it be important to study Black feminist theorizing as a science teacher?
6. What place does Black feminist theorizing have in science education?
7. What did you learn about yourself as a (science) teacher from reading and participating in this discussion? What did you learn from your group members?

Reading Reflection #6: BFT C3

1. What comparisons and contrasts does Collins draw between an “American” upbringing and an “African American” upbringing?
2. (Intersectionality) Collins says “In prior eras, African American women’s relegation to agricultural and domestic work more uniformly structured Black women’s oppression as “mules uh de world’” (2009, p. 74). How can you apply these chapters to the experience of your Black female students? How is there experience learning science influenced by their intersections of their gender, class, and race? How do you see this playing out in your science class.
3. (Intersectionality) What new perspectives do you have on the different methods needed to teach female Students of Color differently than male Students of Color?
4. (Systems of Oppression) What systems or structures at your school create spaces where Black female students or female Students of Color become “mules uh de world”(Collins, 2009, p. 74)?
5. (Personal Connection) How has your science trajectory been different or similar to the experiences of Black women in these chapters or in your classroom? How does this reflect the ways in which the intersections of your identity (race, gender, class, sexual orientation, etc.) influenced your science education trajectory and success in science?
6. (Group Personal Reflections) What did you learned so far about yourself as a (science) teacher from reading and participating in this discussion? What did you learn from your group members?

Reading Reflection #7: BFT C4

1. (Personal Reactions) What were your personal reactions to this first section? Be specific and provide a balanced response that includes feelings and emotions along with rigorous thought. What specific quotes from the text challenged you?
2. (Systems of Oppression) In what ways does the text describe Black woman stereotyped as mommies, matriarchs, welfare recipients, and hot mammas? What connections can you make between these stereotypes, the structures that created them, and the current representation of Black women in STEM professions?

3. (Structural Oppression) “African-American women’s status as outsiders becomes the point from which other groups define their normality.[…] As the “Others” of society who can never really belong, strangers threaten the moral and social order. But they are simultaneously essential for its survival because those individuals who stand at the margins of society clarify its boundaries. African-American women, by not belonging, emphasize the significance of belonging” (p. 77). This chapter discussed the contradiction of belonging and not belonging and of outsider and insider. Where do you see this contradiction living in our school? For which students is this contradiction most obvious? Who are the insiders and outsiders in your science classroom, in STEM, and in our school environment? In what ways is this delineation made across intersection lines of oppression such as race, gender, class, disability, and sexuality?

4. In what ways do you see Black female students stereotyped and therefore not belonging in the academic environment of your science classroom?

5. Personal Connection) What connections can you make between the message(s) of the book, your current/past teaching experiences? Has your trajectory through science ever felt “controlled” our out of your control?

6. (Group Personal Reflections) What did you learn most recently about yourself as a (science) teacher from reading? What did you learn from your group members last week?

Reading Reflection #8: BFT C5

1. (Personal Reactions) This chapter is all about “THE POWER OF SELF DEFINITION.” How does Collins define and discuss what it means to engage in self-definition? How have you engaged in the power of self-definition throughout this book club? Go back into the reflections that you submitted and find key quotes of ways that you have engaged in self-definition.

2. (Intersectionality) Collins (20009) asserts “ (Black women’s lives are a series of negotiations that aim to reconcile the contradictions separating our own internally defined images of self as African-American women with our objectification as the Other” (p. 110). In what ways can you relate to “othering” at the intersections of your identity? How has this influenced your science educational trajectory?

3. (Systems of Oppression) What school systems and structures create experiences where your students feel “othered” in science? How do you reinforce these systems? In what ways have you actively worked to dismantle these systems? Please give yourself time to provide a robust response here.

4. (Systems of Oppression) In what ways does your science planning and classroom culture create an “othering” experience for your science students? How do you reinforce these systems? How could you better navigate the systems and structures at our school to use them productively to resist the othering of your students? In what ways have you actively worked to dismantle these systems?

5. (Group Personal Reflections) So far in this study, … What did you learn about yourself as a (science) teacher from reading and participating in this discussion? What did you learn from
your group members? Please don’t feel that this is a repetitive question. Answer it again knowing that each week we are together and engage in the work we take away something new.

Reading Reflection #9: BFT C9
1. Read Collins Chapter 9 (9 total pages): introduction (pages 216-219); struggles for institutional transformation (232-234) and Black women’s activism revisited (238-241) and submit your answers to the following questions to the Google site. I shortened the readings of this chapter to minimize your prework.
2. What quotes from chapter 9 most challenged you? Why?
3. What is your role in Black feminist activism?
4. In your opinion, what does it mean to be a social justice science teacher? How has your thinking on this evolved over the course of the book club?
5. How can you influence and engender institutional transformation as a science teacher?
6. Read your individualized text and submit your answers to the following questions to the Google site.
7. In what ways is your intersectionality the same or different as the participants explored in this text?
8. In what ways do you relate or not relate to the participants discussed in the article?
9. In what ways does this text challenge or reinforce your thinking about your science lived experiences?
10. Submit your reflection to Chapter 9 and the individualized text to the Google site under Collins Chapter 9.
Appendix C: Science Story of Self Protocol

Science Story of Self (SSOS) #1:
Describe your science educational trajectory. This includes: 1) your path through the STEM pipeline; 2) your science teaching preparation, and 3) your past and current experiences teaching science.

Pathway Through the STEM Pipeline
1. The setting of your primary, secondary, collegial, and post collegial schooling
2. the primary ways you learned science
3. Any standout experiences you had learning science
4. Your success and failures learning science
5. When you did and did not see yourself as a scientist
6. The identities of your classmates and teachers

Science Teaching Preparation
7. The setting of your schooling
8. the primary ways you learned to teach science
9. Any standout experiences you had learning to teach science
10. Your success and failures learning to teach science
11. When you did and did not see yourself as a potential successful science teacher
12. The identities of your classmates and teachers

Past and Current Experiences Teaching Science
13. The setting of your current and past schooling
14. the primary ways you teach science
15. Any standout experiences you had teaching science
16. Your success and failures teaching science
17. When you did and did not see yourself as a successful science teacher
18. The identities of your students and colleagues

SSOS #2 & #3:
Revise your science story of self. Your science story of self includes: 1) your path through the STEM pipeline; 2) your science teaching preparation, and 3) your past and current experiences teaching science.

Bias is defined as any action that hinders personal or corporate steps towards…
- Acknowledging multiple, intersecting hierarchies of oppression
- Acting against multiple intersecting hierarchies of oppression

Be sure to address the following questions:
1. What have you uncovered about your science educational trajectory from reading and discussing Black Feminist Thought (Collins, 2009)?
2. What have you uncovered about your science educational trajectory from supplementary texts you are reading or have read in the past?
3. What stories or a-hah moments emerged from your journal writing and discussions with colleagues outside the book club?
4. How have your conceptions of your science educational trajectory changed since your submitted your last draft?
5. What have you learned about science as an academic discipline since you submitted your last draft?
6. In what ways has your science educational trajectory been unique as a result of your background and identity?
7. What have you uncovered about you plan science lessons, build classroom culture, and teach science?

**Partner Critique:**
1. Download your partner's Collins Chapter 1 and 2 reflection.
2. Annotate your partner's Collins 1 and 2 reflections for....
   - You explored your intersectionality by...
   - In your lived experience you may have reenacted/resisted oppression when...
   - You may want to explore more about...
   - I can empathize with your ideas here/ your experience because....
3. Share your annotations with your partner as he/she jots down notes.
Appendix D: Semi-structured Interview Protocol

Protocol #1 First Interview with Bianca
1. I wanted to start by asking you about the pre-post write… it says in what ways did Ahmed diversity text help you unpack your mindsets, decision making, or instances where you use diversity in its cuddly form instead of what this word/concept represents? What feelings emerge from you from reading the Ahmed text?
2. So what else from the reading resonated with you?
3. How do you feel specifically that the paper relates to your lived experiences and education?
4. What about your lived experiences in studying science or preparing to be a science teacher?
5. What about your experience teaching science?
6. So are you saying that it’s not enough just to be a Woman of Color teaching science, that that’s not enough for students? Why exactly?
7. Where would you have inserted yourself in the conversation that happened this week?
8. If you can think back to yourself in week four, or between weeks three and week five, what became evident to you? What were your breakthroughs at this point in participating in the book club? Where were you before reading this article, and where you after that?
9. What have you gleaned from Winnie and Audrey’s stories? How has that impacted your growth?
10. During week 5 and 6, what had moved from unconscious to conscious? What about that reading from this week resonated with you?
11. So talking about silence, I think we said you were definitely there week five but didn’t necessarily contribute, so what do you think contributed to your silence?
12. What about your comfortability with the group being a new science teacher? Do you think that that played into it at all?
13. What impact did reading the Collins text have on your teaching of science?
14. Where are you right now with trying on Black feminist theorizing as a lens?

Protocol #2 Second Interview with Bianca
1. How did the quote mentioned in the prewrite related to ossified outcomes resonate with you?
2. What were your main takeaways from reading Collins Chapter 4? What really stood out to you? Would you then include quotes or specific references if you like?
3. Can you say a little bit more about what it means for the Black woman’s identity to be fashioned around the white woman? Can you say a little bit more about that?
4. How did you find the chapter either fit in or didn’t it fit in with your lived experiences growing up in schooling maybe in schooling in science classes or even in your general lived experiences?
5. Just for the record, can you restate what you meant by the experience you had with the student?
6. How do you think the chapter relates to studying science before you became a teacher?
7. How did that experience impact your taking on the chemistry class when you started teaching it in January?
8. You said in college that you revamped some of your thinking or you revamped some of yourself, what did that mean? Can you tell me a little bit more about that?
9. So let’s move to the conversation during the week of May 29. Where specifically would you insert yourself in this conversation?
10. What else?
11. How did reading the Mutegi (2011) article impact your thinking and your practice as a teacher?
12. Why did you find that fascinating?
13. So how did reading this article and even where you were this week, how did those new understandings impact your practice in the classroom?
14. How were you at this point and the book club, had you in any way conceptualized the parts of your identity? Had you in any way reoriented yourself or your view of yourself?
15. Do you think of it as first second third fourth? When you think about the categories of your identity, how do you think about them now versus the beginning? Do you think of them as a hierarchy?
16. What were your takeaways from the pre-post write during May 8?
17. Why did that stand out to you?
18. How does it play out in your science classroom?
19. Can you be a little more specific? What was said and what would you have added to what was said on May 29?
20. What do you mean like placing a Brown/Black face, you’re saying like a superficial fix?
21. At the time you finished reading chapter 2 and you were sort of like revising or reflecting on your story of self, were you at that place yet where you had taken on the web of Black feminist theorizing?
22. Where do you feel like that transition happened where you were able to see yourself in this way of seeing the world?
23. How would you say your facilitation of science teaching was at the end of chapter 2 versus say at the end of chapter 4?
24. What facilitated that change, that shifting that happened where you went from the theory to the we like internalizing or accepting or taking on Black feminist theorizing?
25. Anything else you want to add about the week of May 8 or the week of May 29 before we close.

**Protocol #3 First Interview with Winnie**

**Intersectionality and Structural Constraints**
1. In what ways has your experience learning science been influenced by like the major intersections of your identity?
2. What do you consider to be the main intersections of your identity?
3. How do you think that the intersections of your identity affected your ability to teach science?
4. How do you think your intersectionality has influenced your experience teaching physics here at Borough High School?
5. How has your identity impacted your experience teaching science here?
6. How has your gender identity impacted your experience teaching science?
7. How has the intersections being immigrant, Chinese and woman effected your development um in terms of being a better or developing your practice as a science teacher. how has your identity influenced your development?
8. Anything related to teaching science and how you’ve reenacted systems of oppression as it comes to teaching science?
Agent of Change
9. What about resisting structures of oppression, in what ways do you feel like you've resisted structures of oppression while teaching science?
10. Anything else around resisting or reenacting structures of oppression?

Black Feminism
11. What theories from *Black Feminist Thought* (Collins, 2009) have really influenced your conceptions and also maybe really specifically, your conceptions of science teaching and learning?

Protocol #4 Semi-Structured Interview

Changes in Conceptions of Discrimination and Racism - 20 min
1. How was the book club similar or different from D and I (diversity) sessions? How was the book club similar or different than you expected it to be?
2. What salient connections did you make between critical race theories and your science lived experiences? How did you make these connections?
3. How would you describe your lived science experience from the lens of intersectionality?
4. How has your language for describing the word diversity changed since participating in the book club?

Transformational Aspects of the Book Club - 20 min
5. What did you learn from your group members?
6. What aspects of the book club facilitated your learning and changes in your actions [readings, writing, book club discussions, and informal discussions with colleagues, hearing teammates’ stories, putting into action in your classroom]? Where do you see evidence for this in your writings throughout the book club?
7. What about the environment of the book club facilitated your learning about yourself?

Changes in Classroom Practice - 20 min
8. What exactly will be different about your science teaching practice and your classroom next year? What aspects do you hope to incorporate into your science classroom? How do you plan to embed critical consciousness into the science content teach next year?
9. How has participation impacted your work with science students? Your intersection with peers? Your career and professional development choices related to science education? Your educational/ professional trajectory? What concrete evidence do you have for this? What heart work, intellectual uptake, and social justice based actions did you participate in as a result of partaking in the book club?
10. How would you narrate your journey through the book club- in a way to balances emotions, intellectual awakening, and changes in your practices and actions? What happened (what breakthroughs did you have) first, then second, then third…?
Appendix E: Prewrite Protocol

Prewrite #1: Unconscious and Conscious
1. Jot down your thoughts about this quote in the comments below:
   • “Consciously, we teach what we know; unconsciously we teach who we are” (Hamachek, 1999, p. 209).

Prewrite #2: Social Justice Science Educator
1. How do you characterize a social justice science educator?
   FURIOUSLY WRITE IN THE COMMENTS BELOW: Do not worry about your thoughts making sense…. You will share the team what you feel comfortable sharing and your writing will not be shared directly.

Prewrite #3: The D Word
1. Ahmed (2009) referred to the word diversity as a cute and cuddly word that obscures issues. How does her description of this word resonate with you?

Prewrite #4: The D Word Take 2
1. In what ways did the Ahmed "Diversity" text help you unpack your mindsets, decision making, or instances where you use "diversity" in its cuddly form instead what this word/concept represents? Be specific. What feelings emerged when you read this text?

Prewrite #5: Reexamining Our Unconscious
1. During our first session, we reflected on this quote, “Consciously, we teach what we know; unconsciously we teach who we are” (Hamachek, 1999, p. 209).
2. Since the start of our book club, what for you has moved from "unconscious" to "conscious"?

Prewrite #6: Black Feminist Thought (Collins, 2009) and Detours
1. What is your story that led you to teach science to all (mostly) Black kids?
Prewrite #7: Our Evolving Story

One way to define a detour is any action that hinders personal or corporate steps towards…

- Acknowledging multiple, intersecting hierarchies of oppression
- Acting against multiple intersecting hierarchies of oppression

1. Last week we wrote a brief summary of how we came to teach Black kids. Looking back, how has your telling of this story evolved or changed? What detours did you take or blind spots do you see now in how you initially told this story? How has your conception of how you came to teach Black kids changed from last week to this week?
2. In what ways has participation in this book club change your conceptions of your science lived experience (studying science, learning to teach science, teaching science)? In what ways has the book club unveiled detours you have taken in your lived science experience or in telling the story of your lived science experience to others?

Prewrite #8: Rewriting Our Story

From Collins, Chapter 2, p. 43

- "I believe that the truth about any subject only comes when all sides of the story are put together, and all their different meanings make one new one. Each writer writes the missing parts of the other writer's story. And the whole story is what I'm after" -Alice Walker (1983; pp. 49).

1. In what ways has participation in this book club change your conceptions of your science lived experience (studying science, learning to teach science, teaching science)? In what ways has the book club unveiled detours you have taken in your lived science experience or in telling the whole story of your lived science experience to others?

Prewrite #9: Putting In Action

1. In what ways do you see the key themes of this passage play out in your science classroom? What advice does the author give about how to teach for justice?
2. How could the "new world order" act as a parallel or analogy for our movement towards inquiry (5E) based instruction?
3. In what ways is "5E-inquiry based instruction" aligned or not aligned to teaching for justice?

Prewrite #10: Making that Change

In various parts of Black Feminist Thought, Collins (2009) mentions how Black feminist theories and innovation are synonymous:

- "this is the production of oppositional knowledge" (Chapter 1, p. 18)
- "dialogues associated with ethical, principled coalition building creative possibilities for new versions of truth" (Chapter 2, p. 42)
- "can also be empowering and creative..." (Chapter 3, p. 54)
Last week we challenged ourselves to put into action and to create something new in our class based on the theories we discussed thus far.

1. What change did you make and why did you make it?
2. How did students respond to the change?
3. What impact did this have on your culture and instruction? What impact did this have on your students and you?

**Prewrite #11: Ossified Outcomes**

1. When describing intersectionality, Catherine MacKinnon (2013) states:
2. that identities are, of course, “authentic instruments of inequality. And they are static and hard to move (1023). But, addressing the sometimes mystifying relationships between structures and identities, MacKinnon further observes that identities and stereotypes “are the ossified outcomes of the dynamic intersection of multiple hierarchies, not the dynamic that creates them. They are there, but they are not the reason they are there (p. 1023).
3. In what ways does this quote connect to the key themes in Collins Chapter 4?

**Prewrite #12: Demolition and Reconstruction**

1. Think about one quote from Collins chapter 3 through 5 or Mutegi (2011) that has significantly shaped how you conceptualize your science story of self. Insert the quote and describe the way that this quote or passage has pushed your self-definition.

**Prewrite #13: Revising Our Story**

1. Think about Collins Chapters 3, 4 and 5 and use your past reflections and the text to fill in the following chart.

<table>
<thead>
<tr>
<th>Jot down 3 quotes from Collins Chapters 3, 4, or 5 that pushed you that you plan to incorporate into your revised science story of self.</th>
<th>In what way did this quote challenge your thinking? In what ways did this quote support your re-imagining of your science story of self.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
<tr>
<td>Additional quotes (optional)</td>
<td></td>
</tr>
<tr>
<td>Additional quotes (optional)</td>
<td></td>
</tr>
<tr>
<td>Additional quotes (optional)</td>
<td></td>
</tr>
</tbody>
</table>

**Prewrite #14: Moving Unconscious to Conscious**
We started this semester by looking at the following quote, “Consciously, we teach what we know; unconsciously we teach who we are” (Hamachek, 1999, p. 209).

1. What has moved from “unconscious to conscious” for you in terms of your intersectionality and your science lived experiences?

**Prewrite #15: Checking Pre-write**

1. Write the ten most important categories of your identity down in 30 seconds or lesson-brain dump.
2. Ask the researcher for your list from earlier in the semester.
3. How did the categories of your identity change from the start of the book club until now? What have you learned about how these categories work together to shape you experience learning and teaching science?

**Member Checking Activity: Naming and Silencing**

This text is drawn from a 2015 publication in science teacher education

1. What is the meaning of the text?
2. What particular identity markers do you now realize are silenced in "science"? What impact did and does this have on your previous teaching of science?
3. What aspects of your identity did you silence before participating in this book club? What aspects of your students' identities did you silence?

**Postwrite #16: Intersectionality and Activism**

We have previously discussed how your intersectionality may be a source of your oppressing others or imposing oppression on yourself. Now, looking back into your intersectionality from different lens:

how can **YOUR INTERSECTIONALITY** be a source of strength to resist oppression in science education?

How will you effectively utilize **YOUR UNIQUE INTERSECTING FORMS OF IDENTITY** to create a counterstory in science education for yourself and your current and future Students of Color?
Appendix F: Chapter IV Data Analysis Procedure

First Data Analysis:
Modified from
I. Data Collection Prepared
Data Sources:
Analytical Activities: Initial Open Coding (11/02/15-02/01/16)
  • Read transcripts line-by-line and made codes in margins

Results
Research Questions:
1. How do WTOC [Women Teachers of Color] make sense of their science lived experience based on black feminist theories?
2. In what ways was the book club beneficial in helping the WTOC think critically about science teaching in urban classrooms?

First List of Open Codes

<table>
<thead>
<tr>
<th>Winnie</th>
<th>Bianca</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Asian boys put above girls</td>
<td>• Carrying a veil of ignorance</td>
<td>• Defined by oppressed identity</td>
</tr>
<tr>
<td>• Asian female as weak</td>
<td>• Black women’s cultural eye</td>
<td>• Silent</td>
</tr>
<tr>
<td>• Not sure if really loves science or conditioned to love science</td>
<td>• Chose to be a teacher out of a calling</td>
<td>• Self-definition</td>
</tr>
<tr>
<td>• Realized different than Black female students</td>
<td>• Concerned about how perceived</td>
<td>• Embracing racial and gendered identity</td>
</tr>
<tr>
<td>• Seeing Asian identity as only oppressed</td>
<td>• Storytelling</td>
<td>• Empowered</td>
</tr>
<tr>
<td>• Stereotyped as scientist as Asian</td>
<td>• Feeling fearful</td>
<td>• Feeling angry about ignorance</td>
</tr>
<tr>
<td>• Being the only one</td>
<td>• Feeling disempowered teaching science</td>
<td>• Outsider in science world Transnational identity</td>
</tr>
<tr>
<td>• Feeling discomfort in two worlds</td>
<td>• Feeling inadequate teaching students of own ethnic background</td>
<td>• Unknowingly oppressing students through ignorance</td>
</tr>
<tr>
<td>• Still not seeing Asian as a privilege</td>
<td>• Feeling like feminism does not resonate with me</td>
<td>• Unknowingly participating as victim</td>
</tr>
<tr>
<td></td>
<td>• Empty vessel to be filled</td>
<td>• Forming affinity group as support</td>
</tr>
<tr>
<td></td>
<td>• Feeling resigned</td>
<td>• Seeing affinity groups as empowering</td>
</tr>
<tr>
<td></td>
<td>• Feeling like an outsider in urban classroom</td>
<td>• Using affinity groups to empower others</td>
</tr>
<tr>
<td></td>
<td>• Feeling kindred experiences with students</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Guilty- should know more about Black feminism</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Hiding Black intellectual property</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Kept an outside to make</td>
<td></td>
</tr>
</tbody>
</table>
Central Phenomenon: Awakening/Unsilencing

Themes

<table>
<thead>
<tr>
<th>Winnie</th>
<th>Bianca</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Boxed in/ stereotyped/ limited by others</td>
<td>• Affirming Students</td>
<td>• Silence to Speaking Out</td>
</tr>
</tbody>
</table>

- Strengthened
- Seeing Your Science Stereotype

*********************** Prolonged Break to (Re)Analyze Data *************************

Second Data Analysis:

**Analytical Activities:** Secondary Open Coding (11/07/16-11/29/16)

- Refined Research Questions:
  1. What are the racial experiences of the Teachers of Color while learning and teaching science?
  2. In what ways do the words and writings of the Teachers of Color during the book club reflect their development of racial literacy?

- Categorized fragments

<table>
<thead>
<tr>
<th>How the WOC reflected on the effectiveness of the book club structure</th>
<th>Bianca’s personal history related to the sciences</th>
</tr>
</thead>
<tbody>
<tr>
<td>How the WOC reflected on discrimination in their personal histories and in the lives of their students</td>
<td>Winnie’s personal history related to the sciences</td>
</tr>
</tbody>
</table>

- Read transcripts line-by-line and made codes in margins
- Selective Coding: Condensed axial codes by sorting them into more general categories.
  - Highlighted words from the each quote that best captured the essence of the quotations. These words became the in vivo codes.
Results

In Vivo Codes

<table>
<thead>
<tr>
<th>Winnie</th>
<th>Bianca</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Acknowledging of Privilege in Science/grappling</td>
<td>• I never saw myself in this science world</td>
</tr>
<tr>
<td>• Seeking Lost Identity</td>
<td>• Excluded from the science world</td>
</tr>
<tr>
<td>• Believed/encouraged by others</td>
<td>• In science Black girls are typically not seen</td>
</tr>
<tr>
<td>• lost self… not aware of what I want</td>
<td>• Not being able to see it, you cannot imagine yourself there</td>
</tr>
<tr>
<td>• I don't have a specific reason why I like science</td>
<td>• It didn’t seem like there were images of me in STEM</td>
</tr>
<tr>
<td>• advantage as an Asian American.</td>
<td>• No images of me in Science</td>
</tr>
<tr>
<td>• was always told I was good</td>
<td>• I don’t fit there</td>
</tr>
<tr>
<td>• world telling me</td>
<td>• No one like me/ I never saw myself in science- no mentors, not models, no memories</td>
</tr>
<tr>
<td>• stereotype pushed onto me by society.</td>
<td>• Unveiled Awareness</td>
</tr>
<tr>
<td>• pre-determined</td>
<td></td>
</tr>
<tr>
<td>• continuous messages being fed to me by society.</td>
<td></td>
</tr>
<tr>
<td>• missing hole in my life</td>
<td></td>
</tr>
<tr>
<td>• identify these lost pieces of myself</td>
<td></td>
</tr>
</tbody>
</table>

Initial Categories Shared with Science Teacher via member check

Central Phenomenon: Racial Stereotypes

Themes

<table>
<thead>
<tr>
<th>Winnie</th>
<th>Bianca</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Defined For Me</td>
<td>• No Affirming Images in Science</td>
</tr>
<tr>
<td>• Privilege in Science</td>
<td>• Out of Place</td>
</tr>
<tr>
<td>• Unsure About My True Passion for Science</td>
<td>• A System Ruled Out Science For Me</td>
</tr>
</tbody>
</table>
Appendix G: Chapter V Data Analysis Procedure

First Data Analysis:
Modified from
Data Collection Prepared
Data Sources:
Analytical Activities: Initial Open Coding (11/02/15-02/01/16)
Read transcripts line-by-line and made codes in margins
Results

Research Questions:
In what ways do race, gender, socioeconomic status, and other important identity markers of ISTs converge in the science lived experiences of secondary science teachers?
How did the theoretical foundation of the book club reveal changes in ISTs’ thinking and approaches to teaching in urban science classrooms?

First List of Open Codes
• acknowledging privilege
• activism and social justice
• assigning Black girls menial tasks
• being more responsive leads to student achievement
• being vulnerable with students
• benefit of learning about intersectionality
• Black women defined by oppressor
• Black women have no place outsider
• book club facilitates reflection
• building discussion leads to student ownership
• changes
• considering how to differential in CRP
• created new affinity groups
• critical race can silence black women
• critiquing Mutegi and critical race from black feminist lens
• Crp (culturally responsive pedagogy) for all students not just Students of Color
• desire to affirm students in teaching
• developing confidence
• developing consciousness by relating BFT to personal experience
• developing consciousness by means of re-learning science knowledge
• embracing Black feminism
• empowered to have conversations across lines of difference
• encouraging all to gain BF lens
• engaging more students through discussion
• excluding CRP is oppressive
• expected to teach a softer science subject as Women of Color
• facilitator moves
• false empowerment with words
• feel responsible for being responsive
• feeling comfortable sharing what you don’t know
• feeling empowered to use voice to make changes
• feeling line some identity markers are left out
• fixing science standards without refining SCC lens is ineffective
• gaining knowledge of intersectionality
• getting something different out of study than dominant participants
• giving student voice
• having open conversations with students
• hesitant and apprehensive to share
• hesitating to share personal narrative
• hierarchies and structures
• humanizing the oppressor
• ignoring multicultural conversation in science education
• Intersectional awareness
- leading with vulnerability
- learning from another’s activism
- learning from peer’s vulnerability
- missed empowering experiences in science
- motivated to continue to teach science
- moving beyond anger
- moving to China to discover heritage
- needing oppressor’s approval
- normalizing lack of Students of Color in science
- not getting intersectionality as representing the entire group
- not realizing reenacting oppression
- oppression by dividing People of Color
- participating in the damaging effects of diversity
- rare to see Black women in science classes
- realizing curriculum does not include our students
- realizing curriculum is oppressive
- realizing need for CRP
- redefining relationship with students
- reflecting on past diversity PD
- reframing for students why learning science
- resisting sharing personal narrative
- scc (sociocultural consciousness) training should look different for different races
- science lived experience
- seeing friends drop out of or not choose science major
- Seeing importance of CRP for students of Color
- seeing privilege in science story
- seeing the structures that oppress Black women
- seeking support in affinity groups
- seeking CRP as a way to combat oppression
- Students of Color left out of science curriculum
- transition from disempowered to empowered
- treated differently as Black woman
- two worlds as Asian American
- uncovering bias
- used to view the world oppression as strong and negative
- value developing scc(sociocultural consciousness) in multicultural setting
- writing stories for oppressed
The shortcoming of this first round of coding is that: there were too many codes and no central phenomenon coding was in vivo

Themes

<table>
<thead>
<tr>
<th>Bianca</th>
<th>David</th>
<th>Audrey</th>
<th>Winnie</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oppressed science identity</td>
<td>Privileged science identity</td>
<td>Privileged and oppressed science identity</td>
<td>Privileged and oppressed science identity</td>
</tr>
<tr>
<td>Belonging to the science space</td>
<td>Scientists look like me</td>
<td>Science insider and outsider</td>
<td>Set up for science</td>
</tr>
<tr>
<td>I don’t fit here</td>
<td>Finding their voice in science</td>
<td>Speaking up and taking action</td>
<td>Everyone has a voice</td>
</tr>
<tr>
<td>Unsilencing Students of Color</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uncover the voices in theirs</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

****************************************** Prolonged Break to (Re)Analyze Data ******************************************

Second Data Analysis:
Analytical Activities: Secondary Open Coding (11/07/16-11/29/16)
Refined Research Questions:
1. How do science teachers discuss their intersectionality in the book club?
2. How do the teachers reflect on their approaches to teaching their Black female science students?

Categorized fragments

<table>
<thead>
<tr>
<th>Data that discusses how the teachers conceived of their identity</th>
<th>Data on how teachers’ self-reported changes to their approaches to teaching during and after the book club</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data on how the teachers viewed their Students of Color</td>
<td>Data on how the teachers juxtaposed their identities with those of their students</td>
</tr>
</tbody>
</table>

Read transcripts line-by-line and made codes in margins
Selective Coding: Condensed axial codes by sorting them into more general categories. Highlighted words from the each quote that best captured the essence of the quotations. These words became the in vivo codes.
Results

In Vivo Codes

<table>
<thead>
<tr>
<th>Bianca</th>
<th>David</th>
<th>Audrey</th>
<th>Winnie</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black feminist alive through ourselves</td>
<td>maleness and Whiteness</td>
<td>White woman I knew that there were few places I wouldn't feel safe.</td>
<td>I took a very obvious detour</td>
</tr>
<tr>
<td>my classes became increasingly White.</td>
<td>have been affirmed identity intersects</td>
<td>experience be if I was a Woman of Color</td>
<td>racial identity was an advantage</td>
</tr>
<tr>
<td>dominated by perspectives and stories of</td>
<td></td>
<td>shaped by my Whiteness</td>
<td></td>
</tr>
<tr>
<td>White males</td>
<td></td>
<td>oppressor in relationship to the students</td>
<td></td>
</tr>
</tbody>
</table>

Common Codes Across Cases

- understanding the struggle of being a young Black woman
- noticing the girls in their science
- regularly affirm my Black female students
- remained silent with female contributions
- effort to empower my female students
- analyze my own archetypes of my students
- vision of success for my girls
- feminine voice that has been silenced in my classroom
- be more student centered
- diverse everyone’s perspectives
- shifted my thoughts to be more student centered.

Initial Categories Shared with Science Teacher via member check

Central Phenomenon: Intersectional Awareness

Themes

<table>
<thead>
<tr>
<th>Bianca</th>
<th>David</th>
<th>Audrey</th>
<th>Winnie</th>
</tr>
</thead>
<tbody>
<tr>
<td>oppressed in both instances</td>
<td>my identity intersects at one junction…Privilege Street</td>
<td>less empowered as a woman…privileged by my Whiteness</td>
<td>racial identity was an advantage … but being a woman is a disadvantage in science</td>
</tr>
</tbody>
</table>

Common Codes Across Cases

Relational Privilege in the Sciences
Noticing My Black Female Science Students
More Student-Centered

191
Appendix H: Questionnaire Survey Questions

Questionnaire 1: Background

Family Background
1. What is your name?
2. Where were you born and raised?
3. How much education did your parents (guardians) have?)?
4. Do you have any brothers and sisters? What do your brothers and sisters do for a living?
5. What did your family think about your going into teaching?

Diversity
6. How do children make sense of science?
7. How do you plan meaningful science activities? How do you plan to teach science?
8. How do you define diversity?
9. How do you plan and teach to students of diversity?
10. How do you assess what students know and understand in science?
11. How hard/easy is it to change students’ conceptions? Where do these conceptions come from?

Primary Science Schooling
1. Describe your elementary and middle schools. How would you describe your classmates and your teacher (in terms of race, class, and gender)?
2. What were the primary ways you learned science in elementary and middle school?
3. What did success learning science look like? What did these successful individuals have access to?
4. Did your science teachers seek to know you as a person? Did you connect with your teacher outside of class?
5. In what ways did you teachers incorporate your background into science learning?

High Science Schooling
6. Describe your high school. How would you describe your classmates and your teacher (in terms of race, class, and gender)?
7. What were the primary ways you learned science in high school?
8. When you learned science, what forms or categories of your identity were most important to you or most influenced your life? Examples include: race, class, gender, sexual orientation, religion, etc.
9. How did your experience learning science differ from those who were (category #1)?
10. How did your experience learning science differ from those who were (category #2)?
11. How did your experience learning science differ from those who were (category #3)?
12. What did success learning science look like? What did these successful individuals have access to?
13. Did your science teachers seek to know you as a person? Did you connect with your teacher outside of class?
14. In what ways did you teachers incorporate your background into science learning?
Collegial Science Schooling
15. Describe your college. How many STEM classes did you take in college?
16. How would you describe your STEM classmates and your teacher (in terms of race, class, and gender)?
17. What were the primary ways you learned science in college?
18. When you learned science, what forms or categories of your identity were most important to you or most influenced your life? Examples include: race, class, gender, sexual orientation, religion, etc.
19. How did your experience learning science differ from those who were (category #1)?
20. How did your experience learning science differ from those who were (category #2)?
21. How did your experience learning science differ from those who were (category #3)?
22. What did success learning science look like? What did these successful individuals have access to?
23. Did your science teachers seek to know you as a person? Did you connect with your teacher outside of class?
24. In what ways did you teachers incorporate your background into science learning?

Questionnaire 2:

Learning to Teach Science
1. What were two of your most formative experiences learning to teach science? Examples include: pursing a Master’s of Science degree in teaching, alternative certification programs, etc.
2. Describe your experiences learning to teach science.
3. How would you describe your classmates and your teacher(s) (in terms of race, class, and gender)?
4. What were the primary ways you learned to teach science?
5. When you learned to teach science, what forms or categories of your identity were most important to you or most influenced your life? Examples include: race, class, gender, sexual orientation, religion, etc.
6. How did your experience learning to teach science differ from those who were (category #1)?
7. How did your experience learning to teach science differ from those who were (category #2)?
8. How did your experience learning to teach science differ from those who were (category #3)?
9. What did success learning to teach science look like? What did these successful individuals have access to?
10. Did your teacher(s) seek to know you as a person? Did you connect with your teacher(s) outside of class?
11. In what ways did you teacher(s) incorporate your background into science learning?

Past Teaching Experience(s)
12. Describe your prior teaching experience. Specify where you taught and for how long.
13. How would you describe your students and your colleagues (in terms of race, class, and gender) in your former teaching experiences?
14. What were the primary ways you taught science?
15. When you taught science, what forms or categories of your identity were most important to you or most influenced your life? Examples include: race, class, gender, sexual orientation, religion, etc.
16. How did your experience teaching science differ from those who were (category #1)?
17. How did your experience teaching science differ from those who were (category #2)?
18. How did your experience teaching science differ from those who were (category #3)?
19. What did success teaching science look like? What did these successful individuals have access to?
20. Did your academic coaches seek to know you as a person? Did you connect with your coach outside of class?
21. In what ways did your coach get to know and incorporate your background into coaching?

Current Science Teaching Experience(s)

22. What categories of your identity are most important to you currently? Examples include: race, class, gender, sexual orientation, religion, etc.
23. How does your experience teaching science differ from those who are (category #1)?
24. How does your experience teaching science differ from those who are (category #2)?
25. How does your experience teaching science differ from those who are (category #3)?
26. What does success teaching science look like? What did these successful individuals have access to?
27. Does your academic coach seek to know you as a person? Did you connect with your coach outside of class?
28. In what ways does your coach get to know and incorporate your background into coaching?
### Appendix I: Examples of Researcher NVivo Memos

<table>
<thead>
<tr>
<th>Date</th>
<th>Key Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/02</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Core Category: Unsilencing</td>
</tr>
<tr>
<td></td>
<td>• Literature Review will include: Teachers of Color in teacher education</td>
</tr>
<tr>
<td></td>
<td>• Possible Theoretical Frameworks: positionality, intersectionality, counterstory, Black feminist theorizing, nepantla, critical race theory</td>
</tr>
<tr>
<td>11/11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The Women of Color internalized oppression is by self-doubt and second guessing and not sharing feelings with others for fear of how other will take or interpret one's feelings</td>
</tr>
<tr>
<td></td>
<td>• Reading and reflecting on the text must allow the women in the study to see themselves or their experience represented in the text</td>
</tr>
<tr>
<td></td>
<td>• Women of Color shared more openly in groups with other women</td>
</tr>
<tr>
<td></td>
<td>• Connects to the literature on the benefit of affinity groups for Women of Color</td>
</tr>
<tr>
<td></td>
<td>• I reflected with the group and shared personal experiences. I modeled vulnerability with the group. When I walked along with the participants I feel that’s when I was the most effective at facilitating</td>
</tr>
<tr>
<td></td>
<td>• Oftentimes identifying factors such as race and gender may become &quot;LABELS&quot; that end up oppressing those who don't share dominant forms of identity</td>
</tr>
<tr>
<td>11/27</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• I am starting to see Bianca and Winnie be more comfortable stating their discomfort and both starting to discuss how they see themselves and are validated in the readings of the text.</td>
</tr>
<tr>
<td>11/30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• I have realized just how much shifting occurred for the participants in the area of their use of the word diversity.</td>
</tr>
<tr>
<td></td>
<td>• Participants were using the words d and I (diversity) liberally and were in no way questioning their use of this term. After reading the Ahmed article, I noticed participants at first (Winnie) not quite understanding what the point of the article was but then acknowledging their miss-use of the word and then almost re-definition of the word.</td>
</tr>
<tr>
<td>12/01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Bianca in the one on one interview openly mentions how she was ignorant and was shamed or guilted by her &quot;veil of ignorance&quot; of not realizing the external factors that limited her success in science and her knowledge of her intersectionality as a Black woman</td>
</tr>
<tr>
<td>12/04</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Methodology: narrative</td>
</tr>
<tr>
<td></td>
<td>• Possible theoretical framework: feminism and nepantla</td>
</tr>
<tr>
<td>12/05</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Winnie’s experience is not the same as Bianca’s- she discusses her dominance and oppression</td>
</tr>
<tr>
<td>12/06</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Bianca and Winnie come into their own in understanding their identity and how this relates to science. Both were making statements of feeling like a veil of ignorance was torn from them around what it means to be oppressed and how the oppressed were described and represented in the literature.</td>
</tr>
<tr>
<td>02/01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Codes are interpret raw data but are not truly in vivo- I am forcing the codes</td>
</tr>
</tbody>
</table>
to fit too much instead of letting them emerge from the raw data

- Also, some of the theoretical frameworks do not truly fit the identity of the participants. Nepantla does not describe Bianca because she felt like an outside in all ways.

- I need to go back and recode because my codes don’t sufficiently answer my research questions
Appendix J: Findings from Rankings in Identity Markers Activity

<table>
<thead>
<tr>
<th>Participants</th>
<th>Identity Markers Organized (prewrite, January 30)</th>
<th>Identity Markers Sorted as Privileged or Oppressed (prewrite, March 27)</th>
<th>Revised Identity Markers in Order of Importance (prewrite, July 30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audrey</td>
<td>Californian, Daughter of a strong woman, Low-income background, Educated, White, Educator, Oldest sibling of five, Lesbian, Woman</td>
<td>Oppressor: White, Educated, Oldest of five children, Daughter of a strong woman, Educator, Californian Oppressed: Woman, Lesbian, Low-income background</td>
<td>Woman, Lesbian, Partnered, White, Athlete, Member of a large mixed family, Low-income background, Daughter of a strong woman, Deceased father, Extroverted</td>
</tr>
<tr>
<td>Bianca</td>
<td>Spirituality, Race, Ethnicity, Social status, Economics, Gender, Family, Language, Education, Age</td>
<td>Oppressor: Family, Language, Age (depending on setting), Education Oppressed: Gender, Race, Ethnicity, Social status, Economics</td>
<td>Gender, Race, Class, Education, Age, Religion, Language, Ethnicity, Family, Social status</td>
</tr>
<tr>
<td>David</td>
<td>Father, Son, Husband, Cis-gender, Heterosexual, Middle class, Able-bodied, Male, White, Educated</td>
<td>Oppressor: Father, Son, Husband, Cis-gender, Heterosexual, Middle class, Able-bodied, Male, White, College-educated Oppressed: n/a</td>
<td>Father, Husband, Son, Brother, White, Male, Able-bodied, Heterosexual Cis-gendered, U.S. citizen</td>
</tr>
<tr>
<td>Winnie</td>
<td>Chinese, Immigrant, Asian, Borough-NY, Small, Woman, Able bodied, Cis-Gendered, Middle class, Teacher</td>
<td>Oppressor: Borough-NY, Able-bodied, Cis-gendered, Middle class Oppressed: Chinese, Immigrant, Asian, Woman, Small</td>
<td>Asian, Woman, Chinese, Chinese American, Immigrant, Daughter, Teacher, Sister, Vegetarian, Able-bodied</td>
</tr>
</tbody>
</table>