EXPERIENCES OF SCIENCE EDUCATION GRADUATE STUDENTS
IN THE CRITICAL VOICES CLASSROOM

by

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Science teachers in the United States are not prepared to teach the students in their classrooms. Teachers are most often White females, while the children in their classrooms are from diverse backgrounds. Multicultural pedagogies exist, but teachers must be educated during their teacher preparation courses to understand their own relationship with race before they can enact such pedagogies in their classrooms. This qualitative study sought to examine the lived experiences of eight science education doctoral students in a course called Critical Voices in Teacher Education, through the qualitative method approach of transcendental phenomenology. The participants’ experiences were examined through three theoretical frameworks: transformative learning theory, White racial identity, and racial literacy. Interviews, field notes, and student reflections were used to collect data for this phenomenological study. The
findings showed that through the process of critical reflection and group discussion, participants had a transformative experience in which their racial identities developed, and perceptions of students and curriculum shifted to include multicultural pedagogical approaches. The findings from this study supported the idea that teacher education programs must use racial identity development and multicultural curriculum as a foundation for all education programs.
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Although I did not know it then, my first job out of college would introduce me to a wonderful mentor, Dr. Natasha Cooke-Nieves, from whom I would, over the course of my career, seek advice and guidance. I followed her path to the Ed.D. program at Teachers College and am eternally grateful for our relationship.

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Chapter I

INTRODUCTION

Personal History

As a product of the New York City Teaching Fellows program, I had limited exposure to science education courses that were framed in a context of race and culture. I dove head first into the science classroom 10 years ago, without much sense of cultural pedagogy, and admittedly little understanding of how that would impact my students. I earned my master’s degree from Brooklyn College after 2 years of evening classes. While the science content coursework was strong, I was not exposed to any courses on multicultural education during my 2 years, and thus did not have the foundation to enter a science classroom as a White 21-year-old with students whose background I did not yet understand. Unfortunately, I was not the only teacher ill-prepared for the classroom and unfit to work with my 5th grade students. I learned through trial and error, watching veteran teachers, and getting to know my students to see if by better understanding them, I could better understand myself as a teacher. Looking back, my teacher preparation coursework should have been rooted in multicultural education. Even in science coursework, the pedagogical approaches employed by my professors for my master’s degree should have been designed through the lens of multicultural education to ensure that teachers going into science classrooms not only understand how to connect with all
students on a deep level, but also reinforce the concept that science is not an objective subject that is not influenced by race and power.

As an in-service teacher, I sought out professional development opportunities to help me hone my craft as a middle school science teacher. The most common professional development programs were short, 1- to 2-day workshops that covered a variety of topics, including classroom management, new science technologies, and science experiments. I was able to participate in a research program for science teachers over two summers at Columbia University laboratories, reinforcing my science content knowledge. Still, I was missing something. I struggled to find programs that fused culture and content, addressed race conversations in the classroom, or included real-world issues in the subject I taught. It was not until doctoral work at Teachers College, Columbia University that I was able to immerse myself in topics of race and critical perspectives as a science teacher. My coursework on race and critical perspectives has no doubt enhanced my work as a science teacher. I only wish that I had encountered programs sooner before I entered the classroom.

Unfortunately, my story as an ill-prepared White female teacher in an urban classroom with students I do not look like is far from unique. There are approximately 3.1 million elementary and secondary school public teachers in the United States, and according to a study conducted by the U.S. Department of Education National Center for Education Statistics (USDOE NCES) in 2011, 76% of the teachers were female and 82% of public teachers were White. According to another study by the USDOE NCES from 2014, the percentage of Hispanic students is expected to increase to 29% in 2024 (up from 24% in 2012) and of the Asian/Pacific Islander population is expected to increase.
from 5% to 6% by 2024. White public school students are expected to decline from 51% in 2012 to 46% in 2024, and the percentage of Black public school students is expected to decline from 16% to 15% by 2024. By 2050, it is predicted that there will be no true majority race or ethnic group (Deruy, 2013). Thus, the majority of teachers entering the classroom are White females, while the students they teach are racially diverse. Without a solid foundation in multicultural education, the majority of teachers are not prepared to enter the classroom and work with students whose cultures may be different from their own (Barton, 2000; Milner, 2006). In my case, I was not exposed to multicultural education, nor forced to confront my White racial identity, until I began my doctoral work in 2014—6 years after I entered the workforce as a science teacher.

**Multicultural Education Coursework in Teacher Education Programs**

While the multicultural education movement emerged out of the Civil Rights movement in the 1960s and 1970s, the majority of research on multicultural education did not emerge until the 1990s when education researchers addressed the need to incorporate multiculturalism into foundational teacher education coursework (Gay, 1993; Gollnick, 1995; King, 1991; Menchaca, 1996; Nieto, 2017; Sleeter & Grant, 1987). In a study conducted in a majority White university in rural Texas, 84% of teachers received very little to no training in multicultural education; if multicultural education was taught at all, it was taught in isolation (Menchaca, 1996). A shift in the focus of teacher education programs, from generic to intentional on the specific population of students, is necessary for multicultural education to progress (Gay, 1993). Teachers with privileged views must be re-educated to let go of prior beliefs in order to embrace a multicultural
pedagogy (King, 1991). After national reform standards were released promoting diversity in curricula, institutions still failed to create programs from a culturally diverse perspective over the course of 20 years (Gollnick, 1995).

A decade or more later, research reiterates the same call to action for teacher education programs at the institutional level, implying little change has been made. Multicultural education must move from the edges to the foundation of teacher education programs; teacher educators must come together to create curriculum that uses multicultural education as a focus, including courses that challenge deficit thinking and promote discussion from diverse backgrounds (Grant & Gibson, 2011; Milner, 2010a; Nieto, 2000).

Critics of multicultural education have argued that multicultural education is a vehicle to promote assimilation into White dominant culture rather than exposing and confronting racial injustices as in anti-racist curricula (Todd, 1991). What is missing from multicultural education models and research is the “most formidable problem confronting the American education system: racism” (Mattai, 1992, pp. 70-71). While there is a large volume of literature of multicultural education and many overlapping themes, a single, shared definition that educators and members of the research community can agree on does not exist (Nieto, 2017; Sleeter & Grant, 1987).

So why has it taken so long for institutions to use multiculturalism as a foundation for all teaching? A number of factors have contributed to the slow progress of infusing multicultural education into teacher education programs. Among those reasons include a lack of skills and education for a majority White faculty, resistance to change and elitism, and lack of funding for research in the area of multiculturalism (Gay & Howard, 2000;
Grant, 2005; Mattai, 1992). Additionally, there is a call for an increase in the body of research to impact policy as well as an increase in empirical research (Grant & Gibson, 2011).

Scholars in the field of multiculturalism must continue to conduct studies that highlight the importance of the field, further refining a definition of multiculturalism. In this study, I contribute to the conversation and research on multicultural education, science education, and racial literacy by demonstrating what a graduate-level teacher education course, Critical Voices in Teacher Education, has on science education students’ understanding of critical perspectives for science education.

I argue that students in teacher education programs need to develop their own racial identity and become racially literate in order to fully embrace, understand, and implement critical multicultural pedagogies. While I acknowledge that multicultural education encompasses more than understandings of race, it cannot be denied that topics of race serve as either a barrier or a gateway to true understanding of critical multicultural education. Race is often viewed as an “uncomfortable” conversation topic and is therefore avoided (Buchanan, 2015; Howard, 2003; Kelly & Gayles, 2010). Furthermore, because the majority of the teaching force is White, White teachers must take greater responsibility in dismantling racism in schools (Singleton, 2014). Without a thorough understanding of one’s own racial identity and development of racial literacy, teachers cannot truly enact critical multicultural pedagogical approaches in the classroom.
Purpose of This Study and Research Questions

The purpose of this study was to understand how science education doctoral students experience the course, Critical Voices in Teacher Education (Mensah, 2017), or Critical Voices, specifically in regard to discussing race and racism in science education. I chose to narrow my focus on themes and discussions of race and racism in science education because it has been noted as a topic that teachers often intentionally avoid (Howard, 2003; Kelly & Gayles, 2010) and a topic needing additional research in science education (Mutegi, 2013; Parsons, 2008).

The research questions for this study are:

1. What are the lived experiences of science education graduate students in the Critical Voices classroom?
2. How does the pedagogical approach employed in the Critical Voices class influence how science education graduate students see science classrooms and science students?
3. In what ways did the Critical Voices course support the science education graduate students’ development of racial literacy?

Organization of the Dissertation

Chapter I outlined the personal history of the researcher and the purpose of the study. I included the research questions that guide this dissertation study. Chapter II includes a review of the literature on K-12 teachers’ understanding of race, critical perspectives, and pedagogical approaches to multicultural education. A literature review of multicultural education in teacher education in the United States is also given. Finally,
the chapter explains the three theoretical frameworks of the study: transformative learning theory, White racial identity, and racial literacy. Chapter III describes the qualitative research method of transcendental phenomenology that was used to collect and analyze data. Chapter IV describes the findings, starting with a profile of each of the eight participants. Following the participant profiles, the findings are broken down into three major themes. Chapter V includes the discussion and implications, next steps, and the conclusion.
Chapter II

REVIEW OF LITERATURE AND THEORETICAL FRAMEWORK

In this chapter, I begin with a literature review of K-12 teachers and their understandings of race as related to the classroom. Then, I discuss the different ways in which race appears in the classroom, including bias as colorblindness, race as stereotype threat, and race in the subject matter—in this case, science education. I then transition to discussing critical perspectives in teacher education, as the perspective needed to address issues of race and other power dynamics in the classroom. From critical perspectives, I discuss the pedagogical approaches of multiculturalism as the practical application of critical perspectives. Two key components of pedagogical approaches to multiculturalism include critical reflection and discussion. In order to address race and the biases teachers may hold in the classroom, teacher education programs must approach education from critical perspectives such that teachers understand race and thus can teach in such a way that embodies multicultural pedagogy. Finally, the chapter closes with a literature review of the three theoretical frameworks used to guide the findings: transformative learning theory, White racial identity, and racial literacy.
K-12 Teachers and Understanding of Race

Teachers in classrooms across the United States have been introduced and exposed to the idea of multicultural education for decades—some in teacher education programs and others in curriculum. But how much background information do teachers really have? How can teachers truly implement the foundations of multicultural pedagogy in their classrooms if they are unable to recognize the biases that they hold? Are teachers able to be effective agents of change if they have not first confronted their own racial biases? I argue that teachers must first understand their own racial biases and confront their misunderstandings before they are truly able to understand multicultural education and implement multicultural pedagogical practices (Buchanan, 2015; Ladson Billings, 1999; Ladson Billings & Tate, 1995; Milner, 2006). Without a critical reflection on race, teachers will be operating on a superficial level of understanding of multicultural education, which will serve as a further detriment to the field of multicultural education.

To understand the relationship between race and schooling, one must understand that “race is indeed a pre-eminently sociohistorical concept” that is an “unstable and ‘decentered’ complex of social meanings constantly being transformed by political struggle” (Omi & Winant, 1994, pp. 60-68). In other words, race is a social construct that is created by society to value some and devalue others, specifically with regard to physical features such as skin color (Daniel, 2009; Kholi, 2008). Omi and Winant (1994) used the phrase racial formation to describe the fluid nature through which race is formed from social, economic, and political forces. This social construct of race contributes to the power dynamics in the classroom, especially when the majority of teachers are White females and the students they teach are not (Feistritzer, Griffin, & Linnajarvi, 2011).
The biases that exist around race have real consequences in the classroom. The racial achievement gap of students between “White and Asian students and their Black, Brown, Native American, Southeast Asian, and Pacific Islander counterparts” is large, even when controlled for socioeconomic status (Singleton, 2014, p. 39).

**White Teacher Bias and Black Students**

Research has shown that many teachers have biased views when it comes to the students they teach (Daniel, 2009; Kholi, 2008; Milner, 2010a; Mutegi, 2013; Prime & Miranda, 2006; Rong, 1996). A qualitative study showed that White teachers rated Black students significantly lower than White students on social desirability, social skills, and leadership scales (Rong, 1996).

In a narrative of a White teacher and a Black 8th grade student discussing career aspirations, the White teacher explained that a career as a lawyer is not a realistic goal for his student, adding, “You need to think about something you can be” (Mutegi, 2013, p. 83). From this biased view, the White teacher imposed a negative view on the Black student, diminishing the student’s value and power. In an interview with eight science teachers (four Black and four White, who worked with a student population that was 95% African American), nearly all of the teachers in this study had a negative view of their students’ behavior—they had poor attitudes and low motivation and were not prepared to do well in science (Prime & Miranda, 2006).

Within this negative perception, White teachers at times express fear in situations with people of color, based on negative stereotypes. Picower (2009) illustrated this in an interview of a White teacher in which she expressed fear of a fight in her classroom of 8-year-old African American students. Teachers often use the “bootstrap” philosophy
(Leonardo & Grubb, 2013, p. 58) to explain how underachievement in a minority group can be fixed by trying harder and not accepting failure. This mentality implies that minority students are “lazy” and can change their destiny but choose not to, thus operating under the deficit perspective that students are lacking the skills to do well in school (Bianchini, Cavazos, & Helms, 2000; Picower, 2009).

Teachers of color may have biases and negative views of students of color, though the research has shown not to the extent of White teachers (Gershenson, Holt, & Papageorge, 2016; Milner, 2010a). Minority teachers must also be taught how to teach culturally diverse populations and discuss racism (Milner, 2010a; Tatum, 1992). Therefore, teacher education must be focused on counteracting these racial ideologies in multiple contexts. Teacher education programs must work to dismantle the biased beliefs of White teachers, while also ensuring that voices and perspectives of teachers of color are valued. Teacher education programs that are geared solely towards White educators do a disservice to teachers of color who are entering the field (Milner, 2010b).

**Bias as Colorblindness**

Colorblindness has its roots in law and can be traced back to the ruling of “separate but equal” in the case of *Plessy v. Ferguson* in 1896, where segregation was not seen as a violation of the U.S. Constitution (Castro Atwater, 2008; Schofield, 2006). More than a century later, we see evidence of the colorblind attitude in American schools (Castro Atwater, 2008; Lewis, 2001; Neville, Lilly, Duran, Lee, & Browne, 2000; Schofield, 2006). As defined by Neville et al. (2000), a “color-blind racial attitude refers to the belief that race should not, and does not matter” (p. 60). While that could be a utopian image, racism and differences in society exist. The problem with adopting a
colorblind approach is that students of different racial backgrounds experience the classroom differently, and teachers who adopt this colorblind approach often do not have the skillset to function in a diverse classroom (Milner, 2010). Additionally, the notion of colorblindness leads many to a false sense of reality, that in turn causes more discrimination in an effort to ignore race all together (Schofield, 2006).

In a study focused on peer relations between White and African American middle school students, Schofield (2006) found that while the school made attempts to integrate the population of students, administrators and staff—both White and African American—operated under a colorblind approach. The topic or race was seen as a taboo topic. The absence of words like “Black” and “White” were made apparent; in more than 200 hours of interviews, explicit reference to race was made only 25 times. While the school was a recipient of many government-funded programs directed towards desegregation efforts, it made very little impact on the way faculty and students spoke (or, in this case, failed to speak) about race. Though teachers and administrators were working in a mixed-race middle school setting, it did not imply that they would engage in conversations around race and, in fact, the opposite occurred.

A year-long study in a suburban, mostly White school indicated that White teachers did not see race as a factor in the school, and they did not see the point in “dealing with” race outside of Black History Month activities (Lewis, 2001, p. 787). When asked about how she dealt with race in the classroom, one teacher switched the topic to respect, stating, “My own attitude is, people are people, and . . . we treat people with respect, and that’s what you get back” (p. 786)—skirting the issue of race.
There are reasons why teachers may avoid talking about race. First, Milner (2010a, 2010b) explained that teachers often resort to the colorblind philosophy in fear of being perceived as racist or politically incorrect when broaching the topic of race. Second, conversations around race bring up extensive anxiety and discomfort for teachers and administrators, and therefore not addressing the topic circumvents those uncomfortable emotions (Picower, 2004, 2009; Schofield, 2006). In the case of new White teachers, many view the concept of race as diametrically opposed to White, which emphasizes difference and thus adds to the discomfort when topics on race are raised (Picower, 2004). Additionally, the colorblind approach tends to “simplify life” and “increase freedom of action” (Schofield, 2006, p. 272) such that race does not have to be considered in the decision-making process of an act. In the case of this study, a middle school teacher chose a White student over a Black student for student council, even though the Black student had won. She explained her logic in that she chose the “responsible child” (the White student) to win, skirting the issue of race altogether (p. 272). Furthermore, teachers often adopt the notion of “colorblindness” to dismiss the topic of race altogether. If a teacher is “colorblind,” then she claims to not see the race of her students, and thus does not have to face the complexities of the inevitable power structure that race in the classroom brings.

**Race and Stereotype Threat**

Originally borrowed from social psychology, the term *stereotype threat* can be applied to countless scenarios and fields, including education. We all have identities, and negative stereotypes exist within those identities in different contexts (Steele, Spencer, & Aronson, 2002). Stereotype threat, as first defined by Steele and Aronson (1995), refers
to the experience of self-characterization, in which a person identifies with a particular group, and that group is at risk of feeling or experiencing discrimination by the majority group. Steele et al. (2002) described stereotype threat as a “situational threat” (p. 389). In any given situation, there are social cues that reveal a potential for a person to be marginalized through inaccurate perceptions of a group with which he or she identifies. Even if these stereotypes are not expressed outright, the mere feeling that a stereotype may be perceived is enough to trigger a response. This type of stereotype response can be characterized by others, outside of the stereotyped group, or “in one’s own eyes” (Steele & Aronson, 1995, p. 797; Steele et al., 2002). All people have a social identity, and within each is potential for the existence of a negative stereotype. The terms “yuppie, feminist, liberal, White male” (Steele & Aronson, 1995) or “the elderly, the young, Methodists, Blacks, Whites, athletes, artists” (Steele et al., 2002, p. 390) are some examples.

In American classrooms, stereotype threat has been most studied in females and minority students, including African Americans and Latino students (Aronson, Fried, & Good, 2002; Good, Aronson, & Inzlicht, 2003; Nosek et al., 2009; Steele & Aronson, 1995; Sherman et al., 2013; Tan, Calabrese Barton, Kang, & O’Neill, 2003). McGee and Martin (2011) described examples of how professors’ negative stereotypes affect Black mathematics and engineering students. Similarly, Beasley and Fischer (2012) attributed stereotype threat to be a cause in the attrition of minority and women in STEM career fields.
Race and Subject Matter, Including Multicultural Science Education

Teachers often view academic subjects as separate and disconnected from race, and therefore must be exposed to concepts of race as foundational for multicultural education. For example, a study of elementary school teachers showed that race and literacy were viewed by the teachers as separate entities (Nash, 2013). In attending a training, teachers wondered why they spent time on racial issues and felt as though it was taking away time from learning literacy content. This demonstrates race was viewed as an entirely different topic from the literacy content they were to teach in elementary school.

Science teachers use the “colorblind” approach to justify teaching content and excluding race (Bianchini et al., 2000). One teacher attempted to exclude race from her classroom in order to be “fair” to her students: “to be equitable, Debbie focused on the science subject matter she taught. She let the subject matter drive her instruction” (p. 531).

Another example in a science classroom highlights the need for multicultural education. Prime and Miranda (2006) described science teachers’ perceptions of students, pointing out that teachers were not concerned with making the science content culturally relevant to students. Teachers were mostly focused on providing “accommodations to the deficiencies they perceived in their students” (p. 529).

The examples above highlight the need for an increase in university courses that help teachers understand their own biases and negative perceptions about students of color and the subject they teach. Teachers need time to grapple with topics that might be uncomfortable in order to better understand how race plays a role in multicultural
education (Howard, 2003; Mensah, 2009). When science teachers are exposed to topics of multiculturalism, they can begin to see bias, understand the implications of the colorblind approach, and connect content to culture (Barton, 2000; Mensah, 2009).

In the science classroom, students of color are perceived as “intellectually inferior when it comes to scientific reasoning” (Atwater, 1996, p. 823). Therefore, science education must work against inequities and give students a voice in the classroom. Science educators must develop skills to help facilitate the construction of knowledge in their classrooms, as opposed to imparting knowledge to their students. Science classrooms must include all voices, and help students empower themselves to engage in science in a way that includes all (Atwater, 1996; Barton, 2000). Three main guidelines should steer the multicultural science classroom: “all students can learn science, every student is worthwhile to have in the science classroom, and cultural diversity is appreciated in the science classroom because it enhances, rather than detracts from the richness and effectiveness of science learning” (Atwater, 1993, p. 35).

Just as the processes to teach through a multicultural lens should be constructivist in nature, so should teacher education programs. Providing a textbook on multiculturalism will not help teachers develop a critical lens. Rather, providing situations for teachers to develop their knowledge constructively provides for an impactful and lasting experience. In one teacher education program, secondary science education students engaged in service learning to develop their understandings of multicultural science education. Students taught implemented science lessons at a homeless shelter, and engaged in weekly planning and reflection meetings. Through this service learning, teachers were able to see the cultural context of learning outside of a
school setting, and were able to connect to students’ needs on a personal level (Barton, 2000).

**Critical Race Theory**

Originally from critical legal studies and credited to Derrick Bell, critical race theory (CRT) questions the foundations on which power is built to challenge ways in which race impacts law and society (Crenshaw, 1995). CRT is activist in nature; critical race theorists are interested in disrupting the relationship between race and power (Delgado & Stefancic, 2012). Delgado and Stefancic (2012) contended that “racism is ordinary” (p. 7) and “race and races are products of social thought and relations” (p. 8).

Ladson-Billings (2003) pointed to race as a “unit of analysis” through which to understand power (p. 16). In education, CRT is used to break down the structures of the dominant Eurocentric discourse that are used to undermine minority culture (Solorzano & Bernal, 2001).

Ladson-Billings and Tate (1995) expressed the importance of narrative and voice as key elements to CRT. In order to transform classrooms and our understanding of children, educators must first seek to understand the relationship between race and power, and then they can act as agents of change. Ladson-Billings and Tate maintained, “the voice of people of color is required for a complete analysis of the educational system” (p. 58). Solorzano (1997) posited that we must engage in dialogue using CRT as a guide to expose stereotypes from society as a way to begin the discussion.
Critical Perspectives Origins and Teacher Education

Origins of Critical Perspectives

Critical perspectives come from the critical theory of education. The critical theory of education evolved from the Frankfort School in 1930s Germany (Brookfield, 2013) and sought to challenge the dominant ideology that inequalities in society was a “normal state of affairs” (p. 418). The writing of Brazilian educator Paolo Freire (1970) in Pedagogy of the Oppressed applied critical theory to pedagogical approaches in education; he wrote, “this, then, is the great humanistic and historical task of the oppressed: to liberate themselves and their oppressors as well” (p. 26). Teaching is an inherently political act, and schools can and must act as agents of change (Giroux, 1997). When examining schools, critical theorists examine practices and institutionalized forms of oppression while seeking to change the power structure to become more equitable for all (Beyer, 2001).

Utilizing critical perspectives challenges the traditional view and puts dominant viewpoints into question. Critical perspectives scrutinize society through a lens, focusing on groups that have been marginalized in society, and drawing attention to the inequities that exist at both an institutional level as well as on a day-to-day basis (Beyer, 2001; Bigelow, 2001). Critical perspectives give power to the underrepresented, calling for a deeper understanding of the injustices that exist. Advocates of critical perspectives believe that positive change in society comes from an invested interest in the underrepresented, particularly women, minorities, and the poor; they argue that these groups are “ill-served by social institutions” (Adler & Goodman, 1986, p. 3).
Critical Perspectives in Teacher Education

Critical perspectives in teacher education draw connections between larger societal inequities and classroom experiences, exposing the ways in which classroom experiences often reinforce the majority view of society and further marginalizing those who are not in the majority group (Bigelow, 2001). In schools and curriculum, researchers using a critical perspective seek to uncover the “hidden curriculum” and hidden agendas that value dominant perspectives and exclude others that, in turn, “shape students’ consciousness” (Beyer, 2001, p. 5). By viewing education through a critical lens and incorporating a broader social view (Dewey, 2013), educators and researchers are more prepared to change what has become normalized in classrooms by uncovering elements of the hidden agenda (Beyer, 2001).

Critical perspectives in teacher education focus on three key elements: power (Adler & Goodman, 1986; Beyer, 2001; Bigelow, 2001; Daniel, 2009; Giroux, 1985); value of the individual (Adler & Goodman, 1986; Giroux, 1985; Ladson-Billings, 1999); and an investment in teachers and curriculum as agents of change (Adler & Goodman, 1986; Beyer, 2001; Bigelow, 2001; Conklin & Hughes, 2016; Giroux, 1985).

First, critical perspectives focus on power: who has it and who is excluded. The social structures favor the dominant, Western view, which is historically composed of wealthy White men (Adler & Goodman, 1986). Consequently, non-dominant groups receive inadequate access to social resources, including healthcare and employment in addition to education (Daniel, 2009). As a microcosm of society, schools serve as a small representation of the greater institutions that exist. Thus, power in society molds hierarchical structures within schools, just as much as schools further perpetuate the cycle
of favoritism of the dominant groups (Adler & Goodman, 1986; Giroux, 1985). Often, schools “fail to confront the racial, class, gender, and homophobic biases woven into our social fabric” (Bigelow, 2001, p. 1) and instead further marginalize minority groups.

Culture and power are inherently interconnected in education settings; however, educators claim schools are politically neutral settings “isolated from social, political, ideological crosscurrents” (Giroux, 1985, p. 5). This view poses a danger to those who are advocates of critical theory. Through this lens, power structures are held firmly in place, overlooking the systemic damage that schools cause on underrepresented populations. A way to combat this power structure is through curriculum that focuses on social justice and multicultural education (Bigelow, 2001; Giroux, 1997). The shift to a new curriculum can create systemic restructuring in a way that can change schools and society beyond what funding and school governance can achieve (Bigelow, 2001).

Instead of enacting change from a top-down approach, critical classrooms allow students and teachers to challenge inequities on a daily basis, through academic content. In order to challenge dominant beliefs, this perspective is critical for educators to address (Giroux, 1997).

Second, critical perspectives place value on the individual, emphasizing the importance of the development of teacher and student identity (Giroux, 1985; Ladson-Billings, 1999). To understand the intersection between race, power, and academic content, scholars in this field have argued that individuals must develop and share personal narratives with one another to expose the ways in which society does or does not serve them (Giroux, 1997; Ladson-Billings, 1999; Mensah, 2012). Furthermore, through narrative, teachers and learners develop identities that can be used as an agent of change
(Giroux, 1997). Mensah (2012) argued that identity must be coupled with positionality (gender, race, class, and other social markers) in order for the teacher to construct his or her identity in the classroom context. Social justice and multicultural curriculum rely on personal perspectives as key elements in creating learning that has deep and powerful meaning to the group (Adler & Goodman, 1986).

Finally, critical perspectives call for an investment in teachers and a transformative curriculum that they teach (Adler & Goodman, 1986; Beyer, 2001; Conklin & Hughes, 2016; Giroux, 1985). Giroux (1985) called both teachers and students “transformative individuals” (p. 35). For teachers, they are key to enacting social change with their students. Beyer (2001) argued teachers who are focused on social justice and multicultural curriculum “will intervene in the lives of their students so as to help construct with them futures that are personally rewarding, socially responsible, and morally compelling” (p. 8). To do this, teachers must take part in “compassionate, critical, justice-oriented teacher education” (Conklin & Hughes, 2016, p. 57) while still acknowledging that they do not know all of the answers (Bigelow, 2001). Teachers with a critical perspective must also question the function of certain curriculum, while helping students to analyze their role within society (Adler & Goodman, 1986). Critical perspectives push students and teachers to become “truth-tellers” and “change-makers” (Bigelow, 2001, p. 4), with curriculum that makes them equipped to “talk back to the world” (p. 2) and engage in a critical discourse (Giroux, 1985).
Pedagogical Approaches for Multicultural and Critical Perspectives

Culturally relevant pedagogy (Ladson-Billings, 1995), culturally responsive teaching (Gay, 2000), and reality pedagogy (Emdin, 2011) are some examples of approaches that bring critical perspectives to the classroom.

Culturally relevant pedagogy (Ladson-Billings, 1995) acknowledges the importance of academic achievement and cultural identity by outlining three tenets: holding high expectations, assisting students in the development of cultural competency, and guiding students to develop critical cultural consciousness (Aronson & Laughter, 2016). Teachers who practice culturally relevant pedagogy “think deeply about what they teach, and ask students why students should learn particular aspects of the curriculum” (Ladson-Billings, 2008, p. 168). In order to enact culturally relevant pedagogy, teachers must use students’ culture to drive learning and evaluate the importance of what and how they teach it (Howard, 2003; Ladson-Billings, 1995, 2008; Mensah, 2011).

Often used alongside culturally relevant pedagogy, culturally responsive teaching “empowers ethnically diverse students by simultaneously cultivating their cultural integrity, individual abilities, and academic success” (Gay, 2000, p. 44). Gay explained that self-analysis is crucial to culturally responsive teaching; teachers must be aware of their own beliefs about the relationship between academic achievement and culture when working with a diverse population of students. Additionally, she explained that teachers should engage in dialogue with peers, supervisors, and students so that teachers make sense of their behaviors and beliefs in order to improve their instruction.

Emdin’s (2011) reality pedagogy drew from culturally relevant pedagogy and culturally responsive teaching by highlighting the importance of understanding a
student’s culture and using this information to drive instruction. Through the use of Emdin’s 5 C’s—cogenerative dialogues, coteaching, cosmopolitanism, context, and content, teachers can learn to communicate effectively with students, allow student leadership in the classroom, empower students through leadership, create real-world connections outside of the classroom, and have flexibility with content.

Science teachers in today’s urban classrooms must be able to understand the cultural backgrounds of their students in order to enact pedagogies that are embedded in multicultural education and critical perspectives. To be able to teach students through a critical lens, science teachers must be educated themselves in multicultural and critical perspectives in order to understand how race and power play integral roles in the dynamics of the classroom (Mensah, 2011, 2017).

Critical Reflection and Discussion

In order for science teachers to be able to enact the pedagogies mentioned in the section above, sustained dialogue and critical reflection on race are most important for teacher development and must be implemented in teacher education programs as foundational practices. First, discussion has been proven to be a valuable tool in teacher education to help people change views and talk about race (Daniel, 2009; Duncan-Andrade, 2005; Gay, 2000; Kelly & Gayles, 2010; Mensah, 2009, 2017; Nash, 2013; Rogers & Mosley, 2008; Sealey-Ruiz, 2011; Singleton, 2014).

In elementary science education, Mensah (2009) used the pedagogical strategy of Book Clubs to help transform the views of preservice teachers in science education. In a 16-week course, preservice teachers engaged in “informal peer directed group
discussions” (p. 1043) in the format of a Book Club. Book Clubs were intentionally assembled by Mensah to facilitate productive conversation and foster connections between preservice teachers. Through reading and discussion, the preservice teachers learned how a multicultural text aligned with science education and curriculum and were “forced” to reconcile their previously held notions of science and science education with ideas of diversity and equity. While Mensah acknowledged that teaching diversity is a challenging undertaking, it is nonetheless “vital to the education of every child, and the professional development of every teacher” (p. 1058).

Daniel (2009) pointed to the success of dialogue in the cohort model of teacher education. In this model, a diverse group of preservice teachers enrolled in a 9-month Bachelor of Arts program through a cohort model. Each cohort had a specific focus relative to a pertinent issue in education; the cohort in this study was focused on “diversity, inclusion, and global community connections” (p. 176). Through the use of discussion, teachers became vulnerable, shared personal narratives with other classmates, and engaged in conversation around race and education. The findings of this study suggested three areas of success. First, the role of the instructor was critically important to the success of the class. The instructors in this cohort model were from diverse backgrounds and had a vast understanding of race and systems of oppression. Second, the cohort was a diverse group of people, from ethnic background to sexual orientation, which allowed for multiple perspectives during class discussion. Finally, preservice teachers were able to use their personal experience and understandings of difference in other areas such as gender and class in topics on race. The power of the cohort model allowed preservice teachers to develop relationships with a diverse group of people, and
enabled them to engage in discussions that moved from “conversations of race from a theoretical space to a site of personal engagement” (p. 186). Through strong relationships, a diverse cohort, and impactful instructors, the cohort model facilitated learning for preservice teachers through productive dialogue.

In San Jose, California, an elementary school used Singleton’s (2014) “Courageous Conversations” model to discuss race in their school community after noticing achievement gaps between students of different races. Through learning about the racial biases that exist in their school, discussing them in the school context, and examining ways to reverse the systems, the school was able to make changes that erased the opportunity gap (a statistical measure of growth towards proficiency separated by racial groups) in one year’s time. Teachers sought to dismantle the bias they found in class selection, curriculum materials, and relationship with families.

Sealey-Ruiz (2011) argued it is imperative that teacher education programs allow future teachers to discuss and analyze personal experiences as they relate to race and racism. These examples show that sustained discussion—discussion that occurs over an extended period of time—can facilitate a change in biased viewpoints.

Second, in order for teachers to enact multicultural pedagogies, they must also engage in critical reflection, in addition to discussion, before they enter the classroom for the first time (Duncan-Andrade, 2005; Gay 2000; Howard, 2003; Kohli, 2008; Milner, 2006; Sealey-Ruiz, 2011). Critical reflection broadens Schon’s (1983) original definition of reflection as thinking about knowledge to apply it to a social context.

Howard (2003) explained that teachers must engage in “honest, critical reflection that challenges them to see how their positionality influences their students in either
positive or negative ways” (p. 197). Gay (2000) referred to this idea as a “careful self-analysis” (p. 71). Similarly, Sealey-Ruiz (2011) called this critical reflection “deep self-examination” in which teachers reflect on the influences of their own culture in order to improve their instructional practices.

**Theoretical Frameworks**

**Transformative Learning Theory**

Transformative learning theory, developed by Jack Mezirow (2000), describes the way in which adult learners make meaning of experiences that may be counter to their original beliefs.

Transformative learning refers to the process by which we transform our taken-for-granted frames of reference (meaning perspectives, habits of mind, mindset) to make them more inclusive, discriminating, open, emotionally capable of change, and reflective so that they may generate beliefs and opinions that will probe more true or justified to guide action. Transformative learning involves participation in constructive discourse to use the experience of others to assess reasons justifying these assumptions and making an action decision based on the resulting insight. (pp. 8-9)

Mezirow’s original study conducted in 1975 sought to examine the transformative experience of women as they reentered the workplace or secondary schooling (Kitchenham, 2008). In this qualitative study, he sought to identify factors that either helped or harmed the success of the women in the reentry programs (Kitchenham, 2008).

By frames of reference, Mezirow (1997) was referring to the “individual structures through which we make meaning of experiences” (p. 5). Meaning perspectives are the structure through which experiences are interpreted, based on past experiences (Mezirow, 1990).
Influenced by Thomas Kuhn (1962) and Paolo Freire (1970), Mezirow developed a theory around adult learning (Dirkx, 1998). From Kuhn (1962, 1970), Mezirow (1991) compared the analogy of the paradigm to his idea of “meaning perspective.” Mezirow equated Kuhn’s idea of the “paradigm shift,” the process through which revolutions occur in hard sciences, to the “crucially important learning dynamic” that adult learners experience (Mezirow, 1990, p. 12). Freire’s (1970) work showed the power of transformation of illiterate and semi-literate adults in Brazil as a form of emancipatory education (Mezirow, 1990). Through the influence of these three scholars, Mezirow (2003) constructed a theory of adult learning that was embedded in critical reflection and dialectical discourse.

Mezirow (1978) developed Ten Phases of Transformative Learning which he continued to refine over the course of the subsequent decades:

1. A disorienting dilemma;
2. Self-examination (with feelings of shame or guilt);
3. A critical assessment of epistemic, sociocultural, or psychic assumptions;
4. Recognition of a connection between one’s discontent and the process of transformation;
5. Exploration of options for new roles, relationships, and actions;
6. Planning a course of action;
7. Acquisition of knowledge and skills for implementing one’s plan;
8. Provisional trying of new roles;
9. Building of competence and self-confidence in new roles and relationships;
10. A reintegration into one’s life on the basis of conditions dictated by one’s new perspective. (Mezirow, 2000, p. 22)

Through this 10-step process, learners recognize a specific event, engage in critical self-reflection, and create a plan of action that can result in a change in world-view. Mezirow (1990) emphasized the importance of critical self-reflection, claiming it is “by far the most significant learning experience in adulthood” (p. 4). According to this theory, frames of reference can be transformed through critical reflection (Mezirow, 1997).
Four conditions for transformative learning as outlined by Mezirow (2000) are the presences of the other, reflective discourse, a mentoring community, and opportunities for committed action. The first condition—the presence of the “other”—stresses the importance of a diverse community of learners. In group settings, the idea of “us vs. them” can, through this theory, transform to a collective “we.” The second condition—reflective discourse, as mentioned above—emphasizes the importance of critical self-reflection that challenges one’s original frame of reference. The third condition—a mentoring community—recognizes the “the extraordinary power of the webs of relationships” (p. 115) in truly transforming one’s view. Finally, opportunities for committed action build on the prior three conditions for transformative learning. Once a learner has experienced learning in a diverse community group and has practiced critical reflection, he/she can then “test and ground one’s growing convictions in action” (p. 117). While Mezirow acknowledged that this is not an exhaustive list of conditions, nor are all of the above conditions necessary for transformative learning, they can be useful guides for those looking to engage in this theory.

Christie, Carey, Robertson, and Grainger (2015) demonstrated the application of the transformative learning theory in two case studies of adult learning. In a study similar to Mezirow’s first published work, Christie (1998) studied the transformation of women reenrolling in a graduate program in Australia. While the women faced challenges in this reentry program due to age and gender, they were engaged in Mezirow’s first of 10 phases of transformation, a disorienting dilemma, when they left their homes and returned to school. As their perspectives changed, they became more empowered, had “greater independence, personal integrity and eventually increased happiness” (p. 17). In
a study by Christie et al. (2015), the researchers used the transformative learning theory to help Papuan teachers at a university in Australia develop their language and pedagogical skills. After the 10-week course, the researchers found that the Papuan teachers had changed their teaching styles once they returned to Indonesia.

Though research on transformative learning theory is expansive, studies on the topic often rely too heavily on literature review and replication of similar studies (Taylor & Cranton, 2013). The authors also expressed the lack of research on European adult learners in transformative learning theory, while there is much research on other topics of adult education from European scholars. Additionally, the authors also expressed the need to incorporate the theme of “empathy” as a key component of transformative learning theory (Taylor & Cranton, 2013). Empathy is a common emotion that is elicited by critical reflection; however, it does not appear as a concept in Mezirow’s theory, nor in the literature when discussing transformative learning theory. Taylor and Cranton (2013) called for increased research that assesses the role of empathy in facilitating transformative learning in classrooms. While Mezirow’s transformative learning theory is cited prolifically in the field of adult education, critiques continue to encourage the theory to be refined and tested further (Kitchenham, 2008).

**White Racial Identity**

The White racial identity model from Janet Helms (1997) is defined as a “linear process of attitudinal development” (p. 211) in which White people develop a non-racist identity along a continuous spectrum. In this model, Helms adapted her original five-stage model to include six stages, separated into two distinct phases, as seen in Figure 2.1 below.
The first phase includes what Helms (1997) called contact, disintegration, and reintegration. The contact stage is the first in the linear process. In this stage, the White person has fear of Black and Brown people based on stereotypes often presented in the media or from limited cultural context. He or she is unconscious of race and is unaware of racism. People in this stage may make generalist statements about a race (Tatum, 1992). In the second stage of the spectrum, disintegration, the person experiences a range of emotions from guilt and discomfort to anger and shame. Upon learning about racial inequities, this stage “triggers recognition of moral dilemmas associated with being white” (Helms, 1997, p. 58). Feelings of denial, depression, or helplessness may be evident in this phase. The third and final state in first phase is called reintegration, where the person becomes consciously aware of his or her White identity. In this phase, the feelings from the prior stage may morph into feelings of anger towards another racial group for “causing” the discomfort.

The second phase of Helms’ (1997) White racial identity model include pseudo-independence, immersion/emersion, and autonomy. After the reintegration stage from
phase one, a person will enter the pseudo-independence phase when he or she begins to redefine a White identity. In this stage, the person no longer has a negative White identity, but does not yet have a positive White identity either. While a person’s beliefs may no longer constitute a racist ideology, his or her actions may not match. In the immersion/emersion stage, the person is able to redefine his or her White identity in a positive light, and is able to dispel any racial stereotypes he or she once believed. Discomfort in this stage may still exist, though with the newfound knowledge that he or she is able to see himself or herself as White. The final stage of Helms’ linear White racial identity model is autonomy. In this culminating stage, the person feels empowered to enact change and confront inequities in daily life. His or her views are no longer shaped by false stereotypes, and he or she is open to learning information from different cultural groups that might shed more light on inequities and how to combat them.

Beverly Tatum, a clinical psychologist, has taught classes about racial inequities since 1980. She uses this model of White racial identity formulated by Janet Helms as a guide to teach students in the university setting. In teaching her courses, Tatum (1992) provided her students with the model so they can personally identify the phase of development of which they are a part. Acknowledging the diversity of experience, she wrote: “It is not surprising that this developmental process will unfold in different ways” (p. 9). In addition to providing students with the model to reference, Tatum also stressed the importance of creating a safe classroom environment, space for self-generated knowledge, and exposure to actionable steps to combat racism.
**Racial Literacy**

Racial literacy emphasizes the relationship between race and power “in which race functions as a tool for diagnosis, feedback and assessment” (Guinier, 2004, p. 115). Twine and Steinbugler (2006) defined racial literacy as “a way of perceiving and responding to the racial climate and racial structures individuals encounter” (p. 344). Similarly, Stevenson (2016) specified racial literacy further as “the ability to read, recast and resolve racially stressful encounters that are conceptual, physical, emotional, social and societal” (p. 58). This occurs on a day-to-day basis that requires self-education and emphasis on learning rather than knowing in an interactive way (Guinier, 2004; Rogers & Mosley, 2008; Twine & Steinbugler, 2006).

Rogers and Mosley (2008) sought to understand how preservice teachers learned to teach literacy within a critical framework using book clubs. In the study, the researchers found that in order to facilitate racial literacy, disagreement and multiple perspectives must exist for participants to be able to see different viewpoints. Understanding what is not being said, as much as what is said, in order to decipher racial structures is equally important to becoming racially literate (Rogers & Mosley, 2008; Twine & Steinbugler, 2006).

In order for educators to become racially literate, Sealey-Ruiz (2011) argued that one must acknowledge that race plays a large factor in the inequalities that exist in the education system, read writings about racism, engage in critical reflection, discuss personal experiences as it relates to racism, and act against practices that promote racist ideologies.
Transformative learning theory, White racial identity development, and racial literacy are the three lenses through which I analyzed the data of Critical Voices. Each theoretical framework served as a framework for examining Critical Voices. First, transformative learning theory uses developmental stages to describe the change a person experiences while embedded in a learning experience. It focuses on critical self-examination to increase development and understanding of a phenomenon. Second, White racial identity addresses the linear process of discovery White people experience while addressing their own racial privilege. Finally, racial literacy focuses on the dialogue and words that are being used to articulate awareness, or the lack thereof, of race. Current teacher education courses do not often focus on race discussions within a specific subject domain, such as science. These theoretical frameworks require that the viewpoint be deeply embedded in race and the ways science teachers understand them.

In summary, this chapter opened with a review of the literature of K-12 teachers’ understandings of race. Research has shown that many teachers have biased views towards the students in their classrooms (Daniel, 2009; Kholi, 2008; Milner, 2010; Mutegi, 2013; Prime & Miranda, 2006; Rong, 1996). Therefore, researchers must take a hard look at the power structures in schooling through a critical lens, focusing on traditionally marginalized groups in society (Beyer, 2001; Bigelow, 2001). Many pedagogical approaches offer ways for teachers to bring minority voices into the classroom, including culturally relevant pedagogy (Ladson-Billings, 1995), culturally responsive teaching (Gay, 2000), and reality pedagogy (Emdin, 2011). Through critical reflection and discussion, teachers can learn how to implement these pedagogies and be agents of change in their classrooms. The theoretical frameworks that guided this study
are transformative learning theory, White racial identity, and racial literacy. The next chapter includes the methods and methodology for this study which sought to understand the essence of the experience of participants in the Critical Voices class through transcendental phenomenology.
Chapter III

METHODOLOGY

In this chapter, the research questions are first outlined. Then, the rationale for the qualitative research approach, transcendental phenomenology, is addressed. Next, the researcher experience is bracketed to acknowledge and address any bias that may exist. The context of the study, including a summary of the Critical Voices course and a description of the settings and participants, is explained. The data collection methods and data analysis methods are then explained with examples of how both were used in the study. To ensure sound data collection, validity, reliability, ethics, and reflexivity are addressed. Finally, limitations of the study are presented.

Research Questions

For this study, the research approach addressed the following research questions:

1. What are the lived experiences of science education graduate students in the Critical Voices classroom?

2. How does the pedagogical approach employed in the Critical Voices class impact how science education graduate students see science classrooms and science students?
3. In what ways did the Critical Voices course impact science education graduate students’ racial literacy?

**Research Approach**

**Qualitative Research**

Qualitative research, as explained by Creswell (2013), “begins with assumptions and the use of interpretive/theoretical frameworks that inform the study of research problems addressing the meaning individuals or group ascribe to a social or human problem” (p. 44). Commonalities among all types of qualitative research include studies that are conducted in natural, field settings as opposed to controlled settings, as in quantitative research, and generally are not designed to tests a hypothesis (Lichtman, 2010). In qualitative research, researchers interact with participants and engage in conversation within a given context. Additionally, the researcher plays an integral role in the collection and processing of data; while the researcher uses methods for conducting research, interviews and data collection are often open-ended (Creswell, 2013).

Qualitative research also relies on multiple methods of data sources. These data sources include interviews, field notes and observations, and written artifacts. Through the process of data analysis, qualitative researchers make meaning from the data and code the data into themes. From the themes developed, qualitative researchers seek to develop a “holistic account” and “complex picture” (p. 47) of the data. Phenomenology is one type of qualitative method that is used in this study to capture the experiences of science education doctoral students enrolled in the course known as Critical Voices in Teacher Education.
Transcendental Phenomenology

Pioneered first in the field of psychology by Edmund Husserl and used commonly in nursing research, phenomenology seeks to capture “the universal essence” (Creswell 2013, p. 76) of the lived experience within a defined phenomenon (Creswell 2013; Van Manen, 2016). Transcendental phenomenology seeks to describe the phenomenon of study through description of experiences (Creswell, 2013) rather than hermeneutical phenomenology, which seeks to interpret the personal experiences to make meaning (Van Manen, 2016). Transcendental phenomenology was used in this study to emphasize the descriptive aspect of the shared experiences of the science teachers who took the Critical Voices class.

I chose to follow the approach used by Moustakas (1994), adapted from Edmund Husserl, which first requires the researcher to “engage in the epoche” in order to “create an atmosphere and rapport for conducting an interview” (p. 13). The epoche, also called bracketing as mentioned by Creswell (2013), seeks to separate the experience of the researcher from the phenomenon of study as best as possible. The goal is to withhold judgment and examine the researcher’s own prejudices (Trainor & Graue, 2013). Within this idea, I, as the researcher, explain my positionality, experiences, and relationship to the research setting to gain a “fresh perspective toward the phenomenon under examination” (Creswell, 2013, p. 80). In addition, Chan, Fung, and Chien (2013) used the word “bracketing” as a pneumonic device to give researchers concrete steps to follow to reduce bias. In sum, these steps include: outlining the researcher’s personality, identifying bias, recording reflexive notes in a diary, bracketing participants’ bias when
necessary, maintaining unbiased curiosity when interviewing, and generating knowledge after data collection has been completed.

**Researcher Bracketing**

Currently, I am an 8th grade science teacher in a New York City public middle school, and a doctoral student in a science education program. I recognize my biases as a White female graduate student, seeking to research experiences of students in a class on race and power. Having been in the university setting for several years, I have become exposed to many different classes and readings on social justice, constructivist theories, and critical perspectives. I was enrolled in the Critical Voices class (Spring 2015) that is the context of this current study. While I did not experience the exact same interactions and dialogue as the participants in my study, I did see many of the same videos, read many of the same books and articles, and engaged in similar reflections and discussions as the participants in this study. I acknowledge that for many of the students in the class, this is the first time they have been exposed to conversations around race, gender, and power. As I interviewed participants and read through reflection notes, I was conscious that I was seeking to understand the experience of the participants, while withholding my own experiences and judgments as best as possible.

My role in this research is that of a participant observer (Merriam, 2009). Over the course of the semester (Spring 2017), I sat in the class, took notes, completed readings, and participated in group activities as well as small and whole group discussion. I completed the course in the spring of 2015 as a doctoral student in the science education program. Drawn to the topic of race conversations as it applies to science education, I sat in the course again as a researcher. While I did not complete written assignments or the
final project, I participated in both small and whole group discussions as a participant observer (Merriam, 2009). Additionally, I reread many of the course readings, re-watched all of the video clips, and completed the group work during class with the students enrolled in the course.

**Context of the Study**

**The Critical Voices in Teacher Education Course**

The course Critical Voices in Teacher Education (Critical Voices), developed by Dr. Felicia Mensah (2017), uses discussion and critical reflection in the class sessions to help students form understanding around power and privilege in education. It is grounded also in critical perspectives with racial literacy as a goal (Sealey-Ruiz, 2011; Twine & Steinbugler, 2006).

At the beginning of every class, students watch a short video clip. Some video topics include interracial relationships, race experiments, a news segment about stop and frisk, and standardized testing. Students are allotted 5 minutes to write a “Pre-Thought” reflection, which includes any ideas or feelings related to the video clips.

The structure of every class is discussion-based. Students are given tasks to complete in small groups first based on the assigned readings. After students have adequate time to discuss in small groups, each group shares the main discussion points with the class as a whole. After all groups have shared, an open discussion including the entire class usually takes place. Before class concludes, students complete a 5-minute “Post-Thought” reflection, either in response to a specific question or as a reflection on the day’s class. The structure of the course is relatively the same for each meeting.
During the last two meetings of the course, students present group projects to the whole class.

Critical Voices is not simply a course designed to relay information from instructor to student. It is a vehicle for change, through which science educators are able to wrestle with ideas of power and racism. Science educators are able to tell their own narratives through discussion, interact with one another for extended periods of time, and engage in critical reflection in the hopes of shifting their understanding of how race is embedded within their science classrooms. This pattern is repeated week by week, in the same format within varying topics. In facilitating sustained discussion and allowing critical reflective practices to become habit, the science teachers in the course have an opportunity to come to their own understandings of how race and power play significant roles in their science classrooms.

Setting and Participants

This study took place at a large university in an urban setting. The study included a semester-long course, Critical Voices, that met once a week for a total of 14 times during the Spring 2017 semester. The course included 16 doctoral students: 15 students were female and 1 was male. The majority of the students had a background in science education. The class was racially and ethnically diverse. This setting was chosen because it allowed for an extended period of time for students to discuss and reflect upon the ideas of critical perspectives and race and racism in U.S. education.

Participation in this study was open to all students in the course who were enrolled in the science education graduate program and who completed the course with fewer than three absences. Attendance was important to the study because in order to
gain an understanding of the essence of the experience, participants must have had good attendance in the course and completed all of the assignments required by the instructor. “Good” attendance is defined as no more than two absences, excused or unexcused, in the semester.

An approved study protocol from the Institutional Review Board (IRB) Office of the university was granted (Appendix A). After obtaining IRB approval, I sent an invitation to participate in the study through email and in person when given space in class to tell students about the study. Thus, all students who were enrolled in the Spring 2017 course received an invitation to participate (Appendix B, Invitation). The invitation explained the topic of study, the duration of interviews, and an outline of the ethical protocols, including removing identifying information, security of all data, and verification of transcripts before and after analysis. The Consent Form for those who wanted to participate in the study was returned (Appendix C).

Data Collection Methods

Several different data sources were collected in this phenomenological study. The data sources were qualitative in nature (Merriam, 2009) and were collected from the eight participants who volunteered to be in the study.

First, participants completed a demographics survey (Appendix E) to self-identify race/ethnic background. They identified themselves as a teacher of color and provided their age, years of teaching experience in K-12 settings, and number of graduate-level courses taught.

Second, field notes were taken during each of the 14 class sessions. Field notes provided information that explained the activity and discussion points, direct quotes from
group discussions, as well as any inferred observations that were not explicitly stated, including body language or conversations that were interrupted.

Third, student reflections were used to examine the sentiments and opinions of each participant over the course of the semester. The student reflection document was a single document that each participant updated every class session. This document included Pre- and Post-Writes for each class, a written assignment labeled in this document as Reflection on Race and Identity, student notes from the weekly readings, student notes taken in real-time during class, and an end-of-year Course Evaluation. The Pre- and Post-Writes occurred in the first and last 5 minutes of every class. Students were given a question prompt, video, or image and asked to reflect in writing for the 5 minutes. In the second session of the course, students were asked to reflect on their own identity in a short essay. The end-of-year Course Evaluation asked students to reread their student reflection document and comment on individual changes over time, implications for teacher education, and comfort with conversations centered around race. These reflections were used to gauge the essence of the experience while in the course sitting in the classroom setting, in real time during each class of the semester.

Finally, participants completed semi-structured interviews as dyads (Appendix D, Dyad Interview Protocol). The dyad is useful in this case because it provides an opportunity for social interaction, like a focus group, but does not compromise depth of responses from participants (Morgan, Ataie, Carder, & Hoffman, 2013). The dyad also provides a different data source, separate from the written individual reflection document, and the researcher field notes. Participants were sent the interview questions via email several days before the interview. I recommended to the participants in the email that
they review the student Reflection document prior to the interview to refresh any memories they held. Participants were allowed to bring in notes and computers in order to have access to their Reflection documents as they spoke in the interview. I provided each participant with a copy of the course syllabus (Appendix G, Critical Voices Syllabus) for reference. Interviews took place in the evening between May 10-30, and lasted between 90 and 120 minutes. The Dyad Interview Protocol questions were adapted from questions suggested for phenomenological interviews by Clark Moustakas (1994) in order to understand the big picture of how participants experienced the class. A third-party transcription service transcribed the interview data which eliminated any transcription bias from the researcher. The transcripts were read and checked for errors before analysis was done.

**Data Analysis Methods**

To analyze the data, I first revisited the proposed question of the study: “What is the lived experience of science teachers in the Critical Voices class?” A description of the data analysis method follows as well as a diagram, as shown in Figure 3.1 below.

Next, I bracketed my experience as a participant observer, acknowledging the biases that existed and separating the experience of the researcher from that of the participants (Creswell, 2013; Moustakas, 1994). I read each data source (field notes, participant reflection journals, transcripts of interviews) several times to get an overall feel for the data (Creswell, 2013). During the second read-through of the data, I began initial coding. All interview transcripts and student reflections were printed, and as I read through the data, I labeled themes with codes in the margins. For example, every time the
Figure 3.1. Data analysis methods
word “race” or “awareness” appeared in the data, either explicitly or implied, I wrote the code of the word next to the relevant quote.

When reviewing data sources, Moustakas (1994) explained clear steps of data analysis in transcendental phenomenology. First, he emphasized the importance of horizontalizing, which is “regarding every horizon or statement relevant to the topic and question as having equal value” (p. 97). Once significant statements are identified, they are grouped into clusters of meanings and repetitive statements are removed (Creswell, 2013; Moustakas, 1994). For example, statements mentioning “race” or “awareness” from all participants in all data sources were identified, and grouped together in a document online under each respective heading. Some significant statements were given two codes, and thus appeared under two different theme categories.

Next, I assembled a textural description of the experience. According to Moustakas (1994), this “includes thoughts, feelings, examples, ideas, situations that portray what comprises an experience” (p. 5). The textural description allows the researcher to develop the essence of the phenomenon, the “essential, invariant structure” (Creswell, 2013, p. 82) of the experience. For example, once the significant statements were assembled, I was able to get an overall feel for the data. From the significant statements, I determined that the experience of participating in the Critical Voices class was a transformational experience, in which participants grew as individuals through powerful discussion and personal reflection.

Through this data analysis, I was able to understand how science education graduate students experienced the course Critical Voices, and more specifically the feelings and thoughts that students experienced while participating in the class.
discussions and reflections. In asking broad questions about the course itself, and more specific questions about race and science, I was able to find emergent themes that served as the undercurrent for the experience in the Critical Voices course.

**Validity and Reliability**

In this study, multiple data sources were used to triangulate findings in the data. Interviews, field notes, and reflective journals were cross-referenced to provide “corroborating evidence from different sources to shed light on a theme or perspective” (Creswell, 2013, p. 251). During interviews, participants often referenced writings in their reflective journals and elaborated upon their writing in the interviews. This provided a way for participants to reinforce important information in their journals and to clarify any vague points or holes in their writing.

Researcher bias is bracketed and clarified to acknowledge potential bias and demonstrate validity (Chan et al., 2013). In this study, I addressed my role as the researcher earlier; furthermore, my position as a White female science teacher who works with a majority Latino middle school population also increased my interest in understanding the participants’ experiences in the course. As a graduate student, I have taken the Critical Voices course, and as a researcher, experiencing the course for a second time allowed me to experience it differently as a learner, a researcher, and a White woman. While I can never completely separate my race, gender, or past experiences from this study, in acknowledging my own position I can more clearly explain to the reader my potential biases and how they may interact with the themes I drew during the data analysis and how I reported the findings.
**Ethics and Reflexivity**

Eight participants, all female, elected to participate in the study, and they were given the option to discontinue their role at any time. Topics covered in the interview questions have the potential to cause emotional responses, especially when students are asked to speak about potentially uncomfortable topics such as race and power. While engaging in the dyad interviews, I monitored participants’ mental state while the interviews took place. I gave each participant the opportunity to answer every question in the dyad, but also allowed participants to pass on a question if they did not wish to answer.

**Limitations**

The purpose of this study was to examine the experiences of science majors in the Critical Voices course through a phenomenological method approach. Due to the limited sample size of eight participants, all of whom were female doctoral students, this study cannot be applied to other groups of science education students and thus only shares the findings for this particular participant group. The data would likely have been different with male participants, with participants from different backgrounds or ethnic groups, or with students who are earlier in their education (masters or undergraduate students, for example).

Five of the eight participants identified as White, thus causing much of the data analysis to focus on White racial identity development. The data analysis did not focus on Asian or Asian American racial identity development, nor did it focus on Iranian American racial identity development. This is a limitation because, for three of the
participants, the process of racial identity development was not outlined or analyzed within a specific framework as it was for the five White participants.

The participants also self-selected to take the course, implying that the desire to learn about Critical Voices in Teacher Education might already exist among some of the students in the class. This indicates some bias toward a desire to learn about and engage in the topics in the courses.

Additionally, the interviews of participants were conducted one full year after the course was completed. Due to the time that elapsed, participants needed to refer back to their journals at times to remember parts of the course, as certain memories were not fresh in their minds.

**Summary**

In sum, Chapter III laid out the phenomenological methods used to address the three research questions of this study. The role of the researcher as participant observer, setting and participants, data collection and analysis methods, ethics, and reflexivity were addressed to ensure transparency throughout the research process. Chapter IV addresses the participant profiles and findings of the study.
Participant Demographics and Profiles

Participant Demographics

The course under study was held within a large university in an urban setting. Students who wish to enroll in science education are within the Department of Mathematics, Science and Technology. All participants in this study were enrolled in a doctoral program in science education at the time of the course in 2017, and all were female. At the time of the interviews in May of 2018, one student had graduated from the university with a Ph.D. in science education. The participants self-identified as they chose, thus showing a diversity in ethnic/racial backgrounds. Three participants identified themselves as a Teacher of Color (woman of color),\(^1\) while five did not. The age of participants ranged from 25 to 33 years, with the average age being 29. Years of science teaching experience ranged from 0-6 years, with the average being 4.5 years. Most participants had not taught at the university level. Two participants taught one course each at the university level, and one participant has taught more than five courses at the university level. All participant names in this study are pseudonyms.

\(^1\) Teacher of Color and woman of color are self-identified in this study, and defined as anyone from non-White or European descent.
Table 4.1

**Participant Demographics**

<table>
<thead>
<tr>
<th>Name</th>
<th>Race/Ethnic Background</th>
<th>Teacher of Color</th>
<th>Age in Years</th>
<th>K-12 Science Teaching Years</th>
<th>University Courses Taught</th>
</tr>
</thead>
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<tr>
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<td>Iranian American</td>
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<td>6</td>
<td>0</td>
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<td>Cynthia</td>
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<td>4</td>
<td>1</td>
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<td>Emily</td>
<td>White</td>
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<td>28</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Erin</td>
<td>White</td>
<td>No</td>
<td>33</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>Jenna</td>
<td>Caucasian/Irish</td>
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<td>25</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Kate</td>
<td>White</td>
<td>No</td>
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<td>0</td>
</tr>
<tr>
<td>Lifen</td>
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<td>0</td>
</tr>
<tr>
<td>Rebecca</td>
<td>White</td>
<td>No</td>
<td>30</td>
<td>6</td>
<td>5+</td>
</tr>
</tbody>
</table>

**Participant Profiles**

**Arianna.** Arianna is a 30-year-old Iranian American woman and follower of Bahá’í Faith. She spoke passionately about her faith; it is the core of her identity. She identified as a woman of color, though she recognized that due to her appearance, her perceived race by others depended a lot on context. She stated:

To my mostly Black students in Brooklyn, I was a White lady. To my mostly Muslim students at another school in Brooklyn, I was Middle Eastern. When teaching in California my mostly Latino students saw my features and assumed I was Latina. (Reflection on Race and Identity, January 30, 2017)

Arianna taught science in K-12 schools, and now works for a technology consulting company. She is enrolled in a doctoral program in science education.
Cynthia. Cynthia is a 29-year-old interracial female who identified as a woman of color. She is of Hawai’ian and Chinese descent, and therefore is both Asian and Pacific Islander. Cynthia attended private school for her K-12 education. She compared her schooling to the public school where she now works:

I came from a very privileged family where I was able to . . . I went to private school my whole life and I used to think “Oh my God, it’s so annoying. I work so hard.” And then, when I’m now teaching in a public school, seeing what I was complaining about is nothing compared to what some of my students go through. (Interview, May 17, 2018)

Cynthia teaches sixth grade science and ninth and eleventh grade health. She has taught science for 4 years and has also taught one university-level course.

Emily. Emily is a 28-year-old White female who is the daughter of an immigrant and raised by a single mother. She split time between parents as a child and grew up in a community of working-class Eastern European and Black families. Her first memory of race in education was as an elementary school-aged student:

My first memory of race in education is of my mom arguing with our neighbors as she defended her choice to send me to the elementary school allocated for our side of town. Our neighbors urged that I would not survive in the mostly Black and Hispanic school and that the education would not be as adequate as that of the other eight elementary schools in town. . . . I look back and can see that our neighbors perpetuated ignorance because of their fears and insecurities about race in school. (Reflection on Race and Identity, January 30, 2017)

Emily also recalled being tracked in honors classes because she was White.

Erin. Erin is a 33-year-old White female who has taught high school chemistry for 9 years. She was raised in a small college town, is the middle of five children, and describes her upbringing as “modest.” When describing her ethnicity, she did not identify with any group in particular:
I feel like I do not have an ethnicity. I don’t really know what ethnic background to feel attached. I mean, can American be classified as an ethnicity? I feel like it’s not acceptable to just classify yourself as American. And if you do, then I feel that is considered pretentious by some people. My family heritage is from Europe, but I don’t know much about who, where, or when. That makes me feel kind of sad sometimes because I do not feel that connected culturally to any group or place. (Reflection on Race and Identity, January 30, 2017)

**Jenna.** Jenna is a 30-year-old Caucasian/Irish female, enrolled in a doctoral program in science education. She has not taught in the K-12 setting, but she has taught one course at the university level. She graduated from the doctoral program in science education with an Ph.D. in May of 2018. Jenna grew up in a mostly White, affluent suburban upbringing. She described race conversations during her upbringing as a “topic that was mostly swept under the rug” (Reflection on Race and Identity, January 30, 2017).

The mere thought of the lack of equity and diversity both in the school and in the way the school perceived its students inspired me to embark on a journey where I specifically was looking for educational opportunities that would help me to understand my identity and be surrounded by various cultures, dreams, and aspirations. (Reflection on Race and Identity, January 30, 2017)

**Kate.** Kate is a 27-year-old White female who is enrolled in a doctoral program in science education. She has not taught formally in the K-12 setting or at the university level. She described her background:

I grew up in a predominantly White, suburban town lacking any racial diversity whatsoever, save for a few people of color. Having attended a public school where almost every other student looked like I did, I never thought about how race could impact a learning experience and mostly thought of learning as a culture-less process. (Reflection on Race and Identity, January 30, 2017)

Though Kate did not consider her professor’s race at the time, upon reflecting at the beginning of the semester of the Critical Voices class, she shared the desire to know more about her African American professor’s life story.
**Lifen.** Lifen is a 28-year-old Asian female who identified as a woman of color. She is also an International student, and she spoke about her identity and her feelings about her status:

As an international student here, I am not an American, I am a Chinese in American context. This allows me to see the U.S. context and education system from distinct perspectives. (Post-Write, May 9, 2017)

She has taught middle school science for 2 years.

**Rebecca.** Rebecca is a 30-year-old White female, who has taught science for 6 years in boarding schools in New England.

I have always tried to consider the ways in which race has impacted my students, not just their races, but mine as well. As a White woman, I bring a certain image of what it means to do science and who has access to that science. I do not necessarily, just in my exterior attributes, disrupt White-centered, Western normative ideas of scientists, with the exception of my femininity, and I can certainly recognize the ways in which, particularly early on in my career, I reproduced White-centered, masculine science classrooms, perhaps to the disadvantage of many of my students. (Reflection on Race and Identity, January 30, 2017)

As a student, she also attended one of the boarding schools where she taught. Rebecca has taught high school science for 6 years, and she has taught more than five courses at the university level. She is currently enrolled in a doctoral program for science education.

**Summary**

In sum, these eight female science education doctoral students were introduced briefly in this first section of this chapter. This profile information provides the reader with how the participants identified their race and ethnicity, if they identified as a teacher of color, and their age, years teaching science in K-12 schools, and number of university-level courses taught. The next section describes the findings from all data sources used in this study.
Class Format, Personal Transformation, Racial Literacy Development

Three major themes emerged as a result of phenomenological and qualitative data analysis. These themes then were organized into three major sections: class format, personal transformation, and development of racial literacy.

Class Format

In the semester-long Critical Voices course, the structure of the course proved to have a high impact on participants. First, students were engaged in critical reflection twice a session, at the beginning and again at the end of class. Second, the majority of the class time was spent engaged in discussion, both in small groups and as a whole class. Seats were changed frequently to encourage variety in small group instruction. Finally, the role of the professor as facilitator was also significant. The course instructor never engaged in lecture style, but had student presenters almost every class who were responsible for organizing the discussions.

Critical reflection. A key component of the course was critical reflection. Students in the class engaged in written critical reflection twice per class session. At the beginning of the class, students were shown a short video clip, an image, or a written prompt. They were given 5 minutes to reflect on the media. Students’ written reflections were stored in a personal Google Document that became a running record for the class. At the end of the class, students were again given 5 minutes to reflect on the class session. Sometimes students were given a specific prompt, and other times students were simply asked to reflect on the class as a whole as they wanted.
Participants not only saw value in the class reflection time, but also recommended it as a necessary practice for new teachers. Erin shared that “the Pre- and Post-Writes helped me to reflect on a variety of issues surrounding race and equity. I felt that this time was valuable to my personal growth” (Post-Write, May 9, 2017). Rebecca agreed, “I primarily got out of this course was the time and space to reflect on all of that [issues surrounding race and equity]” (Interview, May 24, 2018). Rebecca also shared her personal experience with reflection during the course, and looking back, realized that reflection was not a built-in practice she participated in as a teacher:

It was nice to have time to reflect on my own positionality in terms of race and education. While I have been able to have some of these conversations in the schools I’ve taught at, I’ve never really felt like I had the time to reflect and consider the effects of my positionality on students. (Course Evaluation, May 9, 2017)

The professor asked students to reread all their reflections over the course and write a Final Thoughts paper. Doing this was helpful to the participants. For example, Lifen did not realize the power of the reflective practice until she went back to read her reflections after the course was over:

The weekly reflection pushed me to reflect on various issues faced in teacher education within a context of diversity. I did not realize how much I’ve learned until I went back to read what I had written a few months ago. My understandings of teaching and teacher education have changed a lot as the course went. (Interview, May 17, 2018)

Lifen was then able to translate the practices of reflection into her science classroom: “I do have my kids do a lot of reflection, in terms of how they think their culture or my culture may influence their learning of science” (Interview, May 17, 2018).

Arianna also took the practice of critical reflection and applied it to her work as a professional development (PD) facilitator: “I really see the value of it [critical reflection],
and I’ve tried to incorporate it into my own PDs that I’m running, [though] with mixed results” (Interview, May 31, 2018). In discussions about critical reflection in professional development, Arianna shared frustrations with time constraints, and working with teachers who had not been trained to reflect critically.

**Discussion.** The majority of class time was spent engaged in discussion. Students were regularly divided into tables. They were given a task or discussion point, and first asked to discuss as a small group of three to five students. After sufficient small group discussion, groups took turns sharing out main takeaways from the small group discussion. Toward the second half of the class, the class would engage in a whole group discussion. Often during this time, students shared personal experiences as they related to the class topic and readings. Erin found this discussion time valuable to her personal growth: “I learned a lot from other people in the class and their experiences” (Interview, May 10, 2018). Emily shared: “I have developed a deep appreciation for discussion as a platform for growth and change” (Course Evaluation, May 9, 2017).

The discussions were also important in that students learned about each other and learned to develop racial literacy. For example, Kate expressed her lack of understanding of racial issues prior to the course and how hearing from others in the class allowed her to become more aware of racial issues in education:

Hearing how these students [in our class] have been oppressed and othered by the structural forms of oppression in the educational system has made me feel ignorant and that I lack sufficient understanding of what others’ have experienced. I have also become hyper aware of my Whiteness in the context of schooling and my lack of understanding of how race can influence learning. Hearing these anecdotes has begun to help me understand these inequalities through the lens of my peers’ perspectives. (Reflection on Race and Identity, January 30, 2017)
In interviews a year later, Kate reflected on the importance of the discussion component of the course and its impact on her personal growth: “I believe that many of the conversations we had planted ‘seeds’ in me that will later develop into moments of insight as I continue my work using a critical lens towards race and racism in education” (Course Evaluation, May 9, 2017).

**Role of professor.** The role of the professor in the class was an integral part of the course. The professor rarely addressed the class when others were leading the discussion. Instead, she observed, took notes, and on rare occasion contributed. She actively participated in the activities and in small group discussions, and she circulated from table to table. Rarely, the professor interjected or shared her opinion or outlook. She allowed the class discussion to unfold organically, even if it meant the discussion took a path that she did not necessarily intend. Rebecca described the professor as an “architect” who “designed a framework . . . so the scaffolding is there, but the way that the floor gets put together looks different each day” (Interview, May 24, 2018). Arianna referred to the professor as a “guide on the side, facilitating for sure” (Interview, May 31, 2018). Jenna agreed, and classified the professor as a “participant observer” (Interview, May 31, 2018). Emily explained the purpose of having a professor that took on the role as facilitator instead of lecturer:

> I think by not talking you were supporting us more. We could really test the boundaries. As a class we came up with our own playing rules. That was a tremendous learning moment socially and also as a teacher. Realizing that you can let people talk and we’ll figure it out. By not saying things, I felt like you were saying, “Go ahead, you can talk. You could say whatever you wanna say.” (Interview, May 10, 2018)

In taking on the role of the facilitator, the professor did not ever answer any explicit questions that students posed, but instead let the class discuss and offer their own
perspectives. Even in times of silence, she did not step in. “You forced us to struggle” (Interview, May 17, 2018), Lifen recalled.

**Personal Transformation**

Each participant showed personal growth and development as a result of the course. First, through self-examination, participants explored new roles in the classroom setting. Second, participants experienced an increase in identity development as well as personal privilege. Additionally, participants experienced emotional responses throughout the course that prompted further reflection and personal growth. Finally, participants experienced many different emotional responses that aided in their transformation.

**Exploration of new roles.** Through critical reflection and self-examination, participants explored new roles in the classroom as a result of participation in the Critical Voices course. Participants shared feelings of being more authentic in the classroom, both with K-12 students and in higher education.

The teachers working with students in the K-12 setting explored new roles when working with middle and high school-aged science students, especially with regard to their classroom structure and management. Erin shared an experience with a student of color in her chemistry class: “I think one thing that stood out to me was the behavior thing. What I view as negative behavior has changed. Especially as I’ve become more sensitive to race in general” (Interview, May 10, 2018). Similarly, Lifen shared a transformation in her views:
I can feel that my philosophy of teaching in the US has changed. Now I understand that it is fine to teach diverse students because they have similarities as Asian kids. What students bring in the classroom is important and that is where I should start my teaching. (Post-Write, May 9, 2017)

Lifen also was able to connect her experiences as an immigrant to the English Language Learners in her classroom: “The other thing that I sort of learned from this process is that it’s not a bad thing for a teacher to admit that you’re not perfect. My English is not perfect, and I have a lot of kids who are also second language learners, so their English is not perfect” (Interview, May 17, 2018).

As a teacher educator at the graduate level, Jenna shared the interconnectedness of multicultural education and identity development. In planning a course of action for her graduate students, she not only recognized growth through her own self-examination, but took it a step further by planning how her newly acquired knowledge could be applied in a graduate-level setting:

I learned a lot about how to actually be mindful of multiculturalism in classrooms and how to help teachers to develop classrooms that can efficiently utilize culturally relevant pedagogy. I also learned about the power of flushing out positional identity and the development that should be happening with teachers around their identities and not just their practice, as these are intimately connected and TE’s cannot focus on one without talking about the other. (Course Evaluation, May 9, 2017)

Jenna also translated this connectedness and transformation to her job search, as she completed her doctorate degree. In deciding where to look for a job, Jenna reintegrated her new understandings into her life based on her new perceptions. She decided to look only for jobs that aligned with her new perspective, thus providing Jenna an opportunity for committed action:
Not everyone is going to have the change that I had but I view my change as so significant going forward into the world right that now I won’t apply to certain jobs if I know they don’t have a sociocultural informed view of education or whatever it is. (Interview, May 31, 2018)

**Increased awareness and understanding of privilege.** All participants discussed an increased awareness of White privilege as a result of the class. Participants shared this insight in real time in their Pre-and-Post-Writes during class, and also during the interviews a year later. During the dyad interview, Cynthia described the class as “eye-opening” (Interview, May 17, 2018). Jenna described her transformation as her ability to “lift the veil of White guilt and constructively develop an identity that contributes to multicultural/race conversations” (Course Evaluation, May 9, 2017).

Participants cited the “Privilege Walk” as a transformative activity that increased their level of awareness around race and privilege. The “Privilege Walk” was referenced several times as an activity that generated a lot of emotion from participants. During the Privilege Walk, students line up shoulder to shoulder with one another. Students are then asked a series of questions. If the student response is “yes,” the student takes a step forward. If the student response is “no,” the student takes a step back. Questions address privilege in a range of categories including gender, race, socioeconomic status, and family education level. For example, with the question, “Are you the first in your family to have a college degree?”, participants respond by moving forward or backward in the line. After a series of questions, participants are asked to look around the room and note their position relative to everyone else. After the activity, the class engaged in discussion.

After the activity, the participants engaged in discussion and then reflected on their privilege. Emily shared in her Post-Write after the Privilege Walk activity the desire to self-reflect and examine her own perspective: “In class today I really wanted to better
explain myself” and “I am probably saying something out of ignorance.” “I need to reflect on today’s conversation more than expected” (Post-Write, March 21, 2017). In this Post-Write, Emily, a White female, is referencing a comment she made about the size of steps she took during the Privilege Walk. Emily shared that at times when she took a step back during the Privilege Walk, she made her steps smaller because she did not feel as though what she went through was as bad as what others had to go through. This explanation elicited a response from several in the class, including a Black female classmate, who shared that, in essence, deciding to take a small step back was another form of exercising White privilege. While in real time Emily did not appear to fully understand the message of her Black female classmate, she wrote in her Post-Write the desire to reflect further and reexamine her own perspective in the activity.

Erin also cited the Privilege Walk as a transformational experience in awareness of her racial privilege: “I feel like since that I’ve kind of accepted more that I’m privileged. Like maybe before I didn’t” (Interview, May 10, 2018). Kate reflected on the activity in the dyad interview, sharing, “I do remember the privilege walk and feeling very aware of the privileges that I have, and almost a sense of guilt for having certain privileges and being able to visibly compare myself and location to where other people were standing” (Interview, May 24, 2018). The physical model of privilege, people standing in different positions in a room, took the concept of privilege and made it tactile. Kate’s sense of guilt demonstrated her entry into the process of self-examination. In Pre- and Post-Write journal writings, Kate shared, “I now understand that personal awareness and understanding of race is an ongoing process of action, rather than a static state we are attempting to reach” (Course Evaluation, May 9, 2017).
Arianna explained that while she identified as a woman of color, she was often perceived as White, thus affording her privileges in different spaces:

My gender as a woman is a big identifier, but I cannot divorce that from the fact that my perceived race is White which gives me certain privileges. Being educated and having a suburban upbringing with a family that was upper middle class, I have so many monetary privileges that contribute to who I am and the way I see the world. Before this class, I didn’t feel like these things mattered as much, but now I acknowledge that they do contribute to my identity. (Post-Write, May 9, 2017)

Arianna recognized that because race is based on context, even though she identified as a woman of color, others might not see her as a woman of color. Straddling this boundary, Arianna started to understand how her perceived White identity afforded her other advantages and privileges that another woman of color might not have.

**Emotional responses.** This course elicited emotional responses—weekly and often during different stages in class. Participants cited emotion during group discussion and in reactions to the media. These types of emotional responses developed further critical reflection and questioning from the participants.

White teachers expressed discomfort and fear when speaking out in the Critical Voices setting. Emily expressed her insecurity stemmed from “being a White student talking about issues perpetuated by White people” (Course Evaluation, May 9, 2017). Emily’s awareness of her White identity was heightened in the Critical Voices class, and the quote above displays her struggling with the moral dilemma of being White. Kate shared similar hesitancies and questioned the effectiveness of conversations at times: “I felt many moments of not being comfortable discussing these issues. At times it felt as though we were talking about race, but not in a productive way.” She explained that she did “remember [the class] feeling almost a little tense at times. Maybe anxious is the right
word” (Interview, May 24, 2018). Fear, anxiety, and discomfort discussing issues of race showed Kate’s process of self-examination as well as a disintegration in her development of White identity.

Fear of perception stopped Erin from sharing to the fullest extent. Erin also showed evidence of self-examination and disintegration with her White identity:

I felt like there were times I wanted to say things, but I didn’t because I was afraid of how it would be viewed. Because like the ‘White privileged girl’ there were times I felt uncomfortable. I probably didn't say things because I don’t wanna offend anybody. (Interview, May 10, 2018)

Emily did not realize her fear in expressing her opinions until after she went back to read through her reflections:

I realize, after looking at all of my entries throughout the semester, that I am afraid to talk about race explicitly. I did not expect to find that I was continuously uncomfortable talking about race. I see throughout my journals that I skirt around the issue of race when talking about systems of oppression. Moving forward, I recognize that I need to confront issues of race in my writing and in my contributions to education. (Course Evaluation, May 9, 2017)

While emotional reactions were strong, not all were negative reactions. For instance, Arianna recalled feeling moved during discussions that she felt strongly about:

What makes the discussion challenging for me is that it brings out a lot of emotions in me. I feel very passionate and have strong reactions when I hear and see injustices and those feelings do not leave me when I leave the classroom. (Interview, May 31, 2018)

Participants shared feelings of fear, isolation, and anxiety when sharing about confronting discrimination and racism at work. While participants felt as though the Critical Voices classroom environment was a safe space, much of the hesitancy to speak out outside of the Critical Voices classroom stemmed from the fear of the unknown. While the classroom setting implies a type of unspoken professionalism in conversation, bridging conversations about race at work did not have that same level of comfort.
Emily felt isolated in her work environment, a school of entirely White teachers. Although Emily also identified as White, she did not feel comfortable initiating difficult conversations around race for fear of her job security and being ostracized from her coworkers:

“I feel nervous about being isolated. I’m a little insecure in that way too. I don’t know what type of ears I’m working with. I get nervous that it would be an isolating situation and that’s cowardly, but that’s how I feel. That’s something that I struggled every day because of this class, which is a good thing. It’s a good struggle to have. Because at least I’m experiencing it and not ignoring it.” (Interview, May 10, 2018)

While she acknowledged the reality of her feelings, the Critical Voices classroom helped Emily to see inequities around her that come up in her school setting.

Jenna explained her fear in the context of not being able to anticipate the response from an individual whom she might be confronting. “I think a lot of the fear stems from like because it’s so emotional and it’s so negative for a lot of people. You always jump to what the worst possible thing that’s going to happen” (Interview, May 31, 2018). Arianna agreed with the fear of the unknown as expressed by Jenna:

“I mean this is . . . I guess it’s fear . . . I’m brave to an extent; it’s kind of a fear of the unknown. You don’t know what someone’s going to say to you. Yeah and that doesn’t make it okay to like not say something, but in the moment it’s like forty-five minutes, and it’s not like something I’m proud of but something that I definitely need strategies. More strategies and more practice addressing. Because like you said, awareness is there but now that I’m hearing and seeing it more and more often I just . . . I feel like . . . somebody who’s in a little bit in a cage. I know all these things and I want to burst out and do something but I feel like . . . I don’t know how or what.” (Interview, May 31, 2018)

Arianna’s fear was unique to this set of participants. As a graduate student conducting professional development workshops, she was often in front of teachers she had not met when doing professional development workshops.
Racial Literacy Development

In addition to personal transformation, teachers also experienced racial literacy development in the ways they were able to use language, display empathy, implement strategies in the science classroom, interact with family and friends, and see themselves as agents of change.

Use of language. Both Emily and Erin felt more equipped to engage in conversations surrounding race, in part because of the vocabulary they had developed from the course. In looking back at her reflections, Emily drew from new vocabulary words that she now felt empowered to use in discussion. “Well, colorblindness is one, multicultural, multicultural education. I wanted to see where I was mentioning that in my journals. Culturally relevant I used a lot in the beginning” (Interview, May 10, 2018). Emily shared that her comfort with language and discussing race as the course progressed throughout the semester, though she did not name race in the text below, suggesting that some discomfort still existed:

I didn’t feel as brave to talk about it [race] before class. After the class I felt like I had words to use and language to use and there are people’s language. Like people that, together as a group, we developed our own conversation that I could then release and turnkey and use again. I used the same questions and the same thoughts that other people asked me that helped me change or at least evolve my perspective or something. I used those in our conversations [with people outside of the course]. (Interview, May 10, 2018)

Erin expressed increased comfort in discussing race and racism in writing and in discussions: “I now feel that I have more facility using the language related to race and racism that will help me to continue to write about and have these conversations in the future” (Interview, May 10, 2018).
**Display of empathy.** Erin and Cynthia, both current science teachers, expressed increased empathy for students in their science classes. This connection to students demonstrated an understanding of the mission of multicultural education—to connect with students, understand where they are coming from, and interact with students in a compassionate and caring way. Erin described an experience with a high school chemistry student where she felt empathy and acted in a humanizing way to help him:

> It’s hard to know exactly how that’s manifested itself. For example, today, one of my students of color, he was clearly upset. I didn’t know why he was upset. I would like to think I would’ve done this for any student. I probably would have. I just felt more compassion than I normally would have before. I just quietly wrote him a pass to the nurse, to the guidance. I was like, “If you need to leave for any reason, here’s a pass so that way you can just go and come back when you’re ready.” I just felt a lot more empathy for whatever he might’ve been going through. I don’t know, it just touched me a little bit more. I think that’s the major change being colorblind and recognizing that some of my kids have different experiences coming into the classroom that I need to be aware of. I can’t treat them . . . the same, because they’re not. (Interview, May 10, 2018)

Cynthia also displayed increased empathy after the course for her students, thus solidifying her understanding of the aim of multicultural education. She stated, “I became more sympathetic towards a lot of my students and understanding their backgrounds” (Interview, May 17, 2018). The Critical Voices class inspired her to start an executive functioning class at her school to help students and families with organization, fundamentals of email communication, and using the internet to check grades. Cynthia realized that in order to connect with her students, she needed to adjust her curricular aims to address the needs of her specific group of students.

During the interview, Cynthia described one of her female students, whose phone was taken away during school. When she did not get her phone back at the end of the day, she took the train home, but it skipped her stop. Instead of breaking down and crying
(what Cynthia admitted she probably would have done), her student got off the train, went into the CVS, asked to borrow the phone, and called her mom to let her know she was okay. Cynthia was impressed by the independence of this student and pointed out the value of having skills that are not necessarily highlighted as “important” in the school setting but very important in children’s daily lives:

If the word was measured based on survival skills, the kid would be at the Harvard of schools. It’s sad because there’s so many cultural values that her family values a little more than just the education, which I think are, and I’ve learned to see, are very important. (Interview, May 17, 2018)

In this reflection, Cynthia saw her student as a strong individual with valuable skills. She dismantled the stereotype of what a “smart student” looks like, and recognized that her student carried with her a lot of strengths that a classroom lacking a multicultural focus may miss.

Lifen related to students who had difficulty with computers and technology in her classroom by connecting her own experience as a child growing up in China with no technology. Lifen recognized that learning how to use a computer required empathy and patience from the teacher:

I had no idea what a computer is. I got my first computer when I was in the second year of my college, and I’ve never learned how to do the coding stuff. . . . I had no idea. . . . Coming from that perspective, to the students I’m working with now, I feel like I’m more tolerant, in terms of the computer problems that I have to deal with. So, I just become more tolerant, patient, when you are teaching and you know that they don’t have access to computers and I have to find alternative ways. (Interview, May 17, 2018)

Lifen drew from her own personal experience and culture to connect with those of her students; her challenges as a child mirrored those of her students. Through examination of her own identity and learning about multiculturalism, Lifen made connections to her students that crossed cultural boundaries.
**Connection to the science classroom.** Participants were able to identify ways that the Critical Voices class impacted their science classrooms to become more racially literate. In the K-12 setting, participants were able to discuss changes in content, advocate for a diverse group of scientists, and appreciate the format of the class itself.

**Teaching scientists in K-12 classrooms.** In her high school chemistry class, Erin was empowered to enact change to address the way famous scientists were taught and highlight racial and gender disparities and to change the science curriculum critically:

> Another thing that changed was how I teach some of the scientists in chemistry. Because they’re all White men, I never took a moment to do anything else. Then in the front of the school, so we have eight Nobel laureates in science and they are all White men as well. I take some time to talk about that, and before I didn’t. In terms of historically, you know, who was able to go to college, where the science was taking place, a lot of my students think that scientists are American. Talking about the context of who could do science and who was living there at the time. Then even talking about the history of our school, which was at the time, there was segregation of schools even in New York City. There was a time where the school was not co-ed, it was just boys. When we look at our old alumni, you can have this idea as a young person without looking at it the historical context. You could get this idea that, “Only these alumni that were White men were good at science and the Nobel prize.” I have them reflect on the flaws of that, and I didn’t do that previously. (Interview, May 10, 2018)

In Lifen’s science class, the majority of her students are Mexican. As a result of the Critical Voices class and learning about critical perspectives in multicultural education, she was able to integrate scientists of different cultures into her curriculum. She also was able to ensure her students understood that not all scientists spoke English, and addressed with her class “the languages that the scientists actually speak” (Interview, May 17, 2018). This transformation demonstrated Lifen’s understanding of racial literacy. She incorporated practices into her classroom that acted again racist ideologies by giving value to voices that are often silenced.
Content and pedagogical approach to teaching science in K-12 classrooms. The teachers discussed specific examples of how the course transformed both content and pedagogical approaches and, in some instances, the challenges associated with trying to change content in a school with standardized science laboratories and materials.

In Emily’s science classroom, she tried to make connections to the community during every project. Her students worked together in a collaborative environment, and she did very little direct instruction or lecturing, allowing which allowed students to construct their own knowledge and understandings together. She allowed students to co-teach content displaying practical application of multicultural pedagogies in the science classroom.

I have a lot of freedom and I try to do anything and everything I can with that freedom. My content, because of this class [Critical Voices], and I’m sure this is because of race also but it’s from my motivation with social justice and community. It’s been my passion, but this has been, especially my passion since Critical Voices. I try to make everything co-taught with my children so they teach. I don’t do a whole lot of teaching, they do a lot of teaching, which was because of our Critical Voices class. I was like, that’s such a great way of teaching A, and because it’s a lot less work for me B, it’s so much more valuable for the kids that they actually get to teach. A lot of lessons are co-taught and a lot of our focus in every unit is who is this for, how are we using this as our voice? What can we do with this voice, with this information we have? It’s a completely ongoing process. It’s completely unfinished. I don’t know if I’ll be teaching long enough. I could be teaching forever and not get to where I wanna get with this. (Interview, May 10, 2018)

Emily emphasized the value of student voice, a key component of multicultural pedagogy. By giving students space to share their own opinions and beliefs, Emily was incorporating the knowledge, culture, beliefs, and opinions of her students into the curriculum. She placed emphasis on the fact that the curriculum is ever-changing, recognizing that with multicultural education, a curriculum cannot be static because it adapts to the unique group of students each year.
Lifen connected a lesson about water molecules to her native country and the native countries of many of her students. In this way, Lifen was making a conscious choice to incorporate culture into her curriculum. Through probing questions and connecting culture to content, she successfully enacted multicultural practices:

I was teaching water molecules and what a molecule may look like, and all of the sudden this question of, some kids they think that the water that’s in the classroom and the water that’s in the cafeteria, the water molecules actually look different because they are at two different locations. That was actually very interesting. So, I started asking them, “What does the water look like?” Especially the water molecules may be different from like in the U.S., the water you’re drinking here, how can that be different from the water they drink in Mexico, or in China? Are they the same or different? (Interview, May 17, 2018)

While this discussion about the water molecules was not planned in the lesson, Lifen allowed time to address the question, instead of dismissing the topic to stay on pace with the curriculum, letting the students drive the learning process. Lifen also built time into the class period to address culture: “I do have my kids do a lot of reflection, in terms of how they think their culture or how my culture may influence their learning of science” (Interview, May 17, 2018).

Lifen shared in the interview that she encouraged her students to develop projects collaboratively, and she bought materials for the students as long as they were able to give her a list. “You choose what topic you wanna work on, give me a list of materials so that I can buy it for you. I’ll just have them keep on doing small projects, do the teamwork, practice it. Just do it one more time” (Interview, May 17). Lifen liked her class to get creative, and she brought in artistic components whenever she could. If her students requested a toy animal for a diorama, she told them to design it themselves on the 3D printer they had in class. For a project on bones, she allowed students to do a
“painting design” (Interview, May 17, 2018). Lifen saw value in bringing in other pedagogical elements into her science lessons.

The teachers tried new approaches to be more inclusive in their teaching. For example, Cynthia and her co-teacher made sure English Language Learners were exposed to new science vocabulary and content before the rest of the class:

So right now, we are focusing on the solar system. My co-teacher and I tried to pull some of our ELLs. We try to kinda pre-read and just have a little discussion in terms of what the topic was gonna be, so that way when they saw the actual material, they would be able to follow along a little better, at least be exposed to that vocabulary. So that’s one way we do it. (Interview, May 17, 2018)

Erin found incorporating culture into her chemistry curriculum to be daunting because of science labs, the standards, and the Regents exams. But she allowed for more discussion and for students to try to make sense of what they were learning, taking a constructivist approach:

It’s harder to do that because our labs are all departmental. The standards are the standards and the Regents are the Regents. I feel a lot of activities like, kids doing activities are able to do like, talk about thinks or social construction. I try to do things like that I feel they benefit, all kids including students of color. (Interview, May 10, 2018)

Again, Erin reiterated the importance of empathy, but struggled with how to incorporate multicultural education into her chemistry course:

The times where race actually does come up which would be the scientists, I think maybe it would be different if I taught biology but I teach chemistry. Because it’s hard to articulate and to make a lot of race discussions with like, these are metals, nonmetals, like, I don’t know. I feel I could definitely do better with the multicultural education. I feel everybody could. (Interview, May 10, 2018)

After some time passed during our interview, Erin offered some possible solutions to teaching chemistry through a multicultural lens:
One thing I can do as a teacher relates to curriculum. I can make sure that I have multiple ways to engage all students, including those of different cultures. I can also provide multiple ways for students to demonstrate their understanding of material that is culturally relevant, as opposed to giving standardized tests. The challenge that I face deals with the status quo. Since students are assessed using standardized tests that can be misaligned culturally, it might be difficult to do both in the classroom. One way to navigate this space is to be creative in making connections to students that are meaningful, but also be willing to accept the limitations of standardized testing and the value of alternative means of assessment. (Interview, May 10, 2018)

While Erin struggled at first to make a connection to multicultural education in her science classroom, she began to see ways that she could engage her diverse group of students more holistically. Even with standardized testing, Erin recognized that approaching the science content to cater to different students or allowing them to complete projects other than just tests could fit into her chemistry teaching. These approaches echo components of multicultural pedagogical practices. As an educator viewing chemistry curriculum, Erin has developed a critical lens. She not only recognized that the standardized test was misaligned culturally, but she expressed the desire to change her pedagogical practices to apply to diverse learners.

Finally, though Kate has not yet entered the classroom, she cited different approaches a student could take to showing their knowledge:

I think it’s important to allow students to demonstrate knowledge in different ways, and to not emphasize traditional tests or writing as the only way of demonstrating knowledge and giving students multiple opportunities to demonstrate their understanding. (Interview, May 24, 2018)

*Constructing university-level science education courses format and content.*

Both Rebecca and Jenna shared experiences of incorporating elements of the Critical Voices course into university-level classrooms. In reexamining course syllabi, both
participants restructured the goals of the graduate-level courses they taught to reflect identity development and multicultural pedagogy.

Rebecca taught a semester-long elementary science methods course. In reexamining the course syllabus, she realized that students in her course needed to reflect and develop their own identity in the context of science before they could move on to other content. Because the students in her class had a diverse perspective of life experiences, it was important for Rebecca to allow her students time to reflect on their own experiences and identity related to science:

I start the class with thinking about what are student ideas of science, what does science for all mean, and how can we create equitable science classrooms? So, in the construction of my syllabi and in my classes, we start with ideas of what science is supposed to be for all of the students that walk through our doors, but what are our own relationships with science and what does that look like? So, in a lot of the elementary classes that I’ve taught, I have students who have a wide range of experiences to science. Some who have done little to no science and have very negative experiences with it and have not seen themselves reflected in science, to some who have science undergrad majors. (Interview, May 24, 2018)

In bringing in her students’ own experiences, both negative and positive, into the classroom space, Rebecca was able to get to know her students as people, not simply as students in her classroom. She allowed for identity reflection to make space for the students to see themselves in science, and for some in her class, this was the first opportunity they had to do so.

During a group project, Rebeca’s students were able to grapple with the idea of privilege in a lesson on sound energy. Furthermore, the students in the group drove the topic that the students were learning about. Though the lesson was on energy, the students in this particular group chose to focus on sound energy because one of the
students was a music teacher. Another member of the group was deaf, so the group was able to incorporate the five senses into an activity on sound energy:

I have one group this semester who was working on a unit around energy. And one of the teachers working in that space is a music teacher. And so, he wanted to do his lesson around sound energy, which is really interesting and fascinating. I also had a deaf student in the class. So, we got to spend time talking about, “Okay, so how do we create multiple forms of knowledge that are equally valued in this space when what we’re talking about is this notion of sound?” And what’s getting privileged and what’s not getting privileged in that space. So ultimately, we came up with multi-tiered groups working together and having specific group rules. And this was a lesson for third graders, I think. So, there was someone whose job it was to observe with their eyes, someone whose job it was to observe with their hands, and someone’s job to observe with their ears. (Interview, May 24, 2018)

This example exemplifies the collaborative, constructivist learning of multicultural education—students in this activity controlled what they were learning about within the topic of sound energy. Additionally, student voices were honored in the construction of the lesson; the music teacher in a science class was not seen from a deficit perspective, but rather added value. The deaf student was not seen as someone who was disabled, but rather offered a different perspective on how sound energy could be observed.

Jenna decided to revamp an old curriculum to make it more relevant to students in her university class. In analyzing the curriculum used in classes before her, she realized that only one voice and perspective were valued, and the curriculum stereotyped low-income people in urban spaces. She also noted that the curriculum used in the prior class was lecture-style, as opposed to discussion-based. As a result, Jenna brought in topics as discussion points into the class, and allowed students to share their individual opinions and life experiences on urban health issues:

So, I started teaching this course in a college in the Bronx. And it’s mostly students of color and the class that I taught was about what are health issues people face who live in urban spaces. When I first got the syllabus, it was all from
a very traditional perspective of lecturing on things like BMI and what does it mean to eat healthy foods. So, like if we’re thinking about how people in urban spaces may be affected by a variety of contemporary health issues, it needs to shift to a social-emotional perspective, it needs to be rooted in embracing ethnicity and equity. So, I used that and like a lot of stuff you learn in this course [Critical Voices], I used that as a platform to teach, like why do people in urban spaces often have issues of obesity? So, then we talked about, well, maybe there is a single-parent household, and that parent works two jobs and they get home at night . . . so thinking about multiple factors, and we went in to a huge conversation about the housing market, and how that has kind of narrowed people into different neighborhoods. (Interview, May 31, 2018)

Jenna’s students wrote reflections every week, a practice borrowed from Critical Voices.

Jenna’s graduate-level classroom practices demonstrated her use of multicultural pedagogy through the transformation of university curriculum to be inclusive and discussion-based, as well as the incorporation of reflection to increase student voice.

Desire to take action. As a result of the Critical Voices course, participants expressed a desire to take action within their school communities and in more casual settings with family and friends. Participants felt more empowered to speak up, engage in conversation, and highlight injustices at work and in everyday life. While many participants expressed taking actionable steps, some still expressed hesitancy in certain environments. In safe spaces with colleagues, friends, and family members, participants were more apt to speak up. However, in formal settings with strangers, participants did not feel as willing or empowered to engage in critical dialogue or speak out against injustices they observed.

In school settings. Emily, Erin, and Cynthia expressed the urge to act against structures of power and oppression. Emily described her newfound purpose as a teacher:

My purpose as a teacher is to advocate for all students, but especially for students of color. My purpose is to protect my students, provide them with a space to share their voices, to give them the tools to empower themselves and have their backs when others do not. My purpose is to push my students to question their
own roles in society and to question how they can become better people and to question how they can make their community better. My purpose is to recognize that I am a White female teacher with my own positionality and my own privileges that afford me the opportunity to support others and seek support from others. (Course Evaluation, May 9, 2017)

Going further, Emily recognized the harm in staying silent. Reflecting in her journal, she wrote, “I realized it was irresponsible for me not to use my voice” (Course Evaluation, May 9, 2017). In interviews, she supported this written statement by recalling, “I remember someone mentioning that if we do not speak, then we do not use our voices to contribute to the solution.” After the Critical Voices course, Emily decided to look at the discipline records at her middle school. She “noticed that my students who are Black or Brown are getting written up for inappropriate behavior” (Interview, May 10, 2018). Upon reflection, she stated, “I have recognized that those students are just getting written up because of race, I think. I think that it’s colorblindness. It’s a way of controlling people of other races without knowing it, maybe” (Interview, May 10, 2018). Emily was unsure of whether or not she would take this up with administrators at her school. In a school with all-White faculty, she felt intimidated to confront a topic that might put her job in jeopardy.

Both Erin and Cynthia expressed their desire to stay engaged in the conversation of racial inequities. Cynthia acknowledged her lack of consideration of topics on race in the past: “I think to be proactive about how to fix it too is something I’ve tried to take on, and that’s not something I would have done in the past. Before this class, I never even thought to consider these inequities that exist” (Interview, May 17, 2018). Erin recognized her White guilt was getting in the way of taking actionable steps: “As I’ve tried to take ownership of this [White guilt], I get not trying to be guilty and to use that in
a way that is constructive as opposed to disengaging” (Interview, May 10, 2018). In interviews, she shared:

I had a lot of discussions with my husband about things that were on my mind, as well as with colleagues at school. I also talked with students [peers from Critical Voices] after class ended. These experiences helped me to think about more deeply issues of race and how they relate to education. I recognize the ways in which education is/can become racist, the power in which schools have to be potentially positive/harmful. (Interview, May 10, 2018)

Erin engaged in critical discussion with colleagues and peers in the Critical Voices class, discussing the new knowledge she had learned about race and education.

With family and friends. Participants’ experience in the Critical Voices course extended beyond the classroom into their personal life. Participants found that they engaged in conversations about race and privilege more frequently as a result of the course.

Erin, Emily, and Kate each had conversations with their significant others about privilege and race. Erin and Emily spoke at length with their husbands, both White men, about the power and privilege they hold due to their gender and race. Erin shared that she and her husband discussed recognizing White privilege through conversation: “He definitely, I think, recognizes it [White privilege] more through our conversations as do I because I was basically going through this revolution of recognizing my own privilege. Then I was like, okay, I guess I’ll help him recognize his too” (Interview, May 10, 2018). Erin found herself asking her husband to look at his upbringing to draw on examples of his privilege:

I was like, “Well, who paid for your gymnastics lessons? Who drove you there? Why did you have the ability to take gymnastics?” I didn’t take gymnastics, I love gymnastics but my parents can’t afford to take me to gymnastics. Just because he worked really hard, doesn’t mean everybody who works really hard has the same opportunity. We have a lot of conversations about
that. He went to pretty privileged schools. He sees that. I think he recognizes more now, but he recognized probably before that he was privileged. He’s still, I think, doesn’t understand that. He feels like his family and where he is, is because he worked hard. (Interview, May 10, 2018)

In helping her husband to understand her privilege and meritocracy, Erin worked through her own understandings as well. By asking probing questions to her husband, she reflected on his responses and his understanding of new knowledge.

While Emily felt empowered to speak up and have conversations with others, she often had difficult conversations with her husband at home:

There are certainly been nights when I went to sleep crying, like so upset with him [her husband] and him really frustrated with me. Because I’m trying to get at something I can’t say sometimes, I can’t say what I’m trying to say. It does lead to a lot of dead conversations sometimes. (Interview, May 10, 2018)

Emotional responses, as mentioned above, were common during the self-examination phase of the transformative learning process in the Critical Voices course. In recognizing one’s own biases and trying to shift a point of view, Kate’s relationship dynamic changed as a result of the Critical Voices course and her graduate program:

I think for me, since this course I’ve had more conversations with my boyfriend about race and racism. He is Black and his parents are from Ghana, and moved here before he was born. And I remember the first time we met, I was just really intrigued with his educational experiences, and I really just wanted to understand what it was like for him at the institutions he went to. Yeah, I think that’s kind of been an ongoing conversation between the two of us just wanting to understand his life story. I don’t even know if I would have the same relationship with him if I wasn’t a part of this institution [and had conversations from Critical Voices]. (Interview, May 24, 2018)

Finally, Jenna confronted a friend who questioned her personal relationship because of her boyfriend’s race. When Jenna’s friend remarked, “You really need to stop dating people of color,” Jenna shared, “I had to address it in the moment, it wasn’t necessarily taken very well, but it did happen” (Interview, May 31, 2018).
New outlook on teacher education. When participants in the course were asked about the place multicultural education has in teacher education preparation programs in final course reflections, Kate shared that education programs should be “grounded in multiculturalism and social justice framework so that future teachers are equipped to enact change we want to see” (Course Reflection, May 9, 2017). Arianna agreed, sharing in her final course reflection the idea that “preservice teacher understanding of the three tenets of Culturally Relevant Teaching [Ladson-Billings, 1995] will enable them to be reflective of their practice and to see areas for improvement to act on” (Course Reflection, May 9, 2017). Emily echoed the sentiment of the importance of multicultural education in teacher education programs so that teachers are “prepared to teach in classrooms of multicultural societies” (Interview, May 10, 2018). Finally, Lifen suggested to include a few articles regarding Asian Americans or International Students (not only from Asian countries but also other places). In the U.S., it is also a critical voice that is usually buried among other voices. This would be very helpful when you have these populations in the class. (Course Reflection, May 9, 2017)
Chapter V

DISCUSSION AND IMPLICATIONS, NEXT STEPS, CONCLUSION

Discussion and Implications

In this chapter, I discuss the findings of the study in addressing the research questions. The purpose of this qualitative phenomenological study was to investigate the lived experience of eight science education doctoral students in the Critical Voices classroom. This course took place in the spring semester of 2017. As a reminder, the three research questions guiding this study were:

1. What are the lived experiences of science education graduate students in the Critical Voices classroom?
2. How does the pedagogical approach employed in the Critical Voices class impact how science education graduate students see science classrooms and science students?
3. In what ways did the Critical Voices course impact science education graduate students’ racial literacy?

To analyze the data, I used coding methods aligned with the phenomenological approach of Moustakas (1994). After significant statements were identified through horizontalizing, they were grouped into clusters of meaning and then into overall themes.
Three major themes emerged: course format, personal development, and external application.

First, the course format greatly impacted participants. The course was formatted to encourage reflection and discussion, and the role of the professor was that of a facilitator who never lectured. The second major theme that emerged was personal identity development. This course encouraged personal growth in three ways: (a) participants explained in real-time journals as well as in interviews after the completion of the course ways in which their perspectives had changed; (b) participants explicitly stated an increased awareness of race and understanding of privilege; and (c) participants shared emotional responses throughout the course prompting further reflection. The final theme was increased racial literacy. In addition to personal growth, participants articulated ways in which the course impacted their daily life and interactions, both in formal and casual settings. Participants demonstrated displays of empathy, ways in which the course impacted work in classroom settings, and a desire to take action both in professional settings as well as with family and friends.

This final chapter outlines the conclusions that can be drawn from this study, recommendations to facilitate this course in future university settings, and the researcher’s own personal reflections on this study.

Based on the findings, there are four major points for discussion:

1. Participants had a transformational experience as reflective practitioners who began to develop racial literacy and awareness of power structures in schooling and in their personal lives.
2. The format of the class allowed participants to construct their own understandings and come to their own revelations about their identities and identities as science education students and science teachers.

3. Classroom teachers benefit from articulating their transformation, or having a language to talk about critical perspectives, and to apply this to their curriculum and teaching and relationships with current students.

4. Participants developed awareness of race and privilege, but at times were not able to advocate for others in formal spaces, and still felt hesitant to talk about race.

**Internal Growth Prompted External Application**

The first research question was “What are the lived experiences of science education graduate students in the Critical Voices classroom?” Participants had a transformational experience as reflective practitioners who began to develop racial literacy and awareness of power structures in schooling as well in their personal lives. In this study, a transformational experience is framed by the transformative learning theory (Mezirow, 2000), in which learners shift their mindset through critical reflection. The reflective nature of the class forced participants to process thoughts, feelings, and opinions over and over again. At the end of the course and during interviews, participants openly expressed their transformation. Both Erin and Emily had similar experiences when interacting with their White spouses. They had heated discussions at home about race and privilege that would emerge while watching the news or talking about childhood. Both women had a heightened realization of their own privilege as well as that of their White male spouses. Emily shared that the class helped her to feel brave and
empowered to talk about race; she “had the words to use and language to use” (Interview, May 10) in order to discuss power inequities more confidently. Lifen, Cynthia, Emily, Erin, Jenna, and Rebecca applied their transformative personal experiences to practices in their classrooms as K-12 science teachers and university-level instructors.

The stages of transformative learning theory connect to the processes of the participants of this study in their experience as students in the Critical Voices classroom. Participants engaged in deep self-examination, and thus were able to question past assumptions; verbalize fear, frustration, discontent with their current state; and express a plan of desired action moving forward. The findings add to the literature on the importance and value that critical reflection holds in teacher education programs (Duncan-Andrade, 2005; Gay, 2000; Howard, 2003; Kohli, 2008; Milner, 2006; Sealey-Ruiz, 2011). Critical reflection is different from reflection in that it requires active participants to see themselves in a social context; for teachers, it requires that they see how personal identity influences the students they teach (Howard, 2003; Sealey-Ruiz, 2011). In this study, participants constantly referenced the development of their own identity and the ways in which it brought to light new opportunities for students in their classrooms.

Class Format Fostered Authentic Personal Growth

The second research question was: “How does the pedagogical approach employed in the Critical Voices class impact how science education graduate students see science classrooms and science students?” Participants spoke at length about the impact of the pedagogical format of the class. While the course had a structured syllabus (Appendix G, Critical Voices Syllabus), assigned readings, and scheduled presentations,
the content of the class discussions each week was original to the students in the room. The course has been taught by the same professor for several years, and in conversations she expressed the great difference in discussions from course to course; no two course discussions were alike (Personal Communication, May 24, 2018). Because the individuals in the room are always different and the class dynamic is always different, the conversation are always unique. Emily spoke about the value of hearing the lived experiences of classmates in addition to sharing her own. The discussion allowed participants to come to their own understandings and realizations without being “told” what to think. This finding aligns with researchers who highlight the importance of sharing personal narratives. In order to understand the relationship between race, power, curriculum, and pedagogy, it is critical that students share personal narratives with one another to understand their positionality, and that of others, within the context of schooling (Daniel, 2009; Giroux, 1997; Ladson-Billings, 1999; Mensah, 2012). The transformative learning theory (Mezirow, 2000) refers to this type of interaction and stresses the importance of learning in diverse communities. Learning in diverse settings allows for the collaboration of understandings, and can broaden viewpoints to see perspectives outside of a narrow mindset.

All participants valued the time set aside in each class for critical reflection. For the first and last 5 minutes of class, students were asked to write Pre- and Post-Write reflections in their online journals. This proved to be one of the most valuable parts of class—both in real time and when students went back to reread through their entire journal at the end of the semester. In writing critical reflections, students were forced to put their thoughts into writing—a practice that not many were familiar with doing.
Participant reflections were honest and at times deeply personal. During each class, students were able to write the thoughts at the top of their mind, without concern that their thoughts would be “graded” or criticized. While the professor did respond to reflections, the objective was not to assess the reflection, but to pose questions that promoted even deeper reflection. At the end of the course, students were asked to read through their writing over the course of the semester and reflect again on the content of the reflections. One participant noted the change in language of her journal writings as the course progressed. Participants in this study engaged in honest, critical reflection that was categorized by Gay (2000) as “careful self-analysis” (p. 71). The finding supports the ideas of Howard (2003); when participants were asked to reflect critically, they were challenged to assess the influence of their thoughts on the students with whom they work.

For the five White female participants, the structure of the class fostered attitudinal development along the linear process of Helms’ (1997) White racial identity model (Appendix H, Stages of White Racial Identity That Appear in the Data). Before the Critical Voices course, both Erin and Kate acknowledged at the beginning of the course the lack of awareness they had of being White. As the course progressed, both women recognized their “Whiteness” and the privilege it holds in society. This aligns with Helms’ (1997) third stage of the White racial identity model of reintegration, in which a person becomes consciously aware of his or her White identity. All five White female participants showed evidence of arriving at Helms’ final stage of White racial identity, called autonomy, in which the participants were open to learning new information from different cultural groups and felt empowered to enact change.
The format of the course undoubtedly had an impact on the learning and development of participants’ racial literacy. Because of the constructivist nature of the course, participants came to these understandings themselves through learning in an interactive way (Guinier, 2004; Rogers & Mosley, 2008; Twine & Steinbugler, 2006). Participants cited discussion and reflection multiple times during interviews as integral factors of their personal progress to understanding the interplay between race and power.

**In-Service Teachers Benefit Most**

The second research question was: “*How does the pedagogical approach employed in the Critical Voices class impact how science education graduate students see science classrooms and science students?*” This question and the findings built from the second point. The class format of discussion and reflection led some science education graduate students to change the structure, curriculum, and content in their science classrooms.

Three participants who are K-12 teachers—Lifen, Cynthia, and Erin—changed the way they taught or what they taught in their classrooms, and they attributed this change to the learning they experienced in the Critical Voices classroom. Lifen adapted her 6th grade class format to be collaborative group projects. She switched roles in the classroom to become the facilitator, similar to the role of the professor in Critical Voices. Cynthia developed an executive functioning class to help students and families access technology in order to be successful in school. Erin expressed the challenge with adapting chemistry concepts that were state-mandated, but she offered several changes that she had made in her classroom prompted by Critical Voices, such as addressing the context
of teaching all male scientists at her school’s entrance, increasing empathy towards her students, and changing her pedagogical approach to follow a constructivist format.

Similarly, two White female participants who taught at the graduate level adapted their course curriculum to align with the Critical Voices ethos. Through discussion and critical reflection, both Jenna and Rebecca realized that the syllabus of their graduate-level coursework was outdated and needed to be reconstructed. Jenna changed her syllabus to address societal issues of health in urban spaces, and Rebecca changed her syllabus to open with a reflection addressing more critical questions, “What does science for all mean?” and “How can we create equitable science classrooms?” (Interview, May 24). Because Rebecca and Jenna had a tangible course syllabus to draw from, they were able to enact pedagogical changes immediately.

Arianna and Kate were not as able to identify and apply learning from Critical Voices into the science classroom. While Arianna has taught science in K-12 classrooms, she did not offer any practical applications for the intersection of privilege or race in the science classroom, though she was able to draw connections to her work in professional development. Kate understood the concept theoretically, but she was unable to identify a specific change that could be made in the science classroom to address a multicultural lens besides a differentiated work product. Kate did not have K-12 teaching experience. This suggests that because Kate and Arianna did not have current student experiences to draw from, they had a more challenging time connecting the concepts to the classroom.

Because multicultural pedagogies such as culturally relevant pedagogy (Ladson-Billings, 1995), culturally responsive teaching (Gay, 2000), and reality pedagogy (Emdin, 2011) draw from relational experiences with students in a given context, the disconnection to
the practical application may have been more abstract because neither woman had a classroom of students at the time of taking Critical Voices.

**Awareness With Incomplete Action**

The third research question was: “*In what ways did the Critical Voices course impact science education graduate students’ racial literacy?*” Based on interviews and participants’ electronic journals, the findings suggested that each participant increased her racial literacy. Participants engaged in a semester-long course devoted to reading literature, discussing salient points of the literature, engaging in conversation about personal stories, and critically reflecting on the topics from the class. This interactive constructive learning approach was at the core of developing racial literacy (Guinier, 2004; Rogers & Mosley, 2008; Twine & Steinbugler, 2006). In ethnographic field notes, I observed many class sessions where students shared conflicting opinions, disagreed with one another, and shared opposing viewpoints on an experience. The sharing of multiple perspectives is a key component of developing racial literacy (Rogers & Mosley, 2008). Participants repeatedly stated realizations of their own positionality in relation to race throughout electronic journal writings and in interviews.

At the beginning of the course, Kate, a White female, wrote in her journal that “I never thought about how race could impact a learning experience, and mostly thought of learning as a culture-less process” (Reflection on Race and Identity, January 30, 2017). By the end of the course, her view had changed, proving her development in racial literacy. She wrote in her final course reflection, “I am becoming more comfortable talking about these issues and comfortable with my own positionality, privilege, and multicultural awareness” (Course Reflection, May 9, 2017). Arianna noted her growth in
racial literacy as well. As a woman of color, who is often mistaken for a White woman, Arianna shared that her gender is usually her first identity marker. The comments made by Kate and Arianna were reflective of the participants as a whole. Participants were more aware of their race (and perceived race by others) and privilege. They openly spoke and wrote about their newfound understandings of power and oppression in school systems, and feelings towards the inequities that exist in schools. The participants developed a toolkit of vocabulary, such as “colorblind” and “multicultural” and “White privilege,” which they felt empowered to reference in academic and casual settings.

As a whole, however, participants were only comfortable to take action against racist ideologies in “safe” spaces, such as within the confines of their own classrooms and with family and friends. Emily expressed her frustration with the discipline rate of students of color in her school, but when she was asked if she would address the racial disparity of the report to her administrators or co-workers, she was unsure and referred to herself as “cowardly” that she kept this information to herself. In a school with an all-White staff, she was unsure how her information would be received, and as an early-career teacher, she feared for her job security. Similarly, Arianna shared her discomfort in addressing racially charged comments in a professional development setting. While she was motivated to speak up in the Critical Voices class and with family and friends, she felt less confident in a work setting of the professional development session she led. She shared that she needed “more strategies” and “more practice” speaking up in a room of strangers. Her concern with the unknown response caused her not to speak out.
Next Steps

Several implications for next steps are given based on the findings and discussion of the findings of this study.

Recommendations for Teacher Education Programs and Pedagogy

The Critical Voices in Teacher Education course was designed and implemented by Dr. Felicia Mensah for advanced doctoral students. The course is an example of the transformative power of discussion and critical reflection as an agent of change. In this study, science education doctoral students were enrolled in a semester-long course to immerse themselves in content addressing the inequities in education and society as a whole. Students kept electronic reflective journals to record responses to Pre- and Post-Writes on a weekly basis, as well as notes to readings that were assigned each week. Students were exposed to a variety of media and interactive activities that helped develop understandings of privilege and racism embedded in society. Dr. Mensah acted solely as a facilitator to the class, rarely addressing the class a whole, except for the first 3 weeks to set the tone of the course and to provide initial framing and activities for engagement. When she did, it was often to explain logistical parts of the course rather than to transmit knowledge to the class, such as the banking model of education (Freire, 1970). She was careful to stay in her role as facilitator, allowing gaps of silence and long pauses between conversations to allow students to think, collect their thoughts, and share.

University courses in teacher education that employ the course modeled after Critical Voices must honor the format of the course to promote the racial literacy development of teachers. When faculty act only as facilitators, encouraging students to
construct their own understandings through critical reflection and discussion, learning becomes personal and meaningful (Mensah, 2009). In order to grow as reflective practitioners, students must practice critical reflection during every class session. Similar to learning a new concept, critical reflection must be practiced as a skill. Faculty must encourage graduate students and teachers to engage in deep self-examination (Sealey-Ruiz, 2011) in order to become reflective practitioners.

The activity most participants spoke about in interviews was the “Privilege Walk.” With a few straightforward binary questions, this activity created a visual representation of privilege. Students in the class were not only in a figurative position relative to their classmates, but they were standing in such a way that classmates were in front of or behind each other. This physical representation forced participants to “see” difference if they had been trying not to before. This activity prompted engaging discussion in the class, and encouraged members of the class to share personal experiences. Because the questions touched on personal topics, the Privilege Walk allowed students to draw from questions presented in the activity and to share meaningful and personal experiences. Through discussions on a weekly basis, members of the class got a chance to know one another, connect on a personal level, and hear from a diverse group of experiences.

**Recommendations for Teacher Education Curriculum**

From the conclusions and feedback of the participants, the value teachers place on exposure to multicultural curriculum is clear. Universities must use multicultural education and social justice frameworks as a foundation for the courses that are offered to teachers, rather than simply an elective course that is only taken by a select group of
individuals. It is also important that science teachers and the science education curriculum make these connections of multicultural education as well (Atwater, 1993; Mensah, 2010, 2011; Moore, 2006). While the majority of teachers in the United States are White females, the students in their classrooms are extremely diverse; it is predicted that by 2050, there will be no true majority race or ethnic group (Deruy, 2013). It is imperative that teacher education programs and the curriculum in teacher education programs seek to empower future teachers to utilize multicultural pedagogy, as well as teachers returning for advanced degrees as in this study.

**Recommendations for Science Teachers and Science Teaching**

It is of utmost importance that science teachers develop their own racial identity and racial literacy skills in order to enact multicultural pedagogies within their science classrooms. Schools that subscribe to the colorblind attitude—and there are still many in the United States—are inflicting significant harm on the students within. Students cannot be subjected to bias and stereotyping by their teachers; teachers must engage in continuing education and work towards dismantling the education system so it can include every voice, not just the White majority. This means that science teachers must see themselves as transformative individuals, capable of changing curriculum to include all voices and perspectives (Adler & Goodman, 1986; Beyer, 2001; Conklin & Hughes, 2016; Giroux, 1985). White science teachers must take on this responsibility; it is not simply up to teachers of color to dismantle racism in schools (King, 1991; Singleton, 2014). Science teachers must prioritize student voice, input, and culture in the classroom in order to help students connect to and better understand and access scientific content (Emdin, 2011; Howard, 2003; Ladson-Billings, 1995a, 1995b, 2008; Mensah, 2011). This
means that generic science content cannot be delivered to students; it must be customized based on the needs of the students and the cultural contexts of each science classroom (Gay, 1993).

In the examples shared by the participants who are science teachers, there are many ways to incorporate student voice and diverse perspectives into science classrooms and science curriculum. There is not only one approach. The class format that was used in Critical Voices was mimicked to foster social construction of knowledge, as in Lifen’s and Emily’s middle school classrooms. Both of these teachers have changed their pedagogical approaches to be more collaborative and constructivist by having students work on projects in groups, and then teaching concepts to the rest of the class. Jenna and Rebecca changed the content of what was taught in their graduate-level courses to reflect a more inclusive curriculum. Jenna changed the perspective of the course syllabus of the health course she taught, and Rebecca incorporated student voice into the beginning of her term by asking students to write and speak about their science identity. Both Erin’s and Cynthia’s empathy towards students changed, and thus changed the way they interacted in their respective science classes. With continued focus on racial development through critical reflection and discussion, science teachers will be able to incorporate multicultural strategies into their classrooms in an authentic and personal way.

**Conclusion**

Conducting research in the Critical Voices course and being a researcher has more value for me than just the findings. Currently, I am in my 11th year of teaching middle school science. Taking this course as a doctoral student and then researching it as a
participant observer have helped me grow tremendously in my own practice as an educator. When I took this class as a graduate student, I had weekly revelations. At that time, I was in my 6th year of teaching. I would constantly have “AHA” moments, and also moments of extreme embarrassment and regret for how I behaved in the classroom as a young, naive, uninformed White female educator—the White female, standing in front of Black and Brown children, doing all of the things I thought were right and fair, which I later came to realize, were perpetuating a system of oppression in my classroom. I always think about those first few years of teaching, and I wish I could take back and redo many of my practices as an educator. My students in my early years of teaching surely did not learn as much from me as I learned from them.

When I entered the Critical Voices classroom for the second time as a researcher, I gained more insights, had more moments of realization, and came to new conclusions after hearing discussions of my peers in the class I was studying. I continued to grow as an educator as I continued to listen to the insights shared in the class. Race and privilege intersect with science education at every possible junction—in the pedagogical approaches that teachers employ, to the materials they choose to focus on, to the scientists teachers choose to highlight, and to the voices they ignore. For me, this research has been yet another step in my process to develop my racial literacy, and to strengthen the multicultural science classroom that my students and I are a part of every day.
REFERENCES


Appendix A
IRB Approval Letter

Teachers College IRB Exempt Study Approval

To: Lauren Mangione
From: Curt Naser, TC IRB Administrator
Subject: IRB Approval: 18-127 Protocol
Date: 02/21/2018

Thank you for submitting your study entitled, "Science Teacher Experiences in the Critical Voices Classroom;," the IRB has determined that your study is Exempt from committee review (Category 1) on 02/21/2018.

Please keep in mind that the IRB Committee must be contacted if there are any changes to your research protocol. The number assigned to your protocol is 18-127. Feel free to contact the IRB Office by using the "Messages" option in the electronic Mentor IRB system if you have any questions about this protocol.

Please note that your Consent form bears an official IRB authorization stamp and is attached to this email. Copies of this form with the IRB stamp must be used for your research work. Further, all research recruitment materials must include the study's IRB-approved protocol number. You can retrieve a PDF copy of this approval letter from the Mentor site.

Best wishes for your research work.

Sincerely,
Curt Naser, Ph.D.
TC IRB Administrator
curt@axiomeducation.com

Attachments:
- InformedConsent.pdf
Appendix B

Invitation

Hi ____________,

This letter is an invitation to participate in a study (IRB # 180127) that addresses the question: “What are the lived experiences in the Critical Voices classroom?”

To answer this question, I am using phenomenological qualitative methods to understand your experience in the class Critical Voices taught by Dr. Mensah in the spring of 2017.

To participate in this study, you must have had taken Critical Voices in the spring of 2017.

I am seeking permission to interview you, both in pairs and individually to gain a deep and comprehensive understanding of what the experience of the class was like for you.

I can be reached by phone at 303-519-8428 or via email at lm2849@tc.columbia.edu for any further questions related to participation in this study.

Sincerely,

Lauren Mangione
Appendix C

Informed Consent

INFORMED CONSENT

Teachers College, Columbia University
525 West 120th Street
New York NY 10027
212 678 3000

The researcher in this study is Lauren Mangione (doctoral student) IRB number 180127. We are inviting you to participate in a research study on how you experienced the course lead by Dr. Felicia Mensah in the spring of 2017, called Critical Voices.

Description of the Research
This research will involve 2 interviews, one interview with another student that also participated in the course, and one interview alone. I seek to understand how you experienced the Critical Voices course, and how you apply your understandings in your science classroom. I also ask permission to review your course reflections, called your “Pre-Thought” and “Post Thought” writings that you conducted during each class period.

Risks and Benefits
Participants in this study are exposed to minimal risk. However, because the nature of the course was at times emotional and perhaps stressful, you may experience emotions similar to those you felt in class during the time of the interview. If for any reason, you do not want to participate in some part of the study, you may ask to reschedule an interview, or withdraw at any time.

Data Storage To Protect Confidentiality
The researcher will preserve participant confidentiality by designating all names with pseudonyms at the beginning of the study. All data will be kept in a password protected document online, while printed materials will be kept in a locked file cabinet.

Time Involvement
Your participation will take approximately 3 hours on two separate days of interviews. You will be asked interview questions alone, as well as in a diad with another class member. Your participation will also require that you review your course syllabus and course reflection document prior to each interview (approximately 30 additional minutes prior to each interview).

Will I be paid for this study?
You will not be paid to participate. There are no costs to you for taking part in this study.

What possible benefits can I expect from taking part in this study?
There is no direct benefit to you for participating in this study. However, your participation may benefit the field of teacher education to better understand and identify the best ways to support and develop socially responsible curriculum.
INFORMED CONSENT
Teachers College, Columbia University
525 West 120th Street
New York NY 10027
212 678 3000

How will the results be used?
The researcher will use the data from this study in her dissertation, and may be used to present at education conferences, publish in journal articles, or used for educational purposes.

CONSENT FOR AUDIO RECORDING
Audio recording is part of this research study. You can choose whether to give permission to be recorded. If you decide that you don’t wish to be audio recorded, you will still be able to participate in this study.

_____ I give my consent to be recorded ___________________________ Signature

_____ I do not consent to be recorded ___________________________ Signature

WHO MAY VIEW MY PARTICIPATION IN THIS STUDY

_____ I consent to allow written and/or audio taped materials viewed at an educational setting or at a conference outside of Teachers College ___________________________ Signature

_____ I do not consent to allow written and/or audio taped materials viewed at an educational setting or at a conference outside of Teachers College ___________________________ Signature

WHO CAN ANSWER MY QUESTIONS ABOUT THIS STUDY?
If you have any questions about taking part in this research study, you should contact the principal investigator, Lauren Mangione at 303-519-8428 or via email at lm2849@tc.columbia.edu. You can also contact the faculty advisor, Dr. Felicia M. Mensah at 212-678-8316.

If you have questions or concerns about your rights as a research subject, you should contact the Institutional Review Board (IRB) (the human research ethics committee) at
INFORMED CONSENT

Teachers College, Columbia University
525 West 120th Street
New York NY 10027
212 678 3000

212-678-4105 or email IRB@tc.edu. Or you can write to the IRB at Teachers College, Columbia University, 525 W. 120th Street, New York, NY 1002. The IRB is the committee that oversees human research protection for Teachers College, Columbia University.

PARTICIPANT’S RIGHTS

- I have read and discussed the informed consent with the researcher. I have had ample opportunity to ask questions about the purposes, procedures, risks and benefits regarding this research study.
- I understand that my participation is voluntary. I may refuse to participate or withdraw participation at any time without penalty.
- The researcher may withdraw me from the research at his or her professional discretion. Conditions for withdrawal may include unethical behavior and being unable or unwilling to complete an interview.
- If, during the course of the study, significant new information that has been developed becomes available which may relate to my willingness to continue my participation, the investigator will provide this information to me.
- Any information derived from the research study that personally identifies me will not be voluntarily released or disclosed without my separate consent, except as specifically required by law.
- I should receive a copy of the informed Consent document.

My signature means that I agree to participate in this study

Print name: ___________________________ Date: ___________________________

Signature: ___________________________

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Teachers College, Columbia University
Institutional Review Board
Protocol Number: 18-127
Consent Form Approved Until: No Expiration Date
Appendix D
Dyad Interview Protocol

1. How did the experience of the Critical Voices classroom affect you? In what ways?
2. What specific class sessions of critical voices stand out for you?
3. What parts of the course did you find to be most meaningful? Why?
4. What changes in your science classroom do you associate with the course critical voices?
5. How did the experience of critical voices affect significant others in your life?
6. How did the experience of critical voices affect the relationship with your students?
7. What feelings were generated by your participation in the class critical voices?
8. Did any classes or activities in particular generate stronger feelings than others?
9. What thoughts stood out for you?
10. What bodily changes or states were you aware of at the time?
11. How did you see the professor’s role in the course?
12. Have you shared all that is significant with reference to the experience?
Appendix E

Demographics Survey

1. Name ______________________
2. Race/Ethnic Background (self-identify as you like) __________________
3. Do you identify as a teacher of color? YES NO
4. What is your age? _________________
5. How many years have you taught science in a K-12 setting?
   a. 0
   b. 1
   c. 2
   d. 3
   e. 4
   f. 5
   g. 6
   h. 7
   i. 8
   j. 9
   k. 10+
6. How many courses have you taught at the university level?
   a. 1
   b. 2
   c. 3
   d. 4
   e. 5+
7. What is your current status in your TC program?
   a. Enrolled in master’s program
   b. Completed master’s program
   c. Enrolled in doctoral program
   d. Completed doctoral program
### Appendix F

**Thematic Coding**

<table>
<thead>
<tr>
<th>Thematic Code</th>
<th>Major Theme</th>
<th>Subtheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discussion</td>
<td>1.1 Transformational Class Format</td>
<td>1.1.1 Designated time in class to critically reflect was valuable to participants</td>
</tr>
<tr>
<td>Reflection</td>
<td></td>
<td>1.1.2 Discussion allowed participants to hear stories of others and make personal connections</td>
</tr>
<tr>
<td>Role of professor</td>
<td></td>
<td>1.1.3 Professor as facilitator aided in social construction of understandings</td>
</tr>
<tr>
<td>Building awareness</td>
<td>1.2 Personal Transformation</td>
<td>1.2.1 Participants explored new roles as a part of their transformation</td>
</tr>
<tr>
<td>Discomfort/fear</td>
<td></td>
<td>1.2.2 Increased awareness and understanding of privilege</td>
</tr>
<tr>
<td>Changing perspectives</td>
<td></td>
<td>1.2.3 Emotional responses from participants showed their awareness development</td>
</tr>
<tr>
<td>Reflections on Critical Voices</td>
<td></td>
<td>1.2.4</td>
</tr>
<tr>
<td>Lessons learned</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Language</td>
<td>1.3 Racial Literacy Development</td>
<td>1.3.1 Participants felt as though they had more language to speak about race productively</td>
</tr>
<tr>
<td>Activism</td>
<td></td>
<td>1.3.2 Teachers developed empathy for students in their science classrooms</td>
</tr>
<tr>
<td>Family and friends</td>
<td></td>
<td>1.3.3 Topics on race and multicultural pedagogies have a place in the science classroom</td>
</tr>
<tr>
<td>Science connection</td>
<td></td>
<td>1.3.4 Participants expressed a desire to take action in formal and informal settings</td>
</tr>
</tbody>
</table>
Appendix G

Course Syllabus

MSTC 5155 CRITICAL VOICES IN TEACHER EDUCATION
Section 1, CRN 51713
Teachers College, Columbia University
Spring Semester 2017

Instructor Information
Felicia Moore Mensah, Ph.D.
212.678.8316 (Office) ~ 908.445.8613 (Home)
fm2140@tc.columbia.edu (Email)

Class Meetings
Tuesday 5:00-7:00 pm
414 Zankel Building

Office Hours
Tuesday 4-5 pm
Wednesday 4-6 pm
415B Zankel Building

COURSE DESCRIPTION
Teacher education has been challenged by increasing attacks and criticisms in national and global spheres. With the advent of national education reform, there is opportunity for highly engaged discussions on the impact of reform on several areas, such as teacher education, teacher professional development, and student learning, and within specific content areas, such as science (my content area focus). In each of these areas, the context of increasing student diversity, changing school demographics, accountability, assessment, and persistent achievement and learning gaps have become areas of deep interest for research and policy in teacher education. A critical voice in teacher education speaks to the use of critical theoretical perspectives that are often silenced in how we talk about teacher education. The course will give allowances to these perspectives as we develop ways of talking about them in teacher education and how we prepare teachers for teaching.

This course is designed doctoral and advanced master’s students interested in teacher education and becoming teacher educators, thus “preparing future teacher educators” is a goal of the course. The course consists of elements of theory and practice and research within a broad or interdisciplinary field of education with emphasis on the preparation of self as teachers. As you prepare to become teachers in any classroom setting (PK-12 classrooms, colleges/universities), you will assume an active role in developing the knowledge and skills necessary to become reflective, thoughtful educators. The course includes large and small group interactive discussions, group assignments, course readings (i.e., reports, published articles, and book chapters), video discussions, and engagement in small research studies applicable in teacher education and classrooms. The course will serve as a foundation for future development of doctoral students and advanced masters students in a co-constructed, reflective environment to address critical issues in teaching and teacher education.

COURSE GOALS/OBJECTIVES
1. Connecting issues prevalent in teaching and learning to the preparation of teachers (preservice) and teacher professional development (inservice), and preparation of teacher educators, with the goal toward student success.
2. Developing critical thinking skills and questioning taken-for-granted discourse in teacher education.
3. Developing an emergent list of issues and questions for potential research studies.
4. Understanding of issues that teacher educators face in preparation, stemming from local, institutional, national, political, and global concerns in teacher education.
5. Becoming familiar with local, state, and national initiatives and organizations that inform teacher education policy, practice, and research.
6. Understanding of teacher education broadly to be applied to specific disciplinary interests.
<table>
<thead>
<tr>
<th>Text</th>
<th>Type</th>
<th>Author</th>
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<tr>
<td>The evolving significance of race</td>
<td>Book</td>
<td>Hughes &amp; Berry</td>
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<tr>
<td>Education and racism: A primer on issues and dilemmas</td>
<td>Book</td>
<td>Leonardo &amp; Grubb</td>
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<tr>
<td>Critical voices in teacher education: Teaching for social justice in conservative times</td>
<td>Book</td>
<td>Down &amp; Smythe</td>
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<tr>
<td>Diversity and teacher education: A historical perspective on research and policy</td>
<td>Book Chapter</td>
<td>Grant &amp; Gibson</td>
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<tr>
<td>What does teacher education have to do with teaching? Implications for diversity studies.</td>
<td>Journal Article</td>
<td>Milner</td>
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<tr>
<td>Preparing the next generation of teacher educators</td>
<td></td>
<td>Stillman &amp; Anderson</td>
</tr>
<tr>
<td>Retrospective accounts in the formation of an agenda for diversity, equity and social justice for science education</td>
<td>Chapter in Book Series</td>
<td>Mensah</td>
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<tr>
<td>Can anybody teach these children?</td>
<td>Book Chapter</td>
<td>Ladson-Billings</td>
</tr>
<tr>
<td>Researching successful efforts in teacher education to diversify teachers</td>
<td>Book Chapter</td>
<td>Sleeter &amp; Milner</td>
</tr>
<tr>
<td>A case for culturally relevant teaching in science education and lessons learned for teacher education</td>
<td>Journal Article</td>
<td>Mensah</td>
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<tr>
<td>Racial pedagogy of the oppressed: Critical interracial dialogue for teachers of color.</td>
<td>Journal Article</td>
<td>Kohli</td>
</tr>
<tr>
<td>Positional identity as a framework to studying science teacher identity: Looking at the experiences of teachers of color</td>
<td>Book Chapter</td>
<td>Mensah</td>
</tr>
<tr>
<td>Preparing students for social action in a social justice education course: What works?</td>
<td>Journal Article</td>
<td>Storms</td>
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<tr>
<td>Title</td>
<td>Journal Article</td>
<td>Author(s)</td>
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<td>How student teachers (don’t) talk about race: An intersectional analysis</td>
<td>Journal Article</td>
<td>Young</td>
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<td>Faculty first: The challenge of infusing the teacher education curriculum with scholarship on English language learners</td>
<td>Journal Article</td>
<td>Costa, McPhail, Smith, Brisk</td>
</tr>
<tr>
<td>The unexamined Whiteness of teaching: How white teachers maintain and enact dominant racial ideologies</td>
<td>Journal Article</td>
<td>Picower</td>
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<td>Disproportionate representation of African American students in special education: Acknowledging the role of white privilege and racism</td>
<td>Journal Article</td>
<td>Blanchett</td>
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<tr>
<td>Who are the bright children? The cultural context of being and acting intelligent</td>
<td>Journal Article</td>
<td>Sternberg</td>
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<td>Raising the stakes: High-stakes testing and the attack on public education in New York</td>
<td>Journal Article</td>
<td>Hursh</td>
</tr>
<tr>
<td>Raising the stakes: High-stakes testing and the attack on public education in New York</td>
<td>Journal Article</td>
<td>Causey, Thomas &amp; Armento</td>
</tr>
<tr>
<td>Theoretically and practically speaking: What is needed in diversity and equity in science teaching and learning?</td>
<td>Journal Article</td>
<td>Mensah</td>
</tr>
<tr>
<td>Preparing culturally responsive teachers rethinking the curriculum.</td>
<td>Journal Article</td>
<td>Villegas</td>
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</table>
Appendix H
Stages of White Racial Identity Model That Appear in the Data

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Contact</td>
<td>Fear, limited cultural context, unaware of racism</td>
<td>Obliviousness</td>
<td>I do not feel that connected culturally to any group or place” (Erin, Reflection on Race and Identity, January 30, 2017)</td>
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<td></td>
<td></td>
<td></td>
<td>I never thought about how race could impact a learning experience and mostly thought of learning as a culture-less process (Kate, Reflection on Race and Identity, January 30, 2017).</td>
</tr>
<tr>
<td>Disintegration</td>
<td>Guilt, discomfort, fear, anger, shame, denial, depression, helplessness</td>
<td>Suppression and Ambivalence</td>
<td>I felt many moments of not being comfortable discussing these issues. At times it felt as though we were talking about race, but not in a productive way. (Kate, Interview, May 24, 2018)</td>
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<td>I felt like there were times I wanted to say things, but I didn’t because I was afraid of how it would be viewed. Because like the ‘White privileged girl’ there were times I felt uncomfortable. I probably didn’t say things because I don't wanna offend anybody (Erin, Interview, May 10, 2018).</td>
</tr>
<tr>
<td>Reintegration</td>
<td>Awareness of White identity, anger, confusion, begins to redefine White identity</td>
<td>Selective Perception and Negative Outgroup Distortion</td>
<td>In class today I really wanted to better explain myself,” and “I am probably saying something out of ignorance.” “I need to reflect on today’s conversation more than expected (Emily, Post-Write, March 21).</td>
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<td></td>
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<td>I feel like since that I’ve kind of accepted more that I’m privileged. Like maybe before I didn’t (Erin, Interview, May 10).</td>
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</table>
Pseudo-independence

Working towards positive White identity, actions may not match ideology. Redefining white identity, accepts own race and race of others.

Redefining white identity, accepts own race and race of others. I can certainly recognize the ways in which, particularly early on in my career, I reproduced White-centered, masculine science classrooms, perhaps to the disadvantage of many of my students (Rebecca, Reflection on Race and Identity, January 24).

I now understand that personal awareness and understanding of race is an ongoing process of action, rather than a static state we are attempting to reach (Kate, Course Evaluation, May 9, 2017).

Immersion/emersion

Sees White identity as positive, dispel any racial stereotypes, discomfort, can see as White

Hypervigilance and Reshaping

Moving forward, I recognize that I need to confront issues of race in my writing and in my contributions to education. (Emily, Course Evaluation, May 9, 2017)

I just felt a lot more empathy for whatever he might’ve been going through. I don’t know, it just touched me a little bit more. I think that’s the major change being color blind and recognizing that some of my kids have different experiences coming into the classroom that I need to be aware of: I can’t treat them … the same, because they’re not (Erin, Interview, May 10).

Autonomy

Values diversity, empowered to enact change and confront inequalities in daily life

Flexibility and Complexity

I specifically was looking for educational opportunities that would help me to understand my identity and be surrounded by various cultures, dreams, and aspirations (Jenna, Reflection on Race and Identity, January 24).

Not everyone is going to have the change that I had but I view my change as so significant going forward into the world right that now I won’t apply to certain jobs if I know they don’t have a sociocultural informed view of education or whatever it is (Jenna, Interview, May 31).