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A Study of Novice Science Teachers' Conceptualizations of Culturally Relevant Pedagogy

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A Study of Novice Science Teachers' Conceptualizations of Culturally Relevant Pedagogy

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in Education

by

Elizabeth Horst Redman

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ABSTRACT OF THE DISSERTATION

by

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Doctor of Philosophy in Education

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Professor Noel Enyedy, Chair

This qualitative study examined new science teachers' conceptualization of culturally relevant pedagogy (CRP). The study followed six novice science teachers from their preservice teaching placements into their first jobs as instructors of record, observing in their classrooms and interviewing them about their use of CRP. The study sought to understand (1) how the participating teachers conceptualize CRP in science, and (2) what challenges the teachers faced in trying to implement CRP. Findings suggest that the teachers conceptualized CRP in ways that were consistent with Enyedy, Danish and Fields' (2011) interpretations of relevance: relevance of authentic purpose, relevance of content and/or context, and relevance of practices. The teachers, however, translated those interpretations of relevance into their conceptualizations and classroom practice in a variety of ways. While they encountered difficulties in conceptualizing and practicing CRP, they also made productive moves in their practice and evidenced positive elements in their conceptualizations of CRP. In order to address the challenges these teachers faced in implementing CRP, I suggest an approach to teacher preparation in CRP that builds upon the understandings and productive moves the teachers evidenced in this study.

The dissertation of Elizabeth Horst Redman is approved.

Thomas Philip

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2014

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Chapter 1: Introduction

A quarter century ago Shirley Brice Heath, studying the language and literacy practices of children in the Carolinas, noted that the institution of school tends to disregard the communication practices of students who are not part of the white middle-class:

> School has seemed unable to recognize and take up the potentially positive and interactive and adaptive verbal and interpretive habits learned by Black American children (as well as other nonmainstream groups), rural and urban, within their families and on the streets. (Heath, 1989, as cited by Rosebery, Ogonowski, DiSchino, & Warren, 2010).

Similarly, Ladson-Billings wrote in the 1994 publication of *The dreamkeepers: Successful teachers of African American children*, that educational interventions to improve teacher effectiveness and student outcomes for African American students have historically taken the form of "compensatory education (to compensate for the deprivation and disadvantage assumed to be inherent in African American homes and communities)… based on a view of African American children as deficient white children" (Ladson-Billings, 2009, p. 8). Both Ladson-Billings and Heath have demonstrated that while African American (and other typically underserved) students, have rich oral and literate practices and a wealth of valuable cultural experiences and knowledge, schools have rarely recognized that, instead perceiving deficit and deficiency. Rosebery and colleagues (2010) remind us that the critique of school for its narrow construction of the practices, meaning making, and experiences relevant and useful in the classroom is still applicable even all these years later.

Science class, in addition to replicating school's disregard for the practices, meaning making, and experiences of minority and poor students as useful in the classroom, also has the propensity for alienating students (Costa, 1995). Aikenhead and Jegede (1999) assert that most students experience the "transition from [their] life-world into the science classroom" as a "cross-cultural experience" (p. 271). This experience may be particularly uncomfortable and poignant for students who do not feel included in the middle and upper-middle class, white culture in which the institution of school (Heath, 1982, 1989) and the discipline of science (Aikenhead & Jegede, 1999) have historically been situated. Okhee Lee explains that for students who speak languages other than English, or who belong to cultural communities other than the "mainstream" culture of school and science, learning science can be alienating:

> Students from diverse cultures and languages are faced with multiple requirements in learning science… When these students' language and cultural experiences are in conflict with scientific practices, when they are forced to choose between the two worlds, or when they are told to ignore their cultural values, the students may avoid learning science. (O. Lee, 1997, p. 221)

Clearly not all racial and ethnic minority students will feel alienated from the culture of school or science, nor will those who feel alienated all belong to the same cultural communities. However, Aikenhead and Jegede (1999) explain that for students who experience alienation, school factors impact how easily the student can navigate traveling between a student's world of friends and family and the world of science. Thus emerges a picture of school and school science that undervalues the practices, meaning

making, and experiences of whole swaths of its student population and creates a context of alienation; we are failing our students.

Educators, concerned with issues of equity and cultural diversity, have long argued that pedagogy should reflect and respond to students' home cultures and languages as a way to better educate students often underserved by schooling. Many in the field of educational research and teacher education have consistently advocated for the use of *asset pedagogies* such as culturally relevant pedagogy (Ladson-Billings, 1995b, 2009), culturally responsive teaching (Gay, 2002, 2010), and funds of knowledge (González, Moll, & Amanti, 2005; Moll & Greenberg, 1990). These pedagogies, and others similar to them, have sought to reframe the "linguistic, literate, and cultural practices of working-class communities—specifically poor communities of color—as resources and assets to honor, explore, and extend" (Paris & Alim, 2014). Of all the various asset pedagogies, Ladson-Billings' Culturally Relevant Pedagogy (CRP) is one of the most commonly referenced, and was thus used as the focus of this study. Ladson-Billings describes CRP as a pedagogy that "produce[s] students who can achieve academically, produce[s] students who can demonstrate cultural competence, and develop[s] students who can both understand and critique the existing social order" (Ladson-Billings, 1995b, p. 474).

The use of CRP in science class has been suggested as a possible answer to the problem of disconnect between science and students' lives and cultures (Norman, Ault, Bentz, & Meskimen, 2001). The implementation of CRP has also been shown to improve students' experience of and attitudes toward science (Basu & Barton, 2007; Bouillion & Gomez, 2001; Lambert & Ariza, 2008a; Matthews & Smith, 1994) and their academic

success in science (Lambert & Ariza, 2008a; O. Lee, Deaktor, Enders, & Lambert, 2008; Matthews & Smith, 1994; Zwick & Miller, 1996), and also lead to feelings of empowerment (Bouillion & Gomez, 2001) and positive attitudes toward their own culture (Matthews & Smith, 1994). However beneficial the use of CRP might be for students, its implementation is not an easy task for teachers. Although teacher preparation programs have begun to incorporate topics in multicultural education, including CRP and other asset pedagogies, and include teaching practica in communities of color (Barton, 2000; Boyle-Baise & Sleeter, 2000; Burant & Kirby, 2002; Ladson-Billings, 2001) the fact remains that use of CRP has been "marginalized" in mainstream schooling, and often misinterpreted in ways that overly simplify the pedagogy or essentialize the students it seeks to serve (Sleeter, 2012).

Though CRP is seen by many teachers as taking "herculean" effort (Morrison, Robbins, & Rose, 2008, p. 444), inexperienced teachers seem to have a particularly challenging time practicing CRP. Both teacher candidates (Morrison et al., 2008) and new teachers (Hyland, 2009) encounter difficulty putting the theory of CRP into practice in the classroom. Hyland presents a case study of a new white teacher who was able to practice some elements of CRP in her classroom, but struggled to eliminate all of her deficit thinking about her students' families (most of whom were African American), and to build relationships with their parents. Additionally, though there has been relatively little documentation of teachers implementing CRP in science, it has been established that science teachers tend not to recognize the valuable cultural resources that their students bring to the science classroom (O. Lee & Luykx, 2006).

Furthermore, the research on teachers' use of CRP has been carried out primarily

with teachers either with a long history of experience with CRP, or with ample support from researchers, or both. Ladson-Billings (1995b, 2009), in her study of expert teachers of African American students, selected the participating teachers on account of their expertise and extraordinary nature. Tan and Barton (Barton & Tan, 2009; Tan & Barton, 2010) worked extensively with a middle school science teacher, documenting as he leveraged students' funds of knowledge and Discourses in the science classroom in order to create a hybrid space where students were comfortable engaging in science. The teacher's practice was exceptional and hence the researchers were studying it in its current form. He also, however, was the recipient of their dedicated support as he planned and implemented lessons. There is much to be learned from these teachers, and thus the documentation and discussion of their practice is important. Nevertheless, seeking to document and understand new teachers' emergent conceptualizations of CRP and the challenges they faced in fully realizing these conceptualizations in their classrooms is a critical step in improving teacher preparation of culturally relevant pedagogues.

This dissertation sought to understand how science teachers conceptualized CRP and in what ways they were helped or hindered in their attempts to use CRP in their classrooms. Through classroom observation and extensive interviews, this study examined the conceptualizations of CRP among science teachers at the beginning of their career. Six teachers were observed and interviewed during the tail end of their preservice teaching placements and at the beginning of the their first semester of teaching in their own classrooms. These teachers had a stated commitment to CRP and also were enrolled in a teacher education program founded in social justice education that provided classes and readings that addressed topics such as culture, asset pedagogies, diverse student

populations, and social justice. Given their teacher preparation experience and their interest in CRP, I sought to understand their conceptualizations of CRP, and the challenges they encountered in their practice of it.

In order to make sense of the teachers' conceptualizations I employ a framework suggested by Enyedy, Danish and Fields (2011) that provides three possible interpretations for the "relevant" in Culturally Relevant Pedagogy. During data analysis, I realized that the ways the teachers talked about CRP largely reflected the ways that Enyedy and colleagues suggested for interpreting CRP in curriculum. They explain:

> It may be helpful to note that there are at least three ways that one can interpret the term *relevant* in culturally relevant pedagogy by locating the relevance in (a) the content or topical context of the lesson; (b) the perceived value to students' lives outside of school; or (c) the processes and participation structures through which the students engage with the lesson. (Enyedy et al., 2011, p. 275)

I organize my teachers' conceptualizations of CRP in relation to these three interpretations, looking at the variations in how they conceptualized CRP within each dimension, and the implications of those interpretations.

In this study I sought to answer the following questions:

1. How do the participating teachers conceptualize Culturally Relevant Pedagogy in science?
2. What challenges did the teachers face in trying to implement CRP?

Chapter Overview

In Chapter two, I introduce CRP and related pedagogies. I do not focus exclusively on Gloria Ladson-Billings' (Ladson-Billings, 1995b, 2009) definition of

CRP, but include similarly culturally attuned asset pedagogies that value student cultural knowledge in the classroom, such as Cultural Modeling (C. D. Lee, 2007), and Funds of Knowledge (González et al., 2005; Moll & Greenberg, 1990). In this chapter, I introduce Enyedy and colleagues' (2011) three interpretations of cultural relevance, illustrating it with various studies that approach relevance in these ways. I also present the literature on CRP use among novice teachers and the benefits of using CRP in science classrooms. Finally, I present the definition of culture I used in the design of this study.

In Chapter three I introduce the teachers and the data sources I used in my research. Further, I explain the multiple settings through which I got to know the teachers and understand their conceptualizations of CRP. In this chapter I also explain how I analyzed the data and the decisions implicit in that analysis. I discuss the positionality that I, as a doctoral student, a former teacher, an upper-middle class white woman, and a former science student, brought to the study of this topic and these teachers.

In Chapter four I present the ways in which the teachers talked about CRP in terms of how their students could use their classroom-constructed science knowledge in their lives outside of school. I consider the very promising first steps the teachers made in their efforts to connect the science content they were learning to authentic purposes outside of school.

In Chapter five I describe how the teachers talked about using the students' prior knowledge, experiences, and interests in the classroom. I lay out the different knowledge sources they (explicitly and implicitly) were culling for student knowledge, experiences, and interests and also present the four functions that the teachers saw them playing in the classroom. I then discuss the implications of those decisions about sources and role of

student resources for student experience and opportunities to maintain cultural competence.

In Chapter six I present the variety of ways that the teachers talked about CRP as a process of instruction rather than a product or object of instruction. One teacher talked about CRP almost exclusively in pedagogical terms, rather than curricular terms, and I offer a case study of her conceptualization and experience.

In Chapter seven I lay out the challenges that the teachers faced in their efforts to use CRP in their classrooms and understand it through their teacher education classes. I also offer their opinions on what they needed from their teacher education program and their schools in order to grow as a culturally relevant pedagogue.

In Chapter eight I draw together the conclusions about the teachers' conceptualizations of CRP, exploring both their successes and challenges in their practice and talk. Then I suggest the implications that my findings have for teacher education.

Chapter 2: Theoretical Framework and Literature Review

In this chapter, I describe the most commonly used asset pedagogies that share much with Culturally Relevant Pedagogy, such as Culturally Responsive Teaching, Funds of Knowledge and Cultural Modeling. Next, I lay out the benefits of using CRP in science education. Then I introduce the framework suggested by Enyedy, Danish, and Fields (2011) around which I organized my analysis and findings. I also review the importance of studying novice teachers' practice of CRP. Finally, I address the concept of culture.

Asset Pedagogies: Culturally Attuned Education

For the last three decades, educators concerned with issues of equity and cultural diversity have been advocating pedagogy that reflects and responds to students' home and community cultures as a way to reach students often under served by schooling. Since school and its cultural norms and expectations exist within the white, middle-class culture of power (Heath, 1982), students whose home cultures do not overlap with this culture may be at a disadvantage.

Historically, there have been several approaches to culture and its relationship with learning. One approach has been to deny categorically that cultural differences exist, with the all too frequent result that the practices of the dominant group are considered the norm. Another perspective takes a deficit approach to cultural differences and posits that racial/ethnic minority students and poor students suffer from "cultural deprivation." Cultural deficit theory posits that racial/ethnic minority and poor students and their families lack the cultural practices associated with success in school (Dudley-Marling, 2007). This insidious perspective has long-standing history within the United States, but

gained visibility in the field of education during Lyndon Johnson's Great Society programs in the 1960s (Dudley-Marling, 2007). The educational programs developed during this time period were in an effort to improve schooling for poor and minority youth, but were based upon theories of cultural deficit that blamed the students and their families for the "disproportionate academic problems among low status students," attributing them, "largely… to pathologies or deficits in their sociocultural background" (Valencia, 1986, p. 3).

Another perspective on cultural differences is that of the cultural styles, which equates membership in particular ethnic communities with ways of learning and knowing (Cole & Bruner, 1971). While this approach to cultural differences sought to counter theories of cultural deficit, showing respect for and placing value on cultural practices of non-dominant groups, it relied on the essentialization of ethnic communities and belied variation among community members. Cultural mismatch theory (Delpit, 1986, 1995), related to the cultural styles perspective, maintains that ethnic/racial communities' ways of learning and knowing are at odds with the learning and knowing that takes plan in school, thus the "mismatch."

In the field of science education, some see Instructional Congruence (O. Lee & Fradd, 1998) is an example of cultural mismatch theory at work. Described as "a process of mediating the nature of academic content with students' language and cultural experiences to make such content (e.g., science) accessible, meaningful and relevant for diverse students" (O. Lee & Fradd, 1998, p. 12), Lee and colleagues have used instructional congruence as both a conceptual and practical framework for development of curriculum and professional development programs (Lambert & Ariza, 2008b; O. Lee

et al., 2008). By using students' language and cultural experiences as mediators, they are placing primacy on the science content instead of the students' cultural knowledge. Ladson-Billings worries that mediating academic content with student culture leads to the "accommodation of student culture to mainstream culture" (Ladson-Billings, 1995b, p. 467).

There are other approaches to culturally attuned instruction that are committed to understanding, valuing, and using students' culture and experiential knowledge as assets in the classroom and as a way to inform classroom practice. Among these pedagogical approaches are Culturally Relevant Pedagogy (Ladson-Billings, 1995b, 2009); Culturally Responsive Teaching (Au, 2009; Gay, 2002, 2010); Cultural Modeling (C. D. Lee, 2007), Cultural Repertoires of Practice (Gutiérrez & Rogoff, 2003), and Funds of Knowledge (González et al., 2005; Moll & Greenberg, 1990). Below, I provide a brief overview of each of these pedagogical approaches.

Culturally Relevant Pedagogy

Culturally Relevant Pedagogy (CRP), which refers to one type of instruction that accounts for and values the point of view of students from non-dominant cultures, was coined by education scholar Gloria Ladson-Billings (2009). CRP is premised on the assertion that these students deserve education that values and draws upon their home cultures, while educating them to a high standard that prepares them to be academically successful.

Ladson-Billings (Ladson‑Billings, 1995a; 1995b) defines CRP as a "pedagogy of opposition" that depends on three criteria: academic success, maintained cultural competence in home cultures, and development of a critical consciousness to challenge

the *status quo* for minority students. The mandate of academic success is relatively straightforward; Ladson-Billings asserts that "students need literacy, numeracy, technological, social, and political skills in order to be active participants in a democracy" (Ladson-Billings, 1995a, p. 160). Students' maintenance of cultural competence means that students "maintain some cultural integrity" (Ladson-Billings, 1995a, p. 160) throughout the experience of school, and that students' culture is valued both in its own right and as "a vehicle for learning" (Ladson-Billings, 1995a, p. 161), instead of devalued. Finally, Ladson-Billings explains that developing a sense of critical consciousness in students means that "students must develop a broader sociopolitical consciousness that allows them to critique the cultural norms, values, mores, and institutions that produce and maintain social inequities" (Ladson-Billings, 1995a, p. 162).

Though she refrains from being too prescriptive about how to achieve CRP in the classroom, Ladson-Billings does highlight that cultural competence may be maintained, in part, by taking care not to alienate students from their home culture (by assimilating them into school culture) and also utilizing their home cultures as vehicles for learning. In *Dreamkeepers*, for example, Ladson-Billings (2009) describes an instructional unit in which a student's mother is called upon to share her expertise in making sweet potato pies, baking them with the class. Her visit is the inspiration for writing assignments, research on various related culinary topics, and the composition of thank you notes for her time.

It is often the incorporation of students' cultural knowledge into the curriculum that gets most attention from researchers and educators. However, it is only one of the three components of CRP. Academic success for students is integral to Ladson-Billings'

vision of CRP. The final essential aspect of CRP, the development of a socio-politically critical stance, is supported by the other two propositions (maintenance of culture and academic success): if one has not maintained one's own cultural competence, and has been assimilated into the culture of power, a critical stance on that culture's institutions is difficult. Furthermore, it is exceedingly difficult to critique the culture of power and its institutions as an outsider. To stay faithful to the spirit of CRP, educators must be mindful to include students' culture into the classroom in an enriching and authentic manner. A superficial inclusion of culture could occur at the expense of students' success in school; students are not well served by a culturally relevant education that does not also allow them to excel (Delpit, 1995).

Culturally Responsive Teaching

Culturally Responsive Teaching (CRT) shares much with CRP, but does not have the social justice goal inherent in CRP. Developed by Geneva Gay (Gay, 2010), CRT is teaching that leverages the experiences and perspectives of ethnic minority students for learning, and situates school knowledge and skills within the students' personal experience. CRT also involves directly addressing issues of race, ethnicity, gender and class in the curriculum. Gay asserts that in order to implement culturally responsive teaching, teachers must be prepare in five ways (Gay, 2002): (1) developing a cultural diversity knowledge base, (2) designing culturally relevant curricula, (3) demonstrating cultural caring and building a learning community, (4) cross-cultural communications, and (5) cultural congruity in classroom instruction.

Unlike Ladson-Billings' descriptive approach to pedagogy, Gay is more prescriptive. According to Gay, teachers must have a deep understanding of the cultural

background of students, including "cultural values, traditions, communication, learning styles, contributions, and relational patterns" (Gay, 2002, p. 107). In order to design culturally relevant curricula, teachers must tackle head on controversy over race and ethnicity while celebrating the contributions of ethnically and racially diverse leaders and thinkers and challenging the stereotypes of ethnic and racial minorities propagated by mass media. To demonstrate cultural caring teachers must model high academic standards for their students while valuing their experiences and knowledge. Gay also suggests that making a classroom into a learning community will appeal to the communal culture familiar to many students of color. To foster cross-cultural communication, teachers must understand and respond to their students' cultural communication styles, which may significantly different than the communication style valued by school. Once teachers can recognize the value in their students' diverse communication styles, they are better able to understand their academic and intellectual capabilities and needs. In order to make classroom instruction culturally congruent, teachers must match classroom discourse with the learning and interaction styles of the students.

Gay provides concrete steps for preparing culturally responsive teachers. Nevertheless, her reliance on characterizing the interaction patterns and learning styles of ethnic and racial minorities could quickly become reductive. It is dangerous to assume that characteristics of minority students are static, based entirely on their cultural membership. Such thinking is problematic because it obscures the relationship between the learning of the individual and the practices of a cultural community that has evolved over time and within historical context (Gutiérrez & Rogoff, 2003).

Funds of Knowledge

Like CRT and CRP, Funds of Knowledge (González et al., 2005; Moll & Greenberg, 1990) also values students' personal and experiential knowledge, where the two approaches differ is Moll's emphasis on bringing cultural and community knowledge into the classroom, in the form of visits from parents and community members who are experts in certain areas. The focus on community experts instead of learning styles may avoid the trap of essentialization of students' cultural heritage. By relying on the students' own knowledge and interests to guide instruction and identify content that is culturally relevant, teachers can then include members of the students' community as experts and teachers. Utilizing funds of knowledge does not ask a teacher to gauge the cultural background of the students and try to match instruction accordingly, but simply to recognize the value of knowledge readily available in the students' homes and community and incorporate it into instruction. Funds of knowledge, as Greenburg (1989) describes them, are an "operations manual of essential information and strategies households need to maintain their well being" (p. 2, as cited by Moll & Greenberg, 1990).

A visit from a construction expert gives rise to a unit on the technical aspects of house building. After doing library research on building and construction, students build model structures and then write essays incorporating the information they gathered in their research and explaining the process of constructing their model structure. After these activities, the teacher invites parents and other community members who are construction experts to visit the class and share their experiences and expertise. The

contribution of these community members is substantive and intellectual and adds significantly to the lessons.

A unit on Mexican candy utilizes Mexican American students' familiarity with Mexican products. During the unit, a visit from a students' mother teaches students about the differences between Mexican and American candies as well as providing an opportunity to use math skills while preparing and cooking Mexican candies. The focus on students' cultural background is not just for the purpose of being responsive or showing how the academic content is relevant; it aims to tap into the very real, rich funds of knowledge held by students' communities through classroom visits from experts in the community.

Cultural Modeling

Cultural modeling is Carol Lee's approach to asset pedagogies that focuses on the rich literacies and practices that students use in their lives outside the classroom. Carol Lee developed Cultural Modeling in her work teaching literacy to poor African American high school students. She leveraged students' ability and facility with writing and understanding rap and hip hop lyrics in order to teach them common literary tropes, such as symbolism. Using "everyday texts" such as song lyrics and movies with which the students were familiar Lee introduced them to the literary tropes and then moved into canonical literature (both African American and western canonical literature):

> Modeling instruction begins with the everyday texts and then moves on to those canonical texts in which the social world is one about which we anticipate students will have greater prior knowledge and then moves on to canonical texts

that are further removed from students' prior knowledge and life experiences. (C. D. Lee, 2007, p. 50)

The everyday texts, or "cultural datasets," were used to make explicit what the students were already able to do (and doing) on their own. Detecting and interpreting symbolism was something the students were readily able to do in song lyrics and through using lyrics and other familiar texts in classroom study, Lee helped the students to "provide them with language to talk about their problem-solving process, and… make connections between what they already do and what they are expected to do with canonical, school-based problems" (C. D. Lee, 2007, p. 61), like interpreting texts from the "literary canon." Thus Cultural Modeling entails much discussion not just of the themes and plot points the texts are conveying, but how the students came to know those themes and plot points. The point of Cultural Modeling is to train students to be metacognitive, more than to merely develop reading comprehension. Lee notes that part and parcel to this instructional approach is the reciprocity in teaching. The teacher must help the students to recognize what they already know and how to apply that to a different literary genre, but the students also have the responsibility to teach their teacher more about the cultural data sets, as they are often more expert in them than the teacher is.

By including students' home and community cultures in the classroom, these four approaches directly address students' alienation from school. Funds of knowledge relies on bringing community members into the classroom to share their knowledge. Ladson-Billings' CRP focuses on developing a critical consciousness to empower students, in addition to maintaining their facility and pride in their home cultures. Gay's approach to CRT encourages teachers to value students' experiential knowledge (very similar to

funds of knowledge and CRP) and learn and respond to their students' (possibly) diverse learning and communication styles. Lee's cultural modeling encourages students to recognize what they already know how to do and how to apply those practices and abilities to school. If students feel that their knowledge and home cultures are respected and valued in the classroom, they are less likely to suffer alienation.

Culturally Relevant Science Pedagogy

In the following sections I will briefly outline the work that has been done applying CRP, CRT, funds of knowledge, and similar pedagogical approaches to science education. Then I will present Enyedy and colleagues' (2011) framework for the interpretation of cultural relevance in CRP.

Culturally Relevant Pedagogy, Culturally Responsive Teaching, Funds of Knowledge and other asset pedagogies have historically been studied and developed within the context of literacy, general education, and mathematics. The problem science education poses, however, is that, unlike math or English, it has traditionally been treated and taught as a canonical body of facts. This means that students have typically been allowed less agency in bringing their ideas, questions, and knowledge into the science classroom. Nevertheless, there has been a fairly recent interest in the use of such pedagogy in science instruction, which has begun to draw upon CRP (sometimes in name, sometimes in spirit) in order to better serve underserved students in the science classroom. While culturally sensitive instruction has gained momentum within the science education reform effort, it is a sub-field that tends to be difficult to pull together because its researchers rarely rely on the same conceptual frameworks or terms and definitions. What this body of work has in common is concern for the science education

of students who tend to be underserved by school and school science. Depending on the researcher, these focal students may be students of color, students for whom English is a second language, or students of low socio-economic status. Fundamental to this research is the belief that students' personal knowledge and experience are relevant and valuable in the science classroom and should be used as resources.

In the following section I will discuss three ways that the aims of CRP and similar approaches have been adapted for science education. Although the list is not exhaustive, I include those adaptations that most closely overlap with CRP and/or guide a program of research on CRP in science education.

Instructional Congruence

Okhee Lee and colleagues' approach to linking students' cultural knowledge and ways of knowing with school science is instructional congruence (Lee & Fradd, 1998), described as "a process of mediating the nature of academic content with students' language and cultural experiences to make such content (e.g., science) accessible, meaningful and relevant for diverse students" (Lee & Fradd, 1998, p. 12). Lee and colleagues have used instructional congruence as both a conceptual and practical framework for development of science curriculum and professional development programs for science teachers (e.g., Lambert & Ariza, 2008; Lee, Deaktor, Enders, & Lambert, 2008). While Lee and colleagues are concerned that instructional congruence encourage science learning (see Lambert & Ariza, 2008 and Lee et al., 2008 for achievement data associated with instructional congruence), it is hard to decipher exactly how they are incorporating students' culture into the classroom, as they offer relatively few details about the curriculum.

Everyday Sense-making

Researchers at the Cheche Konnen Center have sought to make connections between students' cultural ways of knowing and sense-making traditionally sanctioned in science class, by viewing them as "fundamentally congruous" (Warren, Ballenger, Ogonowski, Rosebery, & Hudicourt-Barnes, 2001). Everyday sense-making is similar to Carol Lee's cultural modeling in the way that it positions students' everyday practices as congruous with academic practices. Warren and colleagues (2001) indicate that this is a challenge of instructional congruence (O. Lee & Fradd, 1998), an approach that they regard as viewing students' home cultures as possible impediments to learning. Warren and colleagues (2001) champion "the logic of everyday sense-making" and argue for a critical examination of scientific sense-making and a restructuring of what is counted as sense-making and relevant knowledge in science. These researchers argue that ethnic and linguistic minority students' use of their linguistic conventions and everyday sense-making leads to valuable and nuanced understanding of science concepts. They offer an example of elementary students leveraging Haitian Creole syntax and everyday conversational styles (such as jokes, stories, and arguments) to develop their understanding of growth and biological change. Further, they assert that it is these under served students who are most hurt by a narrow definition of science. These researchers challenge the science community to level critical consciousness at the institution of school science and acceptable participation structures and seek to make students' use of their cultural knowledge more acceptable in science.

Mutual Benefit Partnerships

An interesting approach that has nonetheless been little explored in the literature is

the use of Mutual Benefit Partnership Projects (MBPPs) in science investigations (Bouillion & Gomez, 2001). Bouillion and Gomez describe these partnerships as "bridging contextual scaffolds" (p. 879) because they are partnerships forged between students and the greater community, to bring students' community into the classroom, similar in some ways to funds of knowledge (González et al., 2005; Moll & Greenberg, 1990). MBPPs must fulfill four criteria (a) focus on a real community-based problem, (b) formation of partnerships between school and community or school and businesses, (c) use of problem-based learning, and (d) development of student-developed products that are beneficial to project participants (students and those in partnership with the students) (Bouillion & Gomez, 2001).

In Bouillion and Gomez's (2001) study of a science classroom of Mexican American fifth graders, students worked to get a riverbank in their community cleaned up. Students' selection of the problem constituted a way to bring in their home lives into the science classroom, and their formation of partnerships with local scientists, activists, and community members interested in conservancy encouraged them to span the cultural and linguistic divide between their home communities and the scientific community interested in the river. They were able to play a pivotal role in bridging the two worlds and helping each side understand the other by utilizing both their knowledge of their community and their understanding of science. The participation structure encouraged students to see themselves as agents of change at the local level, and their community members as holders of scientific knowledge. Furthermore, the inclusion of students' parents and members from their community allowed students to see how their cultural knowledge was relevant to science. MBPPs strive for the connection of school with

community, student achievement, and an expanded view of the role students can play in their communities and schools.

Funds of Knowledge in the Science Classroom

There have been several examples in recent years of studies that have taken the concept of funds of knowledge and applied it to science education with promising results (Barton & Tan, 2009; Basu & Barton, 2007; Seiler, 2001; Tan & Barton, 2010). Leveraging students' interests in nutrition to guide curriculum planning, Barton and Tan (2009) found that students brought a variety of funds of knowledge, drawn from family, community, peers, and popular culture, into the lessons. Basu and Barton (2007) also posit that the extent to which students' funds of knowledge are allowed to shape science learning environments is related to their "sustained interest" in science. Similar to those advocating for everyday sense-making, these researchers criticize the process of enculturation that is often experienced by minority students when they learn science. They suggest instead that the process of enculturation should extend in the other direction, with students' funds of knowledge informing and expanding the definition of school science (Barton & Tan, 2009; Seiler, 2001), thus supporting students' maintenance of cultural competence.

Framework of Interpretations of Relevance

In this section I present three interpretations of relevance as described by Enyedy and colleagues (Enyedy et al., 2011), using research on CRP and other asset pedagogies (wherever possible, I use research in science instruction) to demonstrate how the framework takes a curriculum-focused approach to understanding CRP in practice.

Relevance of Authentic Purpose

Relevance of Authentic Purpose is founded on using the academic knowledge students construct in school in their world beyond the classroom. However, relevance of authentic purpose is more than just the directional flow of knowledge. The purpose should encourage students to apply their critical consciousness to an issue of social justice. Thus, for a lesson or other classroom activity to be fundamentally relevant in terms of authentic purpose, it must facilitate students' use of classroom knowledge in their lives outside of school, address an issue of social justice, and support the students' application of their critical consciousness to that issue. Ideally, it also should encourage students to take action to address the social justice issue.

A good example of a research project imbued with relevance of authentic purpose is the MBP project that Bouillion and Gomez (2001) conducted with upper elementary science students (introduced above). The students selected the problem of a polluted riverbank to clean up as a problem in their community they wanted to address and set about using their scientific knowledge and relationships with community members and scientists to agitate for change. This example demonstrates how the use of science knowledge in service of a social justice issue can do more than just motivate or engage students, but also bring about meaningful action and learning.

Relevance of Content and/or Context

Enyedy and colleagues describe this approach to cultural relevance as relying on and incorporating students' familiarity with the content and/or context of the classroom activity (Enyedy et al., 2011). Relevance of content and/or context is an extension of the constructivist approach to learning and instruction. While

constructivism is focused primarily on resources such as physical abstraction and logico-mathematical abstraction that students bring with them into the classroom, CRP includes students' social and cultural knowledge as a foundation for building new knowledge (Enyedy et al., 2011). CRP focuses particularly on students' social and cultural knowledge because of its commitment to valuing students' social and cultural experiences and encouraging them to maintain their cultural competence (Ladson-Billings, 1995b). This approach to cultural relevance has been explored and utilized widely in the field (Enyedy et al., 2011).

An example of relevance of content and/or context in action is Barton and Tan's (2009) study of a 6th grade life science class for which they used student co-planners to create a unit on nutrition. The researchers chose the topic of food and nutrition because they had received overwhelming feedback from the previous year's students that they had enjoyed the nutrition unit, and researchers had noticed that the lessons on food and nutrition had encouraged students' to draw upon their funds of knowledge. While the researchers picked the unit, the students (mostly girls) decided on the topics they wanted to cover and co-planned the unit with the teacher and researchers. In the course of the study, the Barton and Tan found that the students did volunteer their extensive knowledge of food, cooking, and nutrition from their home lives in classroom discussion. These funds of knowledge included favorite family recipes for salads that the students were encouraged to share with their classmates. The teacher and class discussed some of the nutritional elements in the salads and the students compared recipes. Another example of knowledge that many of the students drew upon during the unit was the knowledge of what foods younger children were allowed to eat, which came from their experiences

taking care of younger relatives. The students were able to draw upon the funds of knowledge in their home lives in ways that were productive in the classroom because the teacher planned for and encouraged this type of participation.

Relevance of Practices

Enyedy and colleagues describe relevance of practices as an interpretation of CRP in which the practitioner focuses on the "process rather than the content of instruction" (Enyedy et al, 2011, p. 277). A focus on the process of instruction means that teachers must think carefully about classroom practices. As people we interact daily with the world around us and in doing so produce and reproduce culture. Gutiérrez and Rogoff (2003) coined the phrase "linguistic and cultural-historical repertoires of practice" to describe, "ways of engaging in activities stemming from observing and otherwise participating in cultural practices" (Gutiérrez & Rogoff, 2003, p. 22). The authors describe how students' repertoires of practice can affect their learning and participation in the classroom:

> Individuals' background experiences, together with their interests, may prepare them for knowing how to engage in particular forms of language and literacy activities, play their part in testing formats, resolve inter- personal problems according to specific community-organized approaches, and so forth. (Gutiérrez & Rogoff, 2003, p. 22)

The concept of Cultural Repertoires of Practice acknowledges that members of the same community share a cultural historical context, which predisposes them to participate in activities in certain ways and respond to events in particular manners. Nevertheless, it rejects the equation of race, ethnicity, national origin, religion, or any other label, with

culture. This tendency is essentialist and a weak proxy for the cultures that exist at the intersections of these categories (Gutiérrez & Rogoff, 2003).

Students whose repertoires of practice are somewhat different than those that are valued within the (science) classroom may be faced with the challenge of choosing which set of practices to privilege; on the one hand they may feel pressure to forsake those that they use at home or with their peers in the service of academic success (Brown, 2004), on the other, they may be compelled to opt out of academic practices, possibly at the expense of academic success. By considering the repertoires of practices which students bring with them into the classroom, and the strengths those repertoires afford, teachers can begin to develop a set of hybrid practices for their classrooms (Gutiérrez, Baquedano-López, & Tejeda, 1999). These hybrid practices are negotiated locally (explicitly or tacitly) by the teacher and her students and through this process of negotiation classroom practices, students' cultural practices, and disciplinary practices coalesce into a set of practices for classroom use.

An example of relevance of practices in a science setting in the Cheche Konnen Center's work with "everyday sense-making" (Warren et al., 2001) for which they expanded the discourses and meaning making that were appropriate in science class to include Haitian Creole syntax and everyday conversational styles (such as jokes, stories, and arguments).

CRP Practice by Novice Science Teachers

Thought there is extensive evidence that culturally relevant science instruction is beneficial to students, there are only a few studies that document how teachers implement CRP in science classrooms. Furthermore, following the model of Ladson-Billings' study

of eight exemplar teachers of African American students, the case studies of CRP in science are best-case, ideal scenarios. Most of the case studies that exist describe teachers who have already developed their practice and are successful in implementing CRP. Barton and Tan's (2009; 2010) exemplary teacher, Mr. M. (a sixth grade science teacher at an urban school in a poor community serving racial minority students) is a good example of such a case study.

While some case studies of CRP do not focus specifically on the work being done by the teacher (e.g.,Bouillion & Gomez, 2001), Barton and Tan describe Mr. M's practices extensively. They examine how he leverages students' funds of knowledge and Discourses in the science classroom in order to create a hybrid space where students are comfortable engaging in science and can do so in ways that allow them to bring their own interests and lives into the classroom. Mr. M. reflects on his approach to empowering his students, talking about why what he is doing is unique and why it might be having a positive effect on his students, and he is presented as a role-model for other teachers. Mr. M.'s practice is admirable and as a result the researchers are studying it in its current form. Additionally, for the very successful unit on nutrition, on which the researchers report extensively, Mr. M. enjoys their dedicated support. Probably as a result of his already developed practice of (a form of) CRP and his support from the researchers, Mr. M. does not reflect on the challenges of teaching in this way, on what he has learned from his experiences, or on how his practice has evolved. Neither do Barton and Tan (2009, 2010).

Another example of a case study of an educator practicing CRP in science is that of Gale Seiler (2001) who started a science lunch group with male, African American

high school students. This lunch club discussed students' lives and participated in science related activities that came directly from their own interests, such as the physics of a wrecking ball and the science they saw in TV and movies. Similar to Barton and Tan's (2009, 2010) look at Mr. M.'s practice, Seiler's study is an example of an experienced and well-supported science teacher (or researcher) using CRP.

There is a paucity of research, however on how novice science teachers, who are just embarking upon their teaching careers make sense of CRP and practice it in their classrooms. Only a few studies have addressed the novice teacher's use of CRP (e.g., Bergeron, 2008; Hyland, 2009). Bergeron's subject, a white teacher named Christina in her first year of teaching, enjoyed success in her classroom implementing CRP. By using CRP and creating community in her classroom Christina was able to avoid the "cultural disequilibrium" (Bergeron, 2008) experienced by many novice teachers who are teaching students with backgrounds different from their own. Hyland's subject, Andrea, was a white novice teacher in her second year of teaching. She had vocalized a strong commitment to using CRP, but found it very hard to engage and make meaningful connections with her students' families and communities. She felt uncomfortable interacting and building relationships with her students' parents and this impeded her use of CRP.

It has been suggested that teacher education programs generally do a poor job of preparing their teacher candidates to use CRP (Phuntsog, 1999), and thus we should not marvel at why teachers are experiencing difficulty. Even if teachers envision themselves using CRP, there is still the matter of actually putting those beliefs into action; there is evidence that teachers have a difficult time aligning their practice with their beliefs about

how they should teach (Briscoe, 1991; Bryan & Abell, 1999; Munby & Russell, 1992). Bryan and Abell (1999) studied a preservice science teacher who was trying to reconcile her teaching practice with her beliefs about how science should be taught and learned. Though the teacher, Barbara, envisioned herself as a teacher who used hands-on, activity-based instruction, she noticed tensions between her vision of teaching and what she thought students actually needed from her (direct instruction through which all students reached the "right" answer). Barbara's struggle to reconcile her practice with her vision of teaching, was a difficult one, and demonstrates the challenge of aligning one's teaching practice with one's vision of teaching. Therefore, even if teachers are dedicated to practicing one kind of pedagogy (in this case, CRP), their experiences as learners and their ideas about what science learning should entail may create tensions which impede their teaching goals.

In their study of math teachers implementing culturally relevant pedagogy, Enyedy & Mukhopadhyay (2007) found that it was a challenge to attend simultaneously to the three goals of their study: to have the students explore and understand statistical concepts; to have the statistical investigations be motivated by students' interests and perceptions of need and relevance; and to value students' everyday knowledge and experiences within the unit. Specifically, they found that the three were often in tension with one another. The researchers also reflected upon completion of the intervention on how using culturally relevant mathematics pedagogy required a lot of the teachers: "a great deal of content knowledge, pedagogical content knowledge, planning, continuous reflection—not to mention a commitment to social justice and the education of underserved students of Color" (Enyedy & Mukhopadhyay, 2007, p. 169). This study of

culturally relevant mathematics pedagogy highlights how difficult enacting CRP in the classroom can be.

Since the teachers in this study stated their commitment to CRP, and attended a teacher education program that focused on social justice education, examining these teachers' conceptualizations of CRP and the challenges they encountered using CRP in their classrooms will add to the field's understanding of what is possible for novice teachers. It will also help us, as teacher educators, address the needs of preservice and novice teachers who are trying to use CRP.

Definition of Culture

Finally, it is important to define "culture." In her work on critical race theory, Yosso (Yosso, 2005, pp. 75–76) defines culture as "behaviors and values that are learned, shared, and exhibited by a group of people," adding that culture is "also evidenced in material and nonmaterial productions" and is "neither fixed nor static." While a useful working definition, I add to it Dahlke's (1958) delineation of three aspects of culture, which explicates how culture functions to guide people's behavior and values:

> A culture is instrumental: from it people select the techniques of doing things, the means to reach an objective. A culture is regulative: the actions of persons and the use of the instruments are subject to the rules and regulations, the dos and don'ts of living. They specify what should be done or what must be done. A culture is directive: from it individuals derive their ultimate as well as immediate values, their interpretations of life, the goals for which they strive. Cultural behavior is action based upon a complex of evaluations, i.e., as to what is good or bad, proper or improper, efficient or inefficient, adequate or inadequate, beautiful or trivial,

> valuable or valueless, free or compulsory. Cultural reality is thus a value reality. (Dahlke, 1958, p. 5)

It's clear then that culture is an important mediating factor in how people experience the world.

It is important to note, however, that person's cultural membership depends on many different factors, among them race, ethnicity, linguistic affiliation, gender, class, geographical location, nationality, sexual orientation, and generation. Such an approach to culture aims to avoid the all too common (and simplistic) conflation of race and culture, which occurs in this field of work. A consequence of this conflation, Erickson (2002) warns, are sweeping generalizations about what participation in particular racial or ethnic groups entails. We know, however, that every African American, for example, does not share the same culture; simplistic, monolithic notions of culture miss the many cultural influences that help to shape the culture through which people experience the world. As Erickson (2002) explains, culture is much more than simply a matter of nationality, gender, ethnicity, or race. In fact, it is all of these factors, and more, that make up our culture:

> The initial community of practice is the nuclear family, but then the extended family, the experiences of schooling, of peer groups, of religious congregations, of work situations, of adult avocations, of retirement situations, and or vicarious socialization through the various popular communications media (cinema, television, music, fashion in consumer goods) all provide exposure to differing cultures and subcultures. (Erickson, 2002, p. 303)

I use Erickson's conceptualization of culture for my study because it conveys the myriad nature of culture. Paris and Alim warn that culture should not be equated solely with heritage (ethnic) communities of practice, because this oversimplification ignores the "shifting evolving practices of [students'] communities" (Paris & Alim, 2014, p. 90). However, ignoring students' heritage communities in favor of other communities of practice to which they belong is not productive either. In their discussion of culture, Paris and Alim explain, "[culture is] dynamic, shifting, and encompassing both past-oriented heritage dimensions and present-oriented community dimensions. These dimensions in turn are not entirely distinct but take on different salience depending on how young people live race, ethnicity, language, and culture" (Paris & Alim, 2014, p. 90).

Chapter 3: Methods

The purpose of this study was to understand how the teachers conceptualized CRP and what factors influenced their conceptualizations and practice of CRP. To investigate these questions I recruited six teachers whom I observed and interviewed while they were preservice teachers (in the spring of 2012) and also when they were inservice teachers (in the fall and winter of 2013). For the sake of clarity, throughout the dissertation I will refer to the period of the study during which the teachers were apprentices (preservice teachers) as the "first phase" of the study and the period of the study for which they were instructors of record (inservice teachers) as the "second phase" of the study. In the following sections I introduce the teacher participants and the study settings, the study design, including data sources, and the analysis plan.

Participants

Six participants were recruited from an Urban Teacher Residency program in the spring of 2012, while they were preservice teachers. During recruitment I explained that the study was about CRP and teachers who were interested in using it. All six expressed some level of interest in CRP. The teachers had followed diverse paths to teaching. One had already had an extended career in a field outside of education and science. Another held a master's degree in a scientific field and had worked in a research laboratory. The other four enrolled in the program immediately after completing their undergraduate degrees in science, or relatively soon thereafter. Two of the six teachers were Caucasian/White, three were Asian American, and one was Latina. All six were women. I introduce each of the participants below in addition to the school contexts in which they taught.

Kay[1]

Kay taught middle school life science during both phases of the study. Her school site in the first phase of the had a primarily Latino population (86%) and almost a quarter of the student population were designated "English Language Learners." Her second school site, at which she was an intern, instead of an instructor of record, served a student population of 77% Latino and 13% African American students. The student populations at both schools were described as 100% "economically disadvantaged" by the school district.

Kay described "good science teaching" as "teaching the scientific concept in a way… that the kids are not only able to understand the material, but they're also learning critical thinking skills and inquiry like being curious about what they're doing, what the purpose is" (Kay, Interview 1). However, she also considered science to be generally "dry." Over the course of our interviews she described science as "dry" or "boring" more than thirteen times, and she valued CRP for its ability to engage and motivate her students as well as help them to understand science content. Kay talked about CRP mostly as a way of creating familiarity for her students, primarily through incorporating the foods they ate, though she also thought it was important to incorporate the music and other elements of pop culture in which her students were interested. During the first phase of the study, Kay suggested on several occasions that the way to be culturally relevant was to celebrate the food and holidays familiar to her students in the classroom, such as coloring Mexican Mothers Day cards on the holiday and playing Spanish language music as a "brain break" for her students. In the second phase of the study, she

[1] All teachers' names are pseudonyms, selected for their similarity in origin to the participants' real names.

[2] Title 1 schools receive federal funds to aid in the education of students from low-

began to talk about CRP as using analogies from students' lives as a way to make the science content more culturally relevant, and thus easier to understand and more interesting.

Rachel

Rachel taught middle school life science as an apprentice teacher in the first phase of the study. In the second phase, she taught at a science magnet within a larger public school. While her first school site served a primarily Latino population (86%), demographics provided by the second school listed the student population as primarily Asian (48%) and White (39%). She described her students in the magnet program as "primarily middle class," noting, "some are working class definitely, but then there are a few that are probably more like upper middle class" (Rachel, Interview 2). Rachel regarded good science teaching as "developing problem-solving skills" (Rachel, Interview 1) and helping students to develop critical thinking skills.

As an instructor of record at the science magnet, Rachel taught a very full course-load: two sections of AP biology, two sections of AP chemistry and an honors physics class. Enrolled in a selective magnet program, Rachel's students in the second phase of the study were generally high achieving, and she talked at some points about how trying to prepare her students to pursue higher education in science was culturally relevant to them.

Rachel expressed an interest in CRP, and during our second interview she described CRP in the following way:

> [CRP is] teaching in such a way that you attempt to bring in the students kind of funds of knowledge, things they already know, and then also connect to

> things that are relevant to them culturally and so that could be either ethnic culture or religious culture or something but that could also just be like… the culture of teens. (Rachel, Interview 2)

While an apprentice teacher, Rachel implemented a remarkable community health project during a unit on mental and physical health in her middle school life science class.

During her first semester teaching high school as instructor of record she felt overextended teaching three preps of upper level science and though she "did it last year" she found it difficult to use CRP in her new classes and reported to me that she had used, "virtually no culturally relevant pedagogy, I'm sorry to say," explaining that it was not for "lack of desire" but due to "time pressure" and a lack of familiarity with the curricula of the classes she was teaching (Rachel, Interview 2). Consequently, she went from using CRP during her apprenticeship to using almost none in her first semester of inservice teaching.

Joanna

Joanna taught high school biology during her apprenticeship. The majority of the students at the school were Latino (93%), and almost a third were classified as "English Language Learners." During the second phase of the study she taught high school physiology and biology as an instructor of record at a charter school that was described as 87% Latino, 22% "English Language Learners." At this school, 95% of the students received a free or reduced lunch.

During our first interview, I asked Joanna about what she thought "good" science teaching was, and she described it as connecting "to the student's real-world experiences with science and their understandings, and expand[ing] on that knowledge." She

indicated that it was important to show "students the true inquisitive nature of science, that scientists are really just people trying to answer questions, and that it's all about being curious enough to ask those questions…" (Joanna, Interview 2).

When Joanna was offered the job at the charter school she was very excited at the prospect of teaching physiology because she thought that it would mean that she could have some freedom with curriculum because the physiology standards were an "amalgamation of the 6th, 7th and 8th grade standards" taught to sophomores (Joanna, Conversation 8/23/12). She posited that the fact that her students had already seen most of the science concepts already meant that she might have more leeway to use CRP and do some culturally relevant projects with the students. She was disappointed, however, when she started teaching at the school to find that it had a predetermined lesson plan format that she was required to follow and that projects were discouraged.

Joanna talked about CRP primarily as the incorporation of students' prior knowledge, defining CRP as "a way of teaching that engages students' prior knowledges and experiences into the lesson planning and the implementation of the lesson" (Joanna, Interview 2).

Jessica

Jessica taught biology and biotech classes in a STEM academy within a large public high school for the first phase of the study. She was offered a job during her apprenticeship and in the second phase of the study was instructor of record for biology and bio-medical classes at the same school. The high school served a primarily Latino population of students (81%), with a significant population of students classified as "English Language Learners" (37%).

During our first interview, Jessica asserted that teaching students the scientific method and having them investigate their own questions was "good science teaching." And she posited that good science teaching "will spark curiosity in students… And a lot of times if you [just have students memorize information], students will not really see the relevance" (Jessica, Interview 1). Jessica explained that in order to spark curiosity she thought it was important that the students "see how what [they are] learning in school applies to the outside world." She continued about the students she taught during her apprenticeship, "Whenever I brought up real-world connections in my class, students, they would participate more and I could see them being more enthusiastic" (Jessica, Interview 1). Jessica tended to talk about CRP in terms of making "links" or "connections" to students' lives, often without providing elaboration about what links or connections to students' lives actually looked like or how they could be implemented. In our first lesson debrief (before the our first interview) Jessica defined CRP as "just making more real-world connections" and noted that for her students who were mainly Latino, incorporating "Hispanic food, but [also] just food in general" was a viable way to use CRP (Jessica, Debrief 1).

Mid-way through her first year as instructor of record, during our second interview, Jessica defined CRP as "any way that you try to build a connection between a student's personal life and the curriculum" (Jessica, Interview 2). Jessica was committed to incorporating projects and labs into her classes, feeling it was important to give her students "hands-on" activities. On my visits to her classroom (in both phases of the study) I would predictably find the students engaged in work at the lab stations that ringed the classroom, and on one occasion, presenting projects to their classmates.

Jessica's classroom was well stocked with science equipment, including the centrifuges and EKG machines I observed the students using during my visits. Jessica also taught her biomedical class using a project-based curriculum for which her school had paid for her training and the course materials. The curriculum was organized around extended projects and investigations to which the science content was tied.

Camille

Camille taught high school physics during her teaching apprenticeship in an academy within a large public high school with a primarily Latino population (84%) and a large number of "English Language Learners" (31%). She taught high school chemistry as instructor of record at another large public high school in a different part of the city. The student population at Camille's second high school was 74% African American and though it was not technically categorized as a Title 1[2] school, 45% of the students were listed as "economically disadvantaged" in the information provided by the school district.

Camille shared that after her undergraduate experience as a science major, she realized that "nothing is concrete in science," but that "the misconception with students is always everything is definite" (Camille, Interview 1). She realized a dichotomy between K-12 science and "real research." Camille reported that her time in the teacher preparation program greatly informed her understanding of what it meant to teach science. When asked about "good science teaching," Camille explained:

> I used to think that its just me putting… all the content towards the students but [the teacher preparation program] has taught me… inquiry based learning, and I think that helps a lot because my original idea was 80 percent me talking, 20

[2] Title 1 schools receive federal funds to aid in the education of students from low-income households.

> percent them talking but it kind of reversed where I realized they should be doing more of the discussing and when they are talking to their peers they are more engaged… (Camille, Interview 1)

Camille expressed a lot of confusion over what CRP was in the first phase of the study, but by the end of the second phase she had used her experiences in the classroom and an academic article she had read to come to a more definite conceptualization of CRP. While Camille talked about CRP primarily as a way to incorporate students' outside knowledge into classroom activity during the first phase of the study, during the second phase she revised her conceptualization to talk almost exclusively about how to incorporate students' repertoires of practice into her classroom and foster personal relationships with them.

Eileen

Eileen taught middle school life science and biology at a public middle school affiliated with a research university during the first phase of the study. The school served a primarily Latino student population (78%) and over half of the school's students were designated "English Language Learners." In the second phase of the study she taught chemistry at a charter school that was part of a large network of charter schools. At this school 87% of the students were Latino, almost a quarter were designated as "English Language Learners" and 95% received a free or reduced lunch.

"Good science teaching" to Eileen was "inquiry based." She explained that it allowed "students to ask their own questions, to think in a way where they're always curious and looking for answers" (Eileen, Interview 1). She also indicated that she thought science was, by nature, "very hands-on."

Eileen lived in the same neighborhood as many of her students (during the second phase of the study) and rode the city bus to school with them in the morning. Teaching in a summer enrichment program in the city during her time as an undergraduate had given her the experience of getting to know her students and their community. As part of the teaching experience Eileen walked her students home after school and spent time with their families. She described it as "a really… eye-opening, experience in terms of… really getting to know people from a certain culture so that when we saw them in the classroom, like we knew more about the child than just in the classroom." She explained that this was her "first experience of the importance of culturally relevant pedagogy" (Eileen, Interview 1) and it impressed upon her the importance of making connections to her students' communities. Eileen defined CRP as "teaching strategies that make content accessible to kids by emphasizing that their assets from their home life or their life outside of school is also valid in school" (Eileen, Interview 2). She often used in-depth and complex analogies or stories to present some of the more "abstract" chemistry topics in contexts familiar to the students, like video games or interpersonal relationships.

Settings

This study took place across several settings, all of which are introduced below.

Teacher Education Program

One of the settings for this study was an Urban Teacher Residency (UTR) program situated within the teacher education program at a large public university in the southwestern United States. The UTR prepares teachers who are committed to teaching in historically underserved schools in Los Angeles. The program aspires to help its teachers partner with their larger school communities to make "teaching and learning

culturally relevant."[3] This 18-month graduate program began with summer coursework, and in the fall the teachers became "apprentices" in a yearlong residency at an urban school in the classroom of a mentor teacher. During this residency, the teachers also attended university classes for one full day and one afternoon a week. These classes included a science methods course. At the end of the academic year, the teachers received their credential and applied for positions in local public schools as full time teachers. In the fall, as they began to teach at their new schools, now as instructors of record, the teachers also attended weekly seminars to help them complete their masters inquiry projects. They graduated the program in December with a master's degree in education.

As part of my study of teachers' conceptualizations of CRP, I observed the participants in their 10-week methods course in the spring of 2012 and in their 10-week seminar in the fall of 2012. A professor who also did field supervision of the teachers ran the methods class. She invited the apprentices to share their experiences teaching in their mentor's classrooms by requiring them to share photos from their classrooms of student activity and student work. In addition to the sharing of classroom artifacts and photos, the apprentices were responsible for reading the assigned articles and book chapters.

The science field supervisor and the math field supervisor co-taught the fall seminar, which was attended by both the math and science teachers. Though there were some assigned readings for the seminar, the main purpose of the seminar was to help the teachers conduct their "inquiry project" for which they proposed a research question they could investigate through action research during their first semester of teaching. The

[3] Taken from the UTR website. Presented here without citation in order to protect the anonymity of the program.

teachers wrote up their inquiry project in order to graduate with their masters in December.

Preservice teaching classroom (Phase one of the study)

I also observed the teachers during their preservice teaching in their mentors' classrooms. For their apprenticeship each teacher was assigned a mentor in one of the Title 1 middle or high schools in the district. In their mentor teacher's classroom, the teachers observed their mentors in action and, over the course of the academic year, began to take over more of the instructional responsibilities for one section/class. Each apprentice and her mentor negotiated the exact details of the hand off and its duration. During their apprenticeship, three of the teacher participants taught in middle school science classrooms. Three taught in high schools. All of the schools were in the same large, urban district, and all were within a few miles of one another. The student demographics at these schools were very similar. The majority of students at these schools were Latino/Hispanic[4], ranging from 76% to 95% of the student population, depending on the school. There were substantial numbers of English language learners at each school as well, ranging from 25% to 55%. All were Title 1 schools, with high proportions of the students categorized as "economically disadvantaged" in the demographic information provided by the school district.

Inservice teaching classroom (Phase two of the study)

I also observed the teachers in their own classrooms once they were instructors of record. The teachers in the UTR receive fee remissions and stipends as part of their participation in the program and the overarching study of the UTR program on the

[4] Some schools used the term "Hispanic," others used "Latino."

condition that they seek employment in a Title 1 school (or a school with a comparably economically disadvantaged student population) and teach in a Title 1 (or comparable) school for at least three of the first five years of their teaching career. All but one of my teacher participants secured full time teaching positions upon receiving their credential. The remaining teacher taught one section of science as an intern in the classroom of a middle school science teacher at a Title 1 school. Only that teacher taught middle school, the remaining five all taught in high schools during the second phase of the study.

Data Sources

The data sources for this project were comprised of interviews with the participating teachers during both phases of the study, fieldnotes and artifacts capturing the activities of their classrooms from both phases of the study, the lesson debriefs recorded after each of those observations, and fieldnotes and artifacts from the two teacher education courses I observed (the science methods course in phase one of the study and the master's seminar in the second phase of the study).

Interviews

I interviewed each teacher at the end of her apprenticeship (June, 2012) and at the end of her first semester of teaching (December 2013/January 2014). Both interviews used semi-structured interview protocols and I made an effort to adhere to the questions on the protocol, but also ask follow-up questions. The first interview asked the teachers to talk about science education, making science relevant, and CRP, as well as the challenges and benefits the teachers saw in CRP and what resources they needed to better practice it.

The second interview probed the teachers on many of the same issues, but also asked them to reflect on their use of CRP during the year and how their ideas about CRP

had changed since we had last talked. In the UTR seminar class the teachers (in groups of three and four) had drawn up concept maps to represent their ideas about CRP, and I used photos of these artifacts to ask each teacher to reflect on the concept map and talk about that representation and whether they would add anything to it. In the second interview I also had the teachers participate in a thought experiment of sorts in which they planned out a lesson that would use CRP. Afterwards we talked about why or why not they would actually use the lesson in their classrooms. All interviews were audio-recorded and transcribed for analysis. Protocols for both interviews are included in the appendices.

Classroom observations

I observed each teacher at least once during her apprenticeship, and at least twice during her time as an instructor of record. The number of classroom observations varied depending on each teacher's teaching and testing schedules. During the classroom observations I usually sat in the back of the classroom and tried to be as unobtrusive as possible. I took notes on my laptop because the field supervisors from the UTR and other administrators at the schools and within the district routinely used their laptops to take notes when observing a teacher. I felt that the use of a laptop was not distracting to the students or the teacher. Some of the participating teachers assured me of this. I tried to capture the seating arrangement, classroom activities, student and teacher discourse and all artifacts. I also sometimes used my smart phone to take photos of the board to record more complicated inscriptions. The teachers willingly provided me with all classroom artifacts from the lessons, such as informational handouts or worksheets.

Lesson debriefs

In both phases of the study, after each classroom observation, I conducted a brief lesson debrief asking the teachers to reflect on the lesson they had just conducted. I usually conducted the debriefs immediately following the classroom observations in order to have the teacher reflect while the lesson was still fresh in her mind. This was not always possible, however, and in those cases we would conduct them at the participant's earliest convenience. All debriefs were audio-recorded and transcribed for analysis. The protocols for the lesson debriefs are included in the appendices.

Teacher education course observations

I was a participant observer in the methods course and the master's seminar. I interacted with the teachers, sitting with them and participating in class activities assigned by the instructors. I also read the assigned readings in order to better understand the class discussions. During the class periods I took jottings in a notebook. I used those jottings to write full fieldnotes within 24 hours of the class in order to fully capture the class interactions. Since there were other teachers in the classes who were not volunteers in my study, I avoided recording their comments in my fieldnotes, referring to them only obliquely if their contributions contextualized comments made by my participants. In addition to the fieldnotes, I also collected artifacts from the courses, such as syllabi, readings, worksheets and other handouts, which were provided by the course instructors.

Data Analysis

The primary data sources were the interview and debrief transcripts. I used the classroom observation fieldnotes in order to contextualize the information in the debriefs. The UTR course fieldnotes were used solely for contextualization of events discussed in

the interviews and debriefs, or for triangulating themes I saw developing in the interviews and debriefs. My approach to analyzing the data was consistent with the constant comparative method (Glaser & Strauss, 1967).

Data analysis for research question 1

My first research question asked, "How do the participating teachers conceptualize Culturally Relevant Pedagogy in science?" After reading and rereading the interview and debrief transcripts I saw that themes began to emerge in how the teachers talked about CRP. I focused on the instances in which the teachers were explicitly talking about what they considered to be CRP so that I would not misconstrue their conceptualization by including practices that they used or considered good science teaching but not CRP. I was mindful to provide a fair and balanced understanding of how the teachers conceptualized CRP and thus if they did not specifically label a practice or an example "culturally relevant" or provide it in an answer to a question that asked them about CRP, I did not use it in my analysis.

I began to write memos about these emerging themes and realized that the themes were generally consistent with the interpretations of CRP that Enyedy, Danish and Fields (2011) had proposed: relevance of content/context; relevance of authentic purpose; relevance of practices. After several more iterations of reading and writing memos, and at the encouragement of members of my committee, I began to use Enyedy and colleagues' three interpretations of CRP as broad categories to organize the emerging themes. As I continued to read through the transcripts I flagged instances in which the teachers seemed to be talking about CRP in ways that were analogous or related to the three

interpretations of relevance. Thus, my analysis uncovered the ways in which the teachers were interpreting CRP, organized by the interpretation of CRP.

Throughout the coding process I was constantly recoding data in order to ensure that the emergent themes and my accompanying conclusions were consistent throughout the data corpus. I compared my explanations of the data with alternate interpretations at several junctures in order to scrutinize my explanations and verify that they were the most appropriate conclusions, given the data. In the following sections I will provide more details on the data analysis that corresponded to each interpretation of relevance (Enyedy et al., 2011).

Relevance of authentic purpose. Enyedy and colleagues described relevance of authentic purpose as an interpretation of cultural relevance that "focuses on framing academic content as valuable to one's life outside of school as a way to critique social injustice" (Enyedy et al., 2011, p. 276). In order to decide which data would be included in the analysis of teachers' conceptualization of CRP as relevance of authentic purpose, I created the criterion that the teacher had to talk about how what the students were learning in the class could be useful to them in their lives beyond the science classroom. While this did not address the element of social critique, it did cover the directional flow of knowledge (from the classroom to the students' everyday lives), which seemed to resonate with the teachers because it proved to be a common theme. Once this criterion was established I began to look at the themes that emerged from the data included in this category. The teachers, it turned out, talked about a variety of topics to which they thought the students could apply their classroom-constructed knowledge. These topics included: (1) their own bodies; (2) their health and the health of their families; (3) Access

to and identity with science (4) socio-scientific issues; (5) local/community issues. Once I had established the emergent themes, I began to look to the instances of talk to understand more about them. The inclusion criterion did not require an instance to include a critique of social injustice primarily because so many of the teachers ignored issues of social justice when thinking about how their students could use the academic content outside the classroom. Thus, in order to more fully understand the teachers' conceptualization of CRP as it related to authentic purpose, I examined the productive "half steps" they made toward choosing a social justice topic, and encouraging student critique and action. This meant that I coded each example suggested or described by the teachers for the presence of a social justice issue, critically conscious lens, and opportunity for action. All of the examples that did *not* include a social justice issue, a critically conscious lens or an opportunity for student action (i.e., only included the directional flow of knowledge from the classroom into the students' everyday lives) were not examined in this phase of the analysis; I focused on those instances that had at least one of the other elements of relevance of authentic purpose.

Additionally, I also looked at what the teachers indicated the value of relevance of authentic purpose was. There was less direct talk about the value, but the emergent codes for the value of relevance of authentic purpose were: (1) learning; (2) motivation; (3) empowerment.

Relevance of content and/or context. Relevance of content/context is described by Enyedy and colleagues as "academic topics [that are] couched in familiar contexts that build upon students' existing competencies and prior knowledge for academic success (2011, p. 275). In order to decide which data would be included in the analysis of

teachers' conceptualization of CRP as relevance of authentic purpose, I created the criterion that the teacher had to talk about how the students' knowledge, experience, and/or interests could be used in the classroom. This directional flow of knowledge (from students' lives outside of school into the classroom) was in the opposite direction of the relevance of authentic purpose excerpts. Every instance in which a teacher talked about using students' knowledge from outside of the classroom in the classroom was counted as an excerpt of relevance of relevance of content and/or context.

I then looked at each excerpt in order to understand how the teachers talked about where the knowledge the students were bringing to the classroom came from, what they understood the curricular role or function of that knowledge to be, and what they said the value of using student knowledge in this way was. I decided that types of sources and functions had to be mentioned by at least two teachers in order to warrant their own category; all the sources and functions presented in the relevance of content/context findings chapter have been mentioned by at least two of the teacher participants. The teachers talked less about the value of incorporating student knowledge into lessons, and therefore I was unable to code many excerpts. From the excerpts I was able to code, the two themes that emerged for this category were "interest" and "motivation."

With the aim of understanding the sources that the teachers were trying to leverage for their students, I parsed instances in which teachers talked about the sources of students' resources into three categories: those in which the source was "personal" in nature, those in which the source was "universal," those in which the source was prior knowledge from school and those instances in which no source was discernable from the teacher's explanation. All sources that were either (a) communities in which students

might be involved or (b) could reasonably be considered important to their identities, were counted as "personal." Included in the category of personal sources were family/community, pop culture, and extra-curricular activities, among others. Included in the "universal" category were biological functioning, and nature. The category of "school" was used to mark instances in which the teacher identified the students' knowledge as coming from other classes the students had taken at school. There were several instances in which the teachers were too vague about the source to code, and others in which the teacher did not allude to any source whatsoever.

In order to understand the curricular functions of the students' prior knowledge and experiences in the teachers' classes, I looked for how they talked about using the students' knowledge within the context of a lesson, unit, or project. When the teachers were explaining a lesson, unit, or project that they had already attempted or planned to do, the function of the student knowledge was usually quite explicit. The functions that emerged were: (1) using student knowledge to concretize content knowledge; (2) using student knowledge to build content knowledge; (3) using student knowledge to present content through analogies; (4) using student knowledge and curiosity to direct classroom activity.

Relevance of practices. Enyedy and colleagues describe relevance of practices as an interpretation of CRP in which the practitioner focuses on the "process rather than the content of instruction" (Enyedy et al., 2011, p. 277). My inclusion criteria for instances that would be included under the umbrella of relevance of practices was that the teacher(s) were describing either how they would incorporate into science class practices their students knew from their lives outside the classroom, or processes of instruction,

such as setting up classroom norms, building relationships with students and creating participation structures.

The themes that emerged to capture how the teachers talked about relevance of practices were (1) building relationships with students; (2) attending to students' learning styles; (3) using technology and new media; (4) incorporating students' language practices; (5) attending to students' communication practices. All of the themes were expressed by more than one teacher, aside from attending to students' communication practices, which was expressed by only one teacher. This teacher, Camille, talked explicitly and consistently about CRP in terms of the process of instruction, and focused her practice of CRP on this type of relevance during the second phase of the study. I elected to look more closely at Camille's approach to relevance of practices because she was the only teacher to focus on this interpretation of relevance with such intensity. Her case study is included in chapter 6 because it depicts a teacher's conscious effort to change pedagogical practice and the resulting interpretation of CRP, which in many ways approximated relevance of practices

Data Analysis for research question 2

My second research question asked, "What challenges did the teachers face in trying to implement CRP?" As I read and reread the transcripts of my interviews and debriefs with the teachers, I marked places where they talked about difficulties they were having enacting CRP, their confusion about CRP, and the resources they wished they had. These three types of "challenge" helped me to bound the data I analyzed to answer my second research question. I then did a round of micro-coding in which I identified more than ten different types of challenges expressed by the teachers or manifest in their

talk about CRP. These were, however, too fine grained to be useful, and during subsequent rounds of coding I identified three general categories that described the range of challenges the teachers faced when talking about and practicing CRP. Some of them were reported directly to me (i.e., the lack of collegial support) and some were my own judgments (i.e., the confusion many of them had about culture as a concept). The three categories were (1) conceptualization factors; (2) school factors; (3) factors relating to teaching inexperience.

Positionality

As a former teacher I could often relate to the struggles the participating teachers faced as they balanced the pressures of a demanding course load, and as a current graduate student I could also empathize with their experiences of taking classes while working in the field. I think that these situational similarities helped the teachers trust me and participate eagerly in my study. Additionally, it was apparent to me that the time I spent with them in their methods class in the first phase of the study went a long way toward building trust with the teachers and encouraging their participation in the study. I had to solicit participants twice, the first time just weeks after joining the methods class as an observer. I only received one interested teacher. When I solicited participation again, a few weeks later, six more teachers volunteered. One dropped out for personal reasons immediately after volunteering. I believe that in the intervening weeks showing up to every methods class, participating in the activities and asking the teachers about their experiences encouraged their participation. Some of them referred to my dissertation as my "inquiry paper," which is what the program called the paper they submitted as a requirement for completing their master's degree. I interpreted this as evidence that they

related to me as a fellow graduate student. One of the teachers thanked me for the "support and loyalty" (Camille, personal communication, 1/16/13) I had shown to the cohort of teachers. However, my role as a doctoral student afforded me the privilege of studying CRP in more depth and over a longer period of time than my teacher participants and thus I had to stay cognizant of these differing time scales and the assumptions I made about their understanding of and orientation toward CRP.

My research in CRP and teacher education is complicated also by my position as a white woman. On the one hand, I do not share many demographic similarities with the student population that CRP traditionally serves and benefits, both in terms of ethnicity and socio-economic status. On the other hand, I have much in common with the teaching force, which is predominantly white and middle class. As such, I was constantly conscious about my position as a non-minority researcher. I was wary of making any assumptions about the experience of the students in the teachers' classrooms, but as the focus of this was a study of the teachers' conceptualizations, and not students' experience, I was able to largely avoid this pitfall. Nevertheless, my position as a white woman, and its attendant privilege, was never far from my mind as I asked the teachers about cultural relevance for minority students and social justice education. However, the fact that I was not the same race as the students that the teachers taught may have made them less self-conscious when discussing these topics.

Finally, my experience as a science student both motivated and complicated my research of CRP in science classes. As a science student I was relatively academically successful, but seldom felt like I belonged in advanced science classes and rarely felt as if the science content I was learning had any bearing on my life. Science and scientific

knowledge seemed understandable and malleable for a few select people, of whom I was not one. I do not know if being female compounded this feeling of being a science outsider, but it certainly may have. I do know that I always assumed that the male students would be more successful in science classes than I would be, and the tendency to feel isolated from science among girls is well supported in the literature (Costa, 1995). My experiences prompted my interest in the use of CRP in science, because of the way CRP encourages science teachers and students to broaden the definition of what counts as knowledge and knowing in science class.

I was aware of all these facets of myself, and their attendant points of view, during the design, data collection and writing of this dissertation. I sought to identify and interrogate my assumptions that stemmed from my position as a doctoral student, a former teacher, a white woman, and a former science student during all stages of the study. Some of these positions caused me to be less sympathetic to the teachers and their journey to understand CRP, and some more. At every juncture I tried to look at the data as objectively as possible and consider contradictory explanations in order to minimize the biases and perspectives (or lack thereof) that are inherent in my own experience.

Chapter 4: Relevance of Authentic Purpose

This chapter focuses on relevance of authentic purpose, an interpretation of cultural relevance that "focuses on framing academic content as valuable to one's life outside of school as a way to critique social injustice" (Enyedy et al., 2011). In essence, relevance of authentic purpose strives to develop simultaneously students' academic ability and their critical consciousness (Enyedy et al., 2011), by using academic knowledge in service of critical consciousness. Developing students' critical consciousness means that teachers "help students recognize, understand, and critique current social inequities" (Ladson-Billings, 1995b, p. 476). Authentic purpose fundamentally implies that knowledge constructed in school should be used in students' lives outside of school. That knowledge, however, should be directed through a critically conscious lens to critique an issue of social justice. Ideally, activities that have authentic purpose include praxis in order to foment (student) action to address the issue. Thus there are four components that comprise authentic purpose in classroom activity: selection of a social justice topic to provide "purpose," directional flow of knowledge, application of critical consciousness in contemplating the topic, and the opportunity for students to take action to address the topic.

All the teachers participating in this study talked to some extent about CRP in terms of how classroom activity could be useful for students in their lives outside of the classroom. The directional flow of knowledge seemed to be salient for the teachers in thinking about how classroom activity could be culturally relevant to their students. Many of them regularly talked about the variety of ways in which their students could utilize their classroom-constructed knowledge to some purpose in their lives beyond the

classroom. The teachers talked about a variety of arenas in which students' classroom knowledge could be used in their lives outside of school, and a few themes emerged across participants. What was most striking about the data was that the topics the teachers suggested were often not connected to social justice, and thus did not invite the students to develop their critical consciousness, or only had a tenuous connection to a social justice topic. More often than not, the purpose that the teachers assigned to the academic content they were teaching had a relatively uncritical focus. Additionally, the teachers did not often present opportunities to take action in response to the topics. All of these teachers, however, took the first crucial step towards cultural relevance when they framed the classroom knowledge as useful and meaningful to the students in contexts outside of the classroom.

Many of the instances in which teachers talked about purpose, they concentrated on the way in which the science content the students were learning could be useful to them in understanding more about the functioning of their own bodies. Some of the other topics that the teachers suggested for their students were less individualistic and allowed more clearly for the possibility of critical consciousness, though the opportunity was not always seized. Those topics included socio-scientific literacy, access to the world of science, and addressing local, community issues. In this chapter, I present the different topics, as the teachers expressed them to me, and then examine the differing opportunities they afforded for critical consciousness and action. In particular, the teachers seemed to avoid presenting topics of social justice or encouraging their students to take a critical stance when considering the issue. As new teachers, they understandably struggled to

imbue lessons with authentic purpose, but many of their first steps toward doing so held great possibility.

Relevance of Authentic Purpose as Reflected by Teachers' Talk

Though most of the teachers in this study made mention of their students using their science classroom knowledge outside of school, they did not talk about this type of relevance in equal measure. Jessica and Eileen were the teachers who most frequently talked about CRP in terms of how their students could direct their classroom knowledge to topics outside of school (see Figure 1).

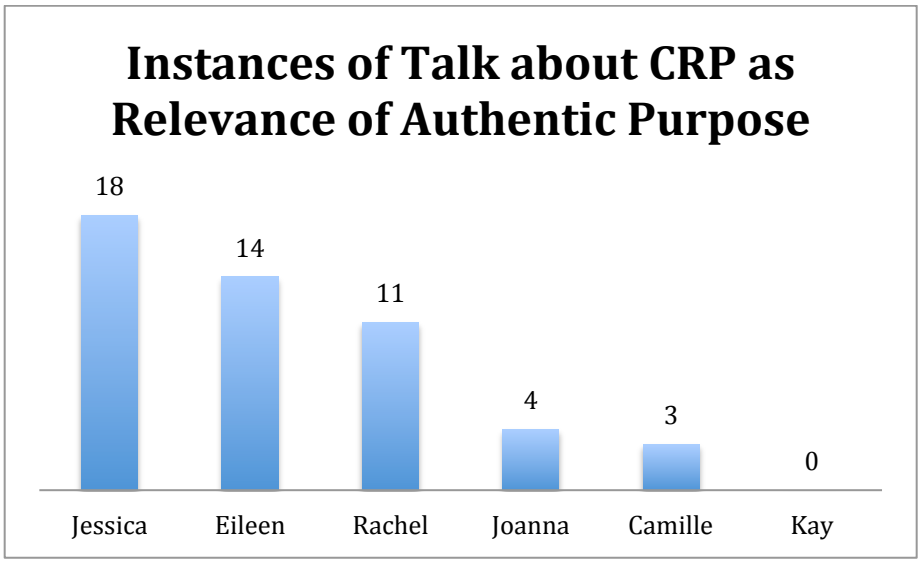

Figure 1: Instances of teachers equating students' use of classroom knowledge outside school with CRP

The teachers talked about a variety of arenas or topics (outside of school) toward which the students could direct their science knowledge. Table 1 presents the topics, their description, and the teachers who talked about those topics. By far the one most frequently cited was understanding their own bodies better. All of the teachers, aside from Camille and Kay, talked about the relevance of students learning more about the biological functioning of their own bodies through the content they were learning in their science classes. Three of the teachers talked about how the students could use science

content to better understand issues regarding their own health and that of their loved ones. Three teachers talked about how teaching their students particular content and presenting them with particular images of science would encourage their participation in science. Two teachers talked about the ways in which their students could direct their science knowledge toward socio-scientific issues such as nuclear energy and genetically modified foodstuffs. Finally, two teachers indicated that it was culturally relevant for their students to use their science knowledge to contemplate issues or problems in their own communities. Jessica and Eileen each talked about four of these five topics in their interviews and debriefs. Camille never spoke about relevance in this way in more than general terms: "I feel like it's easy for me to make it relevant to them by introducing something that… they can apply in their own lives" (Camille, Interview 1). Kay never indicated that she associated CRP with encouraging students to learn for some purpose outside of the classroom.

In the following sections I present the topics of authentic purpose as described by the teachers. I begin with those topics that were mentioned by the most teachers, and present them in descending order. Then I outline the value of relevance of authentic purpose for the students, as expressed by the teachers. Finally, in the discussion section of this chapter, I examine the productive half-steps that the teachers were making toward CRP through their use and talk of relevance of authentic purpose.

Topic	Description	Jessica	Eileen	Rachel	Joanna	Camille	Kay
Students' Bodies	Purpose is for students to learn more about their own bodies and biological functioning through the content they are learning in class.	x	x	x	x	-	-
Health of Students & their Immediate Families	Purpose is for students to use scientific knowledge to understand health issues that affect them and their families.	x	x	-	x	-	-
Science Identity and Access	The purpose is to help students identify with and gain access to science through the science content they are learning in class.	-	x	x	-	x	-
Socio-Scientific Literacy	Purpose is to use scientific knowledge to consider socio-scientific issues in the socio-political realm.	x	x	-	-	-	-
Local/Community Issues	Purpose is for students to use scientific knowledge to consider health issues in their own community.	x	-	x	-	-	-

Table 1: Types of authentic purpose suggested by teachers

Developing Student Understanding of Their Own Bodies

There were an abundance of instances in which the teachers talked about cultural relevance in terms of how students could use science content to better understand their own body: 12 of the 49 excerpts that I coded for relevance of authentic purpose focused on students applying science knowledge to understanding their biological functioning. Every teacher (aside from Camille and Kay) framed students gaining knowledge about their own bodies as a form of authentic purpose. Jessica, who had more instances of talk about authentic purpose than the other participants (see figure 1), focused particularly on students' understanding of their own bodily functions as an authentic purpose. During the second phase of the study, Jessica taught a high school biomedical class that integrated health, biology, and physiology, so it is perhaps not surprising that she imagined

authentic purpose as students learning about their own bodies. She explained how particular activities in her classroom were relevant to her students because they allowed them insight into their own biological functioning, such as looking at their own cheek cells under the microscope instead of pre-prepared slides (Jessica, Debrief 10/01/12) and looking at their "own EKGs instead of just having a worksheet" (Jessica, 11/30/12) during a lesson about the different stages of a heart beat.

This framing of purpose was also apparent in how Joanna, Rachel, and Eileen talked about the purpose of their culturally relevant lessons and activities. Joanna, talked about how helping her students understand their own bodies better made certain lessons culturally relevant. Teaching physiology meant that Joanna, like Jessica, also had opportunities to relate science content to the students' bodies. She explained that a lesson in which she tasked her students with comparing their heart rates, sitting and standing, was culturally relevant. In order for the students to record their heart rates for comparison, she taught them to measure them by placing two fingers on their carotid artery. Knowing how to do this, she asserted, was culturally relevant because it is a "real world skill" that was "important" and "relevant to the students' lives" (Debrief, P3, 10/11/12). Like Jessica, Joanna seems to equate encouraging her students to become more knowledgeable about their own bodies and exert agency over their care with cultural relevance.

Eileen described several moments of cultural relevance that amounted to teaching students about their bodily functioning. During a frog dissection, she commented that the experience was culturally relevant to the students because they got to learn about what

their bodies would look like on the inside because the anatomy of a frog has some similarities with that of a human (Eileen, Debrief 1).

The focus on students learning about their bodies makes sense in many regards. It provides the students familiar context for what they are learning, and ostensibly some motivation for or interest in engaging with the content by encouraging the students to see the utility of scientific knowledge in their own lives (beyond the science classroom). However, the focus on students' understanding of their own bodies personalizes the purpose to such an extent that it lacks some integral elements that define relevance of authentic purpose: the activities lack a social justice context and thus also the critical consciousness that defines relevance of authentic purpose. Demonstrating how knowledge from the science classroom can inform students' understanding of their own bodies is not particular to CRP, though CRP does not preclude the use of these types of activities. The inclination to help the students' use their science knowledge to understand their own bodies could be effectively built upon in order to address larger socio-political issues such as inequality in access to healthy foods or adequate health care. Thus, educating students about their own biology may be a first step toward tackling issues of social justice through science. The examples in the following section demonstrate how some of the teachers in the study began to work out from the context of the individual student, expanding the purpose to encompass students' families and communities while also moving beyond simple biological functioning to address health issues.

Addressing the Health of Students and their Families

Closely related to the purpose of students using science content to gain insight into their own bodies is the purpose of using it to better understand health issues that

affect students and their families. These instances extended the purpose from merely learning about the biology of one's own body to learning about diseases and medicine, in the context of one's own health and one's family's health. Three teachers talked about using science knowledge to address the health of students and their families.

Eileen described two units that she implemented during her time teaching middle school (phase one of the study), in which the students' own anatomy and health was the explicit subject matter: one addressing vision and the other covering sexual education. Eileen reported that the unit on sexual health was, in her students' opinion, the "most valuable out of the whole year" because of "the age they're at… and [sex in] the media… it just feels very relevant to their life" (Eileen, Interview 2).

In the unit on vision and optical health, after learning about eyes, diseases of the eye, and optical disease prevention in class, Eileen asked the students to share what they had learned with their families. Then there was an assignment for the students to write up a health plan with their parents in order to maximize their optical health:

> The kids had to study a different eye disease or disorder like glaucoma or color blindness and they got to make a health brochure out of it. And then at the end of the project, they had to take their brochure home and share it with their parents where they basically had to teach their parents about what they learned and then come up with a family plan for like healthy vision, like how they could protect their eyes. (Eileen, Interview 1)

Eileen's assignment of a healthy vision plan takes the authentic purpose one step further, encouraging steps toward action instead of simply raising awareness, though the topic of healthy vision, is not a social justice topic warranting the application of a critically

conscious lens. The scale (a vision plan for an individual family), confines the activity to a personal level.

Accessing and Identifying with Science

Three teachers thought about CRP in a more idiosyncratic way: in terms of granting their students access to the world of science. By this reasoning, the learning their students were doing in the classroom was, at least in part, for the purpose of granting them access to science through fostering a strong identity as a science student or future scientist.

Eileen explained that she thought about how her students would apply the experiences they were having in her class to their lives beyond the classroom, as students who were interested in science:

> I think it's important for students to have role models or even identify as scientists because I feel like the Latino and African American population is very underrepresented in… the higher science community. So I think for the to develop a sense of like, oh, I enjoy science, I like science and want to study science; it's also [a] very socially just and culturally relevant thing… (Eileen, Interview 1)

Eileen framed relevance here as development of a science identity in order to access science at higher levels. Helping her students identify with science was not the only way Eileen addressed getting them access to science. She also explained in a debrief that "half" of her high school students were interested in majoring in science in college and thus she framed the usefulness of the chemistry class she was teaching as that of "preparing for college" (Eileen, Debrief 10/19/12). Eileen was concerned with helping her students gain access to science through developing academic competence in science

and identifying with scientists who had similar racial and/or ethnic backgrounds. The problem of the underrepresentation of racial and ethnic minorities in science is a real social justice issue that can be considered critically, but interestingly, Eileen did not suggest presenting the problem to the students to critique, instead trying to address it herself through providing the opportunity for access and identification.

Similarly Camille described how she wanted her students to be exposed to scientists who shared their ethnic or racial background because she had the impression her class felt alienated from the world of science. She recounted how one student told her that science was "all white people." She though that by introducing her students to "people from their ethnic background or someone related to them in some way or someone that had the similar interests with them… was involved in science I think they'd have a better sense of ownership of what they're learning" (Camille, Interview 2). Thus she was hoping to encourage her students to become more invested in science through helping them to identify with it.

Rachel similarly framed the purpose of a project she did with her biology students as being that of access to science at the college level. She described the project in which the students read journal articles published in science journals and presented the findings to the class. The content was quite advanced for high school, but her students, who were in AP biology, seemed to approach the assignment with enthusiasm. Rachel explained that while the exercise was perhaps "not very directly culturally relevant" it was "extremely important" and "something like this could be culturally relevant if kids thought they were going into science," which, according to her, many of them did. She further justified the project as culturally relevant, explaining, "I am trying to open their

horizon so that something like this [reading scientific research in primary source form] is something that they feel comfortable around so that that doesn't become a barrier later on to higher science education" (Rachel, Debrief 11/29/12). However, she maintained that she did not believe it was culturally relevant in a traditional sense.

These excerpts demonstrate an idiosyncratic conceptualization of authentic purpose. The teachers seem to be attending to their perceptions of their students' future selves and calibrating relevance based on that future. This particular construal of relevance is not one manifest in the literature and thus is an interesting interpretation of authentic purpose. Also, while the teachers are taking action on behalf of their students, the students themselves are not being presented an issue or problem that they can address critically. The problem, one of access and identification with science, is an issue that the teachers chose to address themselves, but not make manifest to their students. Presenting to their students the problem of underrepresentation of many minorities in science could have provided an occasion for conversation to develop students' critical consciousness.

Fostering Socio-Scientific Literacy

Another purpose that was communicated by the teachers was fostering socio-scientific literacy. This is another example of how the teachers were beginning to move out from relevance to students' immediate personal experience to that of society. Jessica and Eileen both talked about this purpose in the context of their explanations of CRP. Jessica explained that her students were interested in learning about the science they heard about in the news:

> They hear all these things in the news, so it's just like giving them more of a picture of what those things actually are and then what they could mean for them, too, like how can stem cells help you in the future (Jessica, Interview 2).

In this example, the purpose is fostering students' socio-scientific understanding, but it also relates the topic back to their bodies.

Similarly, Jessica identified a unit on genetically modified food as culturally relevant. The students learned about GMOs by extracting DNA from a variety of foods and looking for genetic modifications. The students also took part in a debate about whether or not we should eat genetically modified foods. For the culminating project, her students wrote blog posts presenting their findings from the DNA labs, and included their own opinion about GMOs, based upon their experiment results and the class debate. The science content, concepts of DNA modification and extraction, was highly specialized and academically rigorous. Jessica indicated that this unit was culturally relevant to her students because they realized, "we do eat genetically modified food all the time" (Jessica, Interview 1). Again, the result was both to foster an understanding of a socio-scientific issue (GMOs) and prepare students to make informed decisions about their own bodies and health. The GMO unit had the potential for inclusion of all the elements of relevant of authentic purpose. Students were using their knowledge of GMOs constructed through classroom activities to address issues that exist outside of the classroom, and it was a topic that was playing out in the political stage at the time.[5] The topic of GMOs

[5] Proposition 37, which proposed requiring genetically modified food be labeled as such, was being debated in the media in the lead up to the state-wide vote in November 2012. The topic was trending on social media and in traditional news outlets and there was great debate in the state, and beyond, over the potential ills of GMOs.

was not incompatible with encouraging students' critical consciousness, but Jessica did not explicitly frame it as a social justice issue (e.g., the disparate burden faced by small-scale farmers trying to comply with the bill versus the large-scale farmers, or the relative expense and effort required to avoid GMOs that make it a difficult choice for those without considerable resources). Nor did she encourage her students to take action on their conclusion about GMOs (which would have been possible given the prominence in public debate at that time), such as writing their congress people or educating others about GMOs in advance of the upcoming state-wide vote. This unit was ambitious, comprehensive, and had the potential to comprise all the elements of relevance of authentic purpose. It was, however, limited to the students' personal conclusions about GMOs, largely divorced from the socio-political context of the time.

Eileen also described a project that addressed socio-political issues. The project, which she wanted to do with her students, but had not yet had a chance to implement, involved her students using what they learned about nuclear chemistry to address the socio-political topics of nuclear energy and nuclear medicine. She explained that in a research paper they could weigh the pros and cons of nuclear energy, or nuclear chemistry more generally, and that relating this chemistry content to the world beyond the science classroom would make it relevant: "I feel like that would have been such a good like in-depth way to relate chemistry to why it's relevant to society" (Eileen, Interview 2). Eileen's reasoning for labeling the project relevant was that it addressed nuclear energy, a topic that is prevalent in socio-scientific discourse. The lens she appeared to suggest was somewhat agnostic, in that she did not make clear whether she wanted the students to think about the issue of nuclear chemistry within a context of

social justice. Critically, the nebulousness with which Eileen described this project makes it difficult to untangle what she viewed the issue to be and therefore whether it warranted a critically conscious exploration. Since this was not a project that Eileen had yet attempted, her vagueness was likely representative of the stage she was at in her thinking about that particular project. While the general topics of nuclear energy and nuclear medicine are not on their surface social justice issues, it is possible to see how they might be explored with a critically conscious stance; for example, through an exploration of who in society will benefit from nuclear power and who will not, and whether certain sections of the population will incur more risk than others through the adoption of nuclear energy. Nevertheless, Eileen's description of the proposed research paper did not seem to require a critically conscious stance and the global context of the nuclear energy issue precluded, or at least greatly minimized the opportunity for students to take action in response to it.

Addressing Local Community Issues

Two teachers talked about cultural relevance in terms of using science to address local community issues. Jessica (Interview 1) described how she might try to talk to her students about the lack of healthy, organic, food options in their neighborhood as a way to make science culturally relevant:

> … in the communities that my students live there are certain types of [food]… because of their economic status they can't really have… or… it's not as available-- that typical organic [food] or… the really expensive stores, right. So then -- and then typically a lot of -- because of the area I guess and just [their] means… I think they might have more of those like -- kind of lower nutrient

> food… so that could be one way that you could talk about cultural [relevance]. I guess just like the types of… food that they're eating at school… compared to maybe foods in other areas… that other communities are getting. (Jessica, Interview 1)

Though she did not elaborate, nor did she attempt this discussion in her classroom to my knowledge, the critical conversation she sought to engender as a result of the hypothetical discussion certainly would encourage her students to employ critical consciousness.[6] Combining this conversation with the unit on GMOs could have been a feasible way to incorporate critical consciousness into the GMO debate. Less access to organic foods or stores with high quality food would likely also entail less choice about consumption of GMOs. Thus depending on their stance on GMOs, students could discuss how the issue potentially affected their health and that of their families. Grounding the socio-scientific issue of GMOs in a problem of social justice salient to the students' local community could have been a promising approach to relevance of authentic purpose, if in fact Jessica's assumptions about the food choices available to her students were correct. It is noteworthy that Jessica, as a brand new teacher, was thinking about these issues and implemented one of them in a unit.

The project Rachel implemented in her middle school science class about community health asked students to work in small groups to come up with a problem or

[6] This discussion is predicated on Jessica's impression that her students' neighborhoods are in fact "food deserts." However, whether in fact urban and lower income areas actually have less access to healthy food has not been settled. There is evidence that residents actually have *more* access to food options than residents in wealthier areas (see An & Sturm, 2012; H. Lee, 2012). Jessica's assumption that the students would have less access to healthy food options runs the risk of labeling the neighborhoods in which the students live as lacking.

issue in their community or neighborhood, research it, and then suggest and implement some sort of action to address it:

> I think that definitely the project I did at the end of the year with my health class was culturally relevant in that I asked the students to kind of tap in to their community and think about what their community might need and think about how to best reach their community and I think that that's where the cultural piece came in. (Rachel, Interview 1)

In addressing the community issues, this project captured the essence of relevance of purpose. Rachel required her students only select topics that they knew affected their community, specifying that the topic had to be related to "social health, mental health, or physical health" (Rachel, Debrief 1), as it was part of a health unit. When students tried to pick topics that were merely interesting, and not necessarily relevant to those in their community, Rachel pushed back:

> So some kids were like, child abuse. And I was like, is that something that any of you guys have experienced? Or do you know anybody that's had this? They were like no, [so I was] like, well is that something that's like a pressing need…? (Rachel, Debrief 1)

Rachel was intent on grounding the project in community issues that were relevant to her students' lives. She explained, however, that she left the definition of community to the students' discretion:

> I gave them a little bit of leeway on how they wanted to define communities. So if they wanted it to be just like [their school community], that could be it or if they wanted to just be like the neighborhood [that could be it, too]. (Rachel, Debrief 1)

Rachel's requirement that the topics her students chose be actual community issues meant that they were local enough to be relevant to her students. There was the opportunity for an exploration of social justice issues, but as Rachel ceded most of the decision making to her students, the projects did not all address social justice topics nor did they address the issues through a critically conscious lens. The wide variety of topics that her students undertook is presented in Figure 2. They ran the gamut from the problem of childhood obesity to the prevalence of homeless people in the neighborhood surrounding the school, to pollution. The students, tasked with proposing a solution to their chosen topic suggested remedies such as Zumba (a popular fitness class), donations to charity, and reduction in use of carbon fuel and electricity.

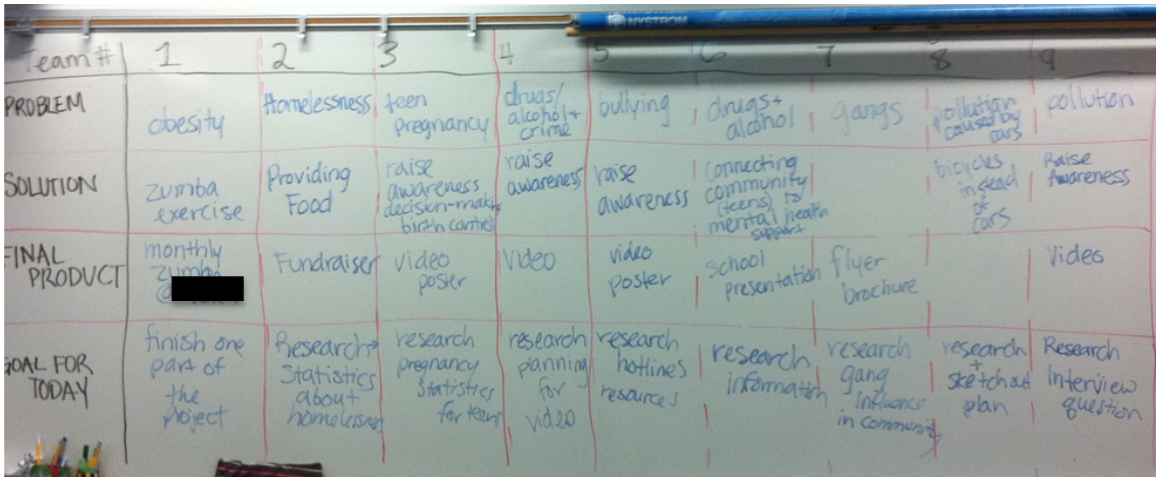

Figure 2: Students' topics, solutions, and final products as recorded by Rachel.

As is demonstrated in Figure 2, the project required the students to take action to address the issue or problem they had chosen. Rachel explained that the requirement was for the students to articulate a solution to the problem they had chosen and then think of a "product" to "actually address the need" (Rachel, Debrief 1) and "connect to the community" (Rachel, Debrief 2&3). In some cases this meant raising money through a

bake sale to donate to a homeless shelter or giving a presentation to parents on the dangers drugs and gangs posed to middle and high school students.

Rachel's community health project was impressive both in scope and in the way in which it directed the students' energies toward researching a problem that directly affected their local community. During the three classes I observed the students were noticeably engrossed in their projects, and Rachel described them as "engaged" as a result of the project on multiple occasions (Rachel, Debrief 1; Debrief 2&3). This project balanced personal relevance with relevance to a community, and the requirement that the topics be issues or problems that the students identified as affecting their communities increased the possibility that they would be issues of social justice.

Function of Authentic Purpose: Interest, motivation, and empowerment

Before examining the productive half-steps that the teachers made in their talk and practice of relevance of authentic purpose, let us first consider the benefit the teachers saw in presenting their students with a purpose toward which to direct their science knowledge. Relevance of authentic purpose has often been thought of as a way to motivate students (Enyedy et al., 2011), and this idea was echoed by the teachers in the study. The teachers talked about how presenting science content within the context of a purpose had a positive influence on the students in their classrooms. Two teachers identified the empowerment of their students as being the result of particular classroom activities they identified as having a culturally relevant purpose. When describing the community health project, Rachel explained, "I think that doing a project that's… relevant to them may ultimately give them a sense of agency that may actually just be more important to [them] than like me talking at length about something…" (Rachel,

Debrief 1). Camille also posited that when students are able to use the material they have learned in science class in their everyday lives, they feel a sense of "power" (Camille, Interview 1).

Some of the teachers also cited student interest and increased motivation as being a result of teaching science content that would have a purpose in students' lives. Eileen explained:

> … I think it makes them a lot more excited to learn… So I think there's a lot more buy-in for their own learning and also just to understand the world around them when [content is] relevant and applicable to their life. (Eileen, Interview1)

All of the teachers, in one way or another, indicated that facilitating their students' use of science knowledge in their lives outside of school increased their interest. Eileen added, that it could also amplify their learning: "I think it develops a much deeper understanding of science content… when people can make connections between what they're learning in school and what's actually happening in their own life or in the world around them" (Eileen, Interview 1).

Discussion: Toward a critically conscious authentic purpose

The teachers in this study considered classroom activity (lessons, projects, units, etc.) culturally relevant when they encouraged students to use their classroom knowledge in their lives beyond the classroom. While the directional flow of knowledge is an essential element of relevance of authentic purpose, it is not the only defining feature. The other components—selection of a social justice issue, application of critical consciousness, and opportunity for action—are also integral but were largely absent from the teachers' examples. Without the elements of social justice, critical consciousness and

praxis for action, creating instances in which students can use their academic knowledge in their lives outside the classroom are not fully in the spirit of CRP.

There were, however, many instances in which the teachers in this study made fledgling steps toward authentic purpose that included a social justice context and critically conscious lens, and praxis by which action could be taken to address injustice. The teachers' ability and desire to incorporate these elements of authentic purpose points at how, even as new teachers, they demonstrated a commitment to CRP, and used it in some innovative ways in their classrooms. Table 2 presents the elements of authentic purpose that some of their activities afforded and others that were sites of future possibility. Positioning activities within a social justice framework so that they would merit the application of critical consciousness seemed to be either a challenge or of lesser priority for the teachers.

Example	Knowledge Flow	Social Justice Topic	Critically Conscious Stance	Opportunity for Action
Vision Unit	✓	No	No	✓
Nuclear Science Paper	✓	Possible	Possible	Possible
GMO Unit	✓	Possible	Possible	Possible
Community Health Project	✓	Possible	Possible	✓

Table 2: Elements of authentic purpose by activity

Eileen's nuclear chemistry research paper and her vision project, Jessica's GMO unit, and Rachel's community health project all approached relevance of authentic purpose and held possibility for further development. Rachel's community health project was probably the most promising of the projects. By having the students identify the issues on their own, Rachel was largely able to avoid the casting the students' communities in a negative light, which is a real concern (Philip, Way, Garcia, Schuler-Brown, & Navarro, 2013). Her commitment to situating the projects within the local

community meant that the projects were personally relevant to the students as well as relevant to a larger community to which they belonged. The focus on issues faced by the community allowed for the possibility that projects would address issues of social justice, though she did not encourage her students to take a particularly critical stance when considering the issues. Encouraging the examination of the "problems" within their social, historical and political context and attendant hegemonic structures is key to developing students' critical consciousness and locating causality in a source other than the community itself (Philip et al., 2013). Rachel did require the students to take action to address their chosen issue, thereby encouraging her students to address the issue in a proactive manner.

Eileen's vision unit offered students the opportunity for action, taking responsibility for their health and the health of their families. While the topic of optical health was not presented as a social justice topic and thus did not encourage students to take a particularly critical stance on the issue, one could see how a similar project could ground issues of health and access to health care in a social justice context and thus develop students' critical consciousness. Her nuclear chemistry research paper also was fertile ground for incorporating a critically conscious stance as students' used their knowledge of chemistry to address a socio-scientific issue.

Jessica's unit learning about and debating the merits and safety of GMOs was another impressive undertaking that required the students to learn about DNA, its modification and how to extract it for testing. It also encouraged them to consider the socio-political context of GMOs as food sources. While Jessica did not, as far as she indicated, construct this as an issue of social justice, she did talk about involving her

students in a discussion about food choices in their neighborhood and school, as an activity unrelated to the GMO unit. Thus, over the course of the class, had Jessica implemented this discussion, students would likely have gotten the opportunity to develop their critical consciousness around the issues of access to healthy food and awareness of the effects of genetic modification of the food we eat.

Something that stands out in all of these moments of possibility is that while the teachers were undertaking creative and innovative activities to help their students learn for a purpose outside of the classroom, they rarely appeared to contextualize the activities as addressing issues of social justice. The issues of GMOs, nuclear science, and community health were not presented as social justice issues. This is crucial, because without framing a topic within the realm of social justice, there is no need for students to address it with critical consciousness. Thus, encouraging teachers to develop activities around social justice topics is a priority, one which is predicated upon their own ability to direct a critically conscious lens toward topics such as nuclear science, GMOs and, and community health issues. If the teachers themselves approached science topics with a highly developed critical consciousness, they would naturally tend to present questions or issues as ones of social justice. Thus, developing their students' understanding of their own bodies could be grounded in the purpose of empowering them to advocate for health care, or develop a deeper understanding of health issues that affect the communities to which they belong. While preservice and novice teachers tend to have a difficult time developing their own critical and cultural consciousness (Gay & Kirkland, 2003), it is a necessity in order to incorporate relevance of authentic purpose into their classrooms.

Chapter 5: Relevance of Content and/or Context

This chapter examines how the teachers spoke about relevance of content and/or context in their talk about CRP. This interpretation of CRP, which focuses on the incorporation of students' prior knowledge and experiences, is a common construal of CRP (Enyedy et al., 2011). Enyedy and colleagues describe this approach to cultural relevance as relying on and incorporating students' familiarity with the content and/or context of the classroom activity (Enyedy et al., 2011). Relevance of content and context is an extension of the constructivist approach to learning and instruction. While constructivism is focused primarily on resources such as physical abstraction and logico-mathematical abstraction that students bring with them into the classroom, CRP includes students' social and cultural knowledge as a foundation for building new knowledge (Enyedy et al., 2011). CRP focuses particularly on students' social and cultural knowledge because of its commitment to valuing students' social and cultural experiences and helping them to maintain their cultural competence (Ladson-Billings, 1995b). By supporting the incorporation of student knowledge and experience, this interpretation of relevance is beneficial to students by encouraging knowledge construction, interest in the subject matter, and demonstration of cultural competence. Thus, relevance of content and/or context supports two of Ladson-Billings' three tenets of CRP: maintaining cultural competence and encouraging academic success. In this interpretation of relevance there is less support for developing students' critical consciousness.

The content and context approach to cultural relevance has been explored and utilized widely in the field, likely in part because of its similarity to constructivism. When

defining CRP, and describing classroom activities that they identified as culturally relevant, the participants in this study talked a great deal about the need to access and incorporate their students' knowledge, experiences, and interests into their classrooms. Of the 228 instances coded for conceptualization of cultural relevance, 104 were instances in which the teachers talked about CRP as relevance of content and/or context. Eileen explained about CRP, "the pedagogy is just about doing what you can to validate kids' home experiences to show them that there is a place for their culture and their strengths inside the classroom" (Eileen, Interview 1). Jessica commented about her use of CRP, "I try to incorporate areas or just little stories where you can draw upon those kind of experiences that anybody has had" (Jessica, Interview 2). As is evident in Figure 3, Kay talked the most about CRP as relevance of content and/or context.

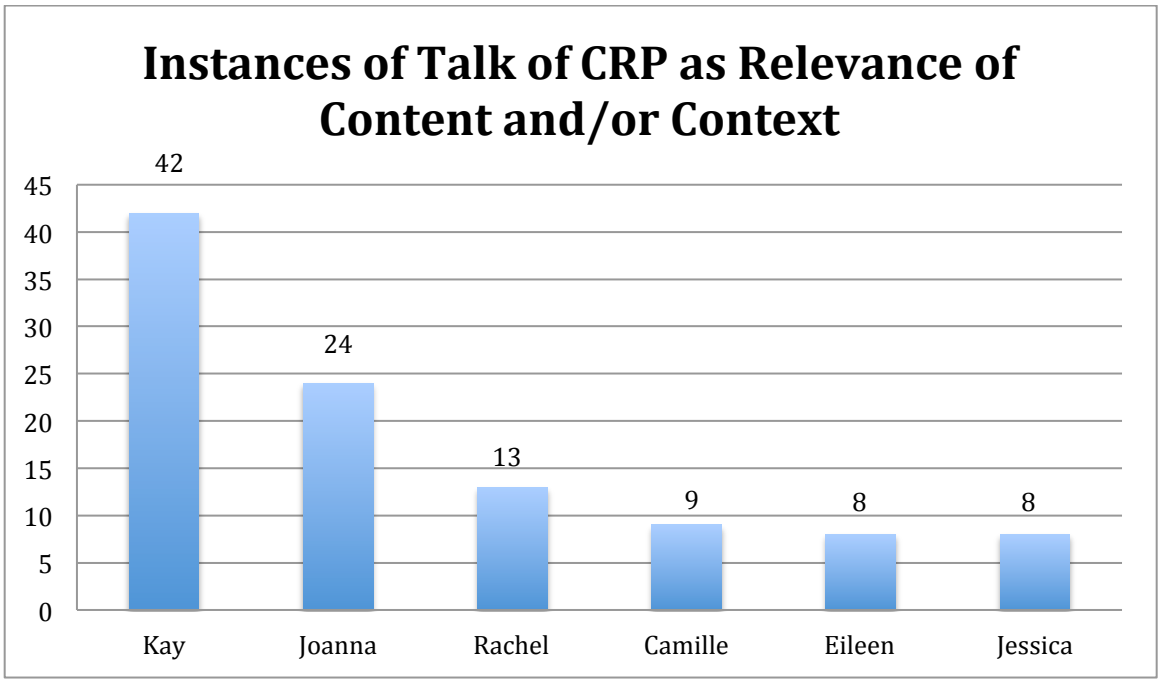

Figure 3: Instances of teachers' talk about using students' knowledge in the classroom

There was substantial variation in the way the teachers talked about integrating and utilizing students' knowledge, experiences, and interests in their classrooms. I made sense of this variation by examining the variety of sources of student knowledge,

experience, and interests, and the function those resources[7] served in the classroom. The teachers talked about incorporating student resources from a wide variety of sources: both those that might be understood as cultural and those that were more universal, and thus a-cultural. The teachers talked about using their students' knowledge as a resource for learning in a range of ways: to concretize content, to build upon, to use in an analogy, and to direct classroom activity.

Examination of the sources of knowledge/experiences and their function within lessons illuminated some of the ways in which the teachers ran into difficulty utilizing student knowledge and experiences in their classrooms. In terms of selecting sources, there was a tendency to include knowledge or experiences from universal sources and identify it as CRP, and a lack of attention to the meaning attached to particular knowledge and experiences that make them inherently cultural. In terms of the function the student knowledge/experience played in the classroom, the teachers frequently leveraged the knowledge in a colonizing fashion, in which the science content was the only goal and the students' knowledge was put to work purely in service of that goal.

In the sections that follow I present the various sources of student knowledge and experiences as described by the teachers and also the function the student resources played in the teachers' classrooms.

Sources of Students' Prior Knowledge and Experiences

Every piece of knowledge that students bring into a classroom has a source. Sources of prior knowledge and experiences are the areas in students' lives in which they

[7] I use the term "resources" at times in this chapter in place of the phrase "knowledge, experiences, and interest" in the interest of brevity and because the students' knowledge, experiences, and interest" are resources that can be constructively used as such by the teachers.

construct knowledge. Since participation in various activity systems such as family life, team sports, after school activities, and pop culture necessitates the construction and co-construction of knowledge, all of these arenas are potential sources for prior knowledge, experiences, and interests. From the data there emerged a variety of sources that the teachers culled for prior knowledge and experiences students could contribute to their classes. Sometimes this culling appeared to be intentional and explicit, while at other times the teacher was not precise about what the source of their students' knowledge was. In those cases, sometimes the source was implicit in the teacher's explanation and in other cases the sources of the prior knowledge and experiences were indiscernible.

The teachers worked hard to draw upon sources of knowledge, experience and interest from students' lives, mentioning a range of sources when they talked about incorporating students' resources as part of CRP. The wide variety of sources of student knowledge that the teachers identified demonstrates that the teachers were thinking expansively about incorporating student knowledge, experience, and interest into the classroom, but it also raises complex questions about what kinds of knowledge, experience, and interests are "cultural" and usefully incorporated as part of CRP. As I will demonstrate in the following section, while the teachers were pulling from a wide variety of sources in their efforts to practice CRP, they focused more on the experiences from those sources rather than the meaning through which the students made sense of those experiences.

Before exploring the sources that offered an opportunity for contributing cultural knowledge, I will first touch about two ways that the teachers talked about sources that fell outside of the field of CRP. Three of the teachers referenced other classes or school

itself as a source for student knowledge they could use in the classroom. This classic constructivist approach to teaching was likely beneficial for the students, but is by definition not CRP, as CRP aims to encourage student knowledge from outside school in order to value knowledge that has not traditionally been sanctioned as useful in the classroom. It was telling that half of the teachers labeled their constructivist teaching moves as culturally relevant. This perhaps was an example of CRP being conflated with good teaching.

Some teachers also included sources that were distinctly universal, and therefore a-cultural in essence. Jessica described how she used CRP in her classroom by "incorporate[ing] areas of just little stories where you can draw upon those kind of experiences that anybody has had" (Jessica, Interview 2). Jessica's inclination to use ideas or experiences that are familiar to "anybody" (and thus, everybody) implies that they are universal and therefore unlikely to be particularly culturally relevant to the students in her class. Camille explained that a unit on circuits was culturally relevant to her students because "they live in a society where everything is run on electricity" (Camille, Interview 1). The assertion that learning about electricity is culturally relevant because her students used electricity every day is negated by the fact that this is almost universal in Western culture, and particularly in the US, where her students reside.

Joanna similarly explained about a lab she had done on taste, "I feel like the tasting exercises would be more culturally relevant because I mean no matter what part of culture you're in, you all eat food" (Joanna, Debrief 12/13/12). Using a universal experience means that there is nothing uniquely cultural for the students, nor does it

promote cultural maintenance, since the resources being contributed by the students is not particular to their cultural participation.

Additionally, using universal or general concepts as a resource for students might also be reflective of deficit thinking about students. This may have been the case in Kay's description of using a hair dryer and a Hello Kitty balloon to demonstrate thermal expansion. Kay explained, "Everyone can relate to a balloon, simple idea, it's not like some foreign [object]… And everybody knows a hair dryer" and "everyone loves Hello Kitty" (Kay, Interview 1). Kay's assertion that "everyone" would be able to relate to a balloon and a hair dryer, means that she thought of the objects as essentially universal. Her insistence that "everyone" was familiar with them and that they were "simple" may signal an attitude that the science content needs to be simplified for students by way of CRP.

Aside from the inclusion of universal experiences and sources of knowledge, and the conflation of CRP with constructivism, the teachers cited a wide variety of sources of student knowledge, experience, and interest that had the opportunity to serve as sources of cultural knowledge for the students. The most commonly utilized source of students' prior knowledge and experiences that teachers relied upon in their classes, or suggested when describing lessons (past, present, or future), was that of the students' family. All of the teacher participants talked about students' families (and sometimes communities) as sources of students' prior knowledge and experiences either explicitly or implicitly over the course of the study when they were talking about CRP. Joanna described how she might call upon her students' familiarity with genetics from their family experiences, "… if you are talking about the genetics unit, like think about like if there was like resources

that said like do you have twins in your family? Do you like have you ever had experience with IVF…" (Joanna, Interview 1). In this example, Joanna suggested encouraging students to use their family circumstances as a source of knowledge in the classroom. Similarly, Jessica also suggested calling upon students' family experience as a source of knowledge about genetics: "I would probably ask [the students], 'Okay, so why do your brothers and sisters, even though they come from the same parents, why do they look different?'" (Jessica, Interview 2).

After a lesson on the cardio-vascular system, Joanna described how she tried to make the content more culturally relevant for her students by asking them where they had heard the term "cardio" before: "Potentially [they] could have [brought] in knowledge… if they ever had a loved [one] have a cardiac arrest. They could pick up on that. Or if they've ever had anyone have a cardiac-related disease, they could pick up on that. So it's just leaving it open-ended if they wanted to bring any knowledge in." (Joanna, Debrief 10/11/12). Including student knowledge sourced from family interactions has the potential to encourage students' cultural maintenance because it fosters students' display of cultural knowledge, and also facilitates constructing new knowledge. By allowing students to draw upon the knowledge and experiences they have from their family life the teachers are demonstrating that their experiences are valuable and useful in the classroom, a source of empowerment for students.

Notably, for all their focus on students' family, few of the teachers talked explicitly about students' ethnic (or heritage) community as being a source for their prior knowledge and experiences. Two teachers gave examples of how their students educated them about Latino foods such as *pupusas* (Camille, Interview 1; Kay, Interview 1).

Though Camille did not explicitly identify this knowledge as coming from the students' ethnic culture, Kay did. She explained, when describing how to use food in classroom activity, "they… prefer their culture['s] food… anything that's Hispanic" (Kay, Interview 1). Kay also suggested showcasing "Mexican bingo," Spanish-language music, and Mexican Mother's Day in her classroom as a way to achieve cultural relevance. It bears noting, given the focus of CRP on serving ethnic minority students, that only two of the six teacher participants talked about the prior knowledge and experiences that came from their students' participation in their ethnic/heritage communities. The teachers' focus on their students' penchant for Latin-American foods as a representation of cultural knowledge is telling. Food has long been used as a proxy for culture, but it is arguably a superficial stand in.

Another potential cultural source of knowledge, pop culture, was mentioned by four of the six teachers. They expressed the idea that students' knowledge of and interest in pop culture, such as music, television, movies, and video games, were resources that could be used in the classroom. One teacher, Camille incorporated her students' love of Pokémon, Mario, and other pop culture characters into her classroom by creating word problems around those characters (Camille, Interview 1).

A source similar to pop culture was that of after-school activities. Two of the teachers mentioned students' out-of-school activities in our interviews and debriefs as a source of students' resources. Both Rachel and Joanna identified knowledge that students had gained from their extra-curricular activities as sources of knowledge that they (the teachers) could and/or should incorporate into their classroom. Joanna referred specifically to her students' interest and commitment to playing sports, particularly

soccer, and expressed an interest in incorporating sports knowledge into her classes (Joanna, Interview 2). Rachel explained how some of the hobbies her students had outside of her classroom could be integrated into the science class. One of her students, during the second phase of the study, was in Future Farmers of America, and Rachel indicated that this meant this student had a wealth of prior knowledge and experiences that might be utilized (Rachel, Interview 2). She did not say that she had incorporated this student's knowledge from Future Farmers of America, just that it might mean the student had knowledge Rachel could build upon in her lessons.

Both pop culture and students' out of school activities or hobbies can serve as meaningful sources of cultural knowledge and experiences, particularly if the students in fact participate in communities of practice such as sports teams or fan clubs. The cultural source is not the sports team itself, but the meaning of that sports team to the student. While students might all participate in sports, the meanings they construct around that participation will not all be the same because the lens through which they interpret the experience will differ from student to student. While for one student soccer might be a fun diversion, or a preferable alternative to other after school activities, to another it might provide empowerment or a sense of accomplishment. For some, playing or watching soccer could be the way through which they relate to members of their family.

The teachers' inclination to incorporate students' families, afterschool activities and pop culture interests into their lessons has the potential to increase student engagement, and frame the knowledge and experiences that are meaningful to the students' lives as valuable in the school context. Incorporating pop culture could be empowering for students, as it is not knowledge that is normally sanctioned in the

classroom (Duncan-Andrade & Morrell, 2008), just as knowledge from students' families is not always valued in the classroom (González et al., 2005). The teachers tended not to talk explicitly, however, about whether they thought these sources of knowledge were in fact meaningful, culturally, to the students. In most instances it appeared that the teachers were indexing student experiences in a bid to make connections to their lives, without connecting those experiences to the meaning they held for students. Linking meaning to experiences is integral to understanding the students' funds of knowledge as cultural (Rosebery et al., 2010). It is possible they were simply looking for sources of knowledge that the students' had access to, regardless of whether they were particularly meaningful, though it is equally plausible that they were selecting, or intended to select sources that were personally and culturally meaningful to their students. It is difficult to ascertain which was the case for two reasons: (1) due to the design of the study, the students' experiences of the teachers' culturally relevant practices were missing, and (2) the teachers often talked about CRP in general terms, divorced from examples from their practice.

I will conclude this section with an example of a teacher who did attend to students' meaning making around a particular experience, and used it in her lesson. Eileen suggested her students' age, particularly their pubescence, as a source of prior knowledge and experiences. She indicated that for students in middle school and early high school, puberty, and the physical maturation and sexual health issues it entails, was a particularly relevant topic, and thus reported that she had tried to focus on "kids as kids, like health-wise" (Eileen, Interview 1). She explained that her students responded enthusiastically to the unit she did on sexual health in which she allowed their questions

to guide the lesson. Eileen elaborated, "it is very relevant to like the youth culture that they're in… they hear a lot about… sex in the media" and their families are reluctant to talk frankly about sex with them (Eileen, Interview 1). In this example, it was clear that Eileen was taking a universal experience, puberty, and considering the meaning it held for her students and used that meaning as a way to approach the lesson that was salient for the students.

Function of Resources for Student Learning

In this section I examine the ways in which the teachers described how they incorporated (or planned to incorporate) student knowledge into their classrooms. The teachers talked more specifically about how they would use their students' knowledge and experiences in the classroom than they did about where the knowledge came from. While it was not always clear from the data what kind of source the teachers thought they were pulling from, they were more explicit about how they would use that knowledge. Out of 228 instances of teachers talking about CRP, there were 104 instances of talk about incorporating student knowledge into classroom activity. Only 14 of those were too general to code for function, such as Joanna's definition of CRP: "teaching that engages students' prior knowledges and experiences into the lesson planning and the implementation of the lesson" (Joanna, Interview 2).

All of the teachers agreed that the value of incorporating students' knowledge, experiences, and interests into lessons was that it increased student understanding and interest in the science content. Early on in my analysis, I thought that the teachers might have associated certain curricular functions with capturing student interest and others with increasing student understanding. Upon subsequent rounds of analysis, however,

this hypothesis was not borne out. The teachers tended to talk vaguely about using these strategies to increase interest and understanding. They generally talked unambiguously about how to incorporate student knowledge into their classroom practice and the way it would function in their lessons.

Function of Resource	Description
Using Student Knowledge to Concretize Content Knowledge	Students' knowledge, experience, and interests functioned as backdrops or points of reference when presenting science content. This type of function utilized the students' resources to contextualize student learning. Many examples of contextualization use students' interests as vehicles for delivering content that is pre-established and often unrelated to the student knowledge and experiences.
Using Student Knowledge to Build Content Knowledge	Students' knowledge, experience, and interests were leveraged as a foundation to build science content knowledge. This is the classic constructivist approach of building on prior knowledge to learn new content.
Leveraging Student Knowledge to Present Content through Analogies	Students' knowledge, experience, and interests were used in analogies to explain science content the teachers considered abstract. These analogies were generally created by the teacher and offered to the students.
Using Student Knowledge and Curiosity to Direct Classroom Activity	Students' knowledge, experience, and interests were elicited and used to direct inquiry or other classroom activity. The students' resources were usually in the form of questions the students had about a particular topic. In this case the students' resources have an impact on the content being learned.

Table 3: Functions of Student Resources

From my analysis of the data, I identified four themes that captured the breadth of ways the teachers talked about using their students' knowledge as a resource for learning: to concretize content, to build upon, to use in an analogy, and to direct classroom activity. Table 3 presents the four ways that the teachers talked about using students' knowledge for learning and instruction. The most popular curricular functions were to concretize (or contextualize) the science content and to serve as a foundation for new (science) knowledge. The use of student knowledge in constructing analogies and directing classroom activity was less common. Eileen stood out from the group because she did not express the more common (and more straightforward) approaches to using student

knowledge (Table 4). In the sections that follow I describe each of these functions in more detail. I also explore the implications these classroom functions had for reciprocity between culture (and attendant knowledge and experiences) and science content. Only the function of directing classroom activity left room for reciprocity. The other three functions maintained learning the science content as the primary and ultimate goal, using the students' resources in the service of science learning.

Function of Resource	Kay	Rachel	Joanna	Jessica	Camille	Eileen
Using Student Knowledge to Concretize Content Knowledge	✔	✔	✔	✔	✔	-
Using Student Knowledge to Build Content Knowledge	✔	✔	✔	✔	✔	-
Leveraging Student Knowledge to Present Content through Analogies	✔	-	✔	-	-	✔
Using Student Knowledge and Curiosity to Direct Classroom Activity	-	✔	✔	-	-	✔

Table 4: Functions of Student Resources Expressed by the Teachers

Using Student Knowledge to Concretize Content Knowledge

Teachers talked about using their students' knowledge to make the science content concrete more than any of the other functions. Of the 104 instances in which teachers talked about incorporating student knowledge into the classroom, 37 were instances in which they described using that knowledge to concretize or contextualize the science content. In these cases, the teachers were usually using topics that their students were interested in, or familiar with, to contextualize and concretize the science content. This was the case with Kay, who routinely used her students' knowledge to concretize the science content she was teaching. She had seven discrete examples of ways she had used (or planned to use) student knowledge to concretize content. She often referred to a demonstration she did with her students wherein she heated up a Cup O Noodles soup to demonstrate the principle of heat conduction. She chose Cup O Noodles because it was

"popular" with her students and thus more "relatable" for them (Kay, Interview 1). Kay also used other interests of her students or familiar cultural touchstones to concretize science concepts such as prompting the students to think about Jurassic Park and Indiana Jones movies when talking about the earth's landscape because in those movies there are "dinosaurs or earth scenes with earth history so they connect a visual with what we learn. That gives them a connection…" (Kay, Debrief 12/10/12). Kay also suggested incorporating her students' love to Spanish language music and singers by using a popular singer as a model in an anatomy lesson:

> We're going to study the anatomy. I will put the cut out a face of a boy actor or boy singer that everyone is crazy about, 'okay, here is the boy and we're going to examine his anatomy.' [It is] something funny, but it's cute because it's not just a body, it's going to be his body, like, you know, it's cute, it's funny. (Kay, Interview 1)

In this example, Kay was using interest she perceived among her students to make the anatomy they would be learning more concrete, and perhaps more importantly for her, fun.

Camille was another teacher who used her students' interests, knowledge and experience to concretize or contextualize the science they were learning. She used their interest in Mario and Pokémon characters in the physics word problems she posed for her students, and she used their familiarity with walking, instead of driving, to school in her word problems about speed and vectors, thus concretizing physics concepts in her students' lived experiences (Camille, Interview 1). She also did a demonstration of the exothermic and endothermic reactions involved in making ice cream in her chemistry

class, and suggested that the lesson was culturally relevant to her students "because they've eaten ice cream" (Camille, Debrief 12/07/12).

Kay and Camille's examples are representative of how most of the teachers in the study talked about how to use their students' knowledge and experience to concretize and contextualize science content. By and large, the concretizing served one of two purposes: to demonstrate how the science existed in the world outside of the classroom, or to dress up the content in a way that might be more palatable or relatable to the students. In neither case was the content that the students were learning influenced or supplemented in a deep way by their outside knowledge, though making science class more engaging or relatable may be considered a worthwhile end onto itself.

Using Student Knowledge to Construct Content Knowledge

Another common way the teachers in the study talked about using their students' knowledge was leveraging it to build content knowledge. Of the 104 instances in which teachers talked about incorporating student knowledge into the classroom, 26 were instances in which they described building upon that knowledge to help the students construct science content knowledge. The teachers often labeled this constructivist approach to learning and instruction CRP. They maintained that leveraging the knowledge their students already had to construct knowledge of science topics was culturally relevant because it used their students' knowledge as a starting point. Most of the teachers used some variation of the phrase "building on prior knowledge" when they described CRP in this way. Kay explained that she invited her students to share "their own prior experience" so that "what I'm teaching them is something building on top of what they already know. I think that's definitely culturally [relevant]" (Kay, Interview 2).

It is noteworthy that while building on prior knowledge was considered culturally relevant, the teachers rarely explained why building on information already known to the students would be culturally relevant.

While building science content knowledge on top of students' knowledge was very similar to the concretizing function discussed in the previous section, there were marked differences. Incorporating students' knowledge, experiences, and interests in order to concretize content provides students with a sort of touchstone; a way to relate the content they are learning to some element that exists beyond the science classroom. In the knowledge building function teachers were using their students' knowledge, experiences, and interests as a foundation for constructing new knowledge about science content.

While this was a common way the teachers talked about using their students' knowledge, it is notable that it often seemed that it did not quite achieve cultural relevance, particularly when the sources of knowledge were not cultural in nature. When the teachers used purely school sources of knowledge (such as previous classes), the use of students' knowledge to build new knowledge became largely culturally irrelevant, though arguably beneficial for student learning. Joanna, for example, described how her students had a lot of content knowledge from their experience in biology class that she could draw upon and build on in order to teach them physiology concepts.

Kay described how she elicited her students' understanding of DNA before doing a lesson on DNA. Kay and her mentor teacher passed around a paper with images of DNA on it and had the students write what they knew about DNA on the paper:

> We put pictures and say, what is this? So then people passed it around, they wrote, 'I don't know' or 'this looks like this' or, you know, they write little things

and then we realized, okay, our class knows a little bit about DNA. (Kay, Interview 2).

Kay explained how this helped her to understand how to tailor her teaching to her students' knowledge base. She also went on to describe how it was also a good activity because it showed her that some of the students had "misconceptions" (Kay, Interview 2) about DNA that she needed to attend to during the DNA lesson. It's notable that the prior knowledge that Kay was trying to elicit was knowledge likely from prior school experiences. Additionally, Kay's reference to eliciting student knowledge in order to assess "misconceptions" runs counter to the spirit of CRP, which focuses on student resources as assets.

Jessica described on two different occasions how she polled her students about their experience of diabetes in their families and community before a project about diabetes in her biology class. She reported that she asked them, "what do you guys know about diabetes?" and that she would use KWL charts[8] to "build up on their prior knowledge" (Jessica, Interview 2). During a debrief of a lesson in a nutrition unit, Jessica said, "… they all knew [about diabetes]. Like, 'Oh, you get your blood checked and get insulin.' They would say things like that." Interestingly, this did not necessarily make the students more interested in the topic. In fact, for some, according to Jessica, it had the opposite effect. Some of the students told her, "I don't want to study this because I know

[8] A KWL chart is a relatively common classroom activity for which a teacher creates a chart with three columns: "Know," "Want to Know," and "Learned." The first column ("Know") aims to elicit what students already know about a particular topic. The second column ("Want to Know") is supposed to be populated with what the students want to know about the same topic. The class usually fills out the first two columns during a whole class discussion at the start of a unit or lesson. The third column ("Learned") is meant to be filled in at the end of the lesson or unit.

people who have [diabetes]" (Jessica, Debrief 11/30/12). However, when she talked about eliciting her students' knowledge of diabetes during our second interview (at the end of the study, over a month after the debrief) she reported a more positive reaction:

> "As an intro to [the lesson], I asked them, 'Okay, what do you guys know about diabetes?' I would do a lot of KWL charts with them… so just kind of building on their prior knowledge… A lot of them would tell me, 'Oh yeah, I have family members that have diabetes.' So just to make them more interested in it, just trying to reach that aspect." (Jessica, Interview 2)

Jessica's explanations indicate that making the connection between learning about diabetes in biology and her students' experiences with diabetics in their families and communities, held some relevance for her students, regardless of (her perception of) how they experienced this relevance. Because the students' were reportedly resistant to studying a topic that hit close to home for them, the opportunity to build knowledge about diabetes using their experiences was likely stymied. While Jessica did not mention following up with her students about why they were disinclined to talk about diabetes, it could have been a productive conversation for her to have with them; their input could help her to understand what it was about that topic that was uncomfortable or uninteresting to them, or what it was about the classroom environment that made them disinclined to share about their lives.

Leveraging Student Knowledge to Present Content through Analogies

The teachers also talked about using their students' prior knowledge and experiences in analogies in order to explain more abstract science content. Through the composition of analogies, the teachers were creating context for the science content by

constructing stories and explanations about topics and phenomena with which the students were already familiar.

Eileen was dedicated to using analogies to explain chemistry concepts such as stoichiometry and radioactive decay. She explained that she first started using analogies in her chemistry class because, "I was feeling like it was hard for them to grasp abstract concepts because it is really hard to conceptualize something as small as like an atom or what exactly an electron is" (Eileen, Interview 2). She used the analogy of interpersonal relationships to understand bonding in atoms:

> how the bonding happens is… one atom is unhappy because it's unstable and it needs to pair up with somebody else. And so I figure[d]… that's kind of like in real life when… people are seeking stability [in]… relationships and that kind of thing. So I turned it into that day's lecture [and] instead of taking notes, the notes were in the form of a comic. We drew all of these bore models with dialogue bubbles and different scenes and stuff like that. And I think the kids really understood… there's an empty spot here and this electron needs to go away because it's making the entire thing unstable… It really helped them understand the octet rule. (Eileen, Interview 2)

Eileen reported that her students seemed to understand the science concepts better when she explained them as analogies to other systems or phenomena with which they already had familiarity. The use of a comic strip format instead of the typical notes her students were encouraged to take in class was a way to highlight explanatory elements of the analogy. Eileen noted, however, that she did need to be careful to include the required academic language in the analogies, "or else I feel like it's kind of dumbing it down too

much" (Eileen, Interview 2), indicating that learning the science content was privileged over the knowledge being used in the analogies.

Kay reported that she also used analogies with her students, and wrote her masters inquiry project on using analogies in the classroom. She explained how the students learned about the cell and its organelles using the analogy of a school and the people and elements that make up the school: "[we talked about the] role of the principal or the role of the fence or the role of the hallway [and] how it relates to the functioning of the cell" (Kay, Debrief 11/15/12). She planned to later assign her students the task of constructing another analogy using their homes and family members to represent the different parts of the cell.

Joanna also used analogy to teach her students about cells and their organelles. She described how she has used her own analogies to teach her students about cells, but that her mentor had encouraged her students to create any analogy they wanted for a project on cells and their organelles. She reported that the students had been tasked with explaining how the organelles within the cell interact and function by creating their own analogy. Some had used sports teams to convey the information; one even used Lady Gaga:

> He related the cell to Lady Gaga somehow. I think, in like the manager was like the nucleus and the PR [agent] was like the ribosome… it was very creative… I never would've come up with that. But the student did and it was awesome. (Joanna, Interview 2)

Joanna mused that having students create their own analogies lent itself to CRP because it encouraged the students to relate science content "to their own lives" (Joanna, Interview 2).

The difference between creating analogies for the students and encouraging them to come up with their own analogies is one of sequencing. In order to have students come up with their own analogies they must have already been exposed to the concepts, as was the case in Joanna's mentor's class and in Kay's class for the assignment she planned to give her students. Eileen did not talk about having her students come up with their own analogies, and used analogies solely as a way to deliver content in a more understandable and relatable fashion.

Though the teachers, particularly Eileen and Kay, were dedicated to using analogies in their teaching, it was, nevertheless, evident that analogies were not universally useful. This is not surprising, as all analogies are bound to breakdown at some point. There were moments, however, when the teachers seemed to be going to great lengths to "fit" the analogy to the content, and vice versa. These teacher-constructed analogies could break down in one of two ways: the structural mapping of the analogy did not sufficiently represent important aspects of the science concept, or the source domain of the analogy was unfamiliar. During one of our interviews, Joanna described an analogy, the structural mapping of which did not appropriately represent the science content. She suggested using soccer players to describe evolution and ran into difficulty explaining exactly how soccer players on a soccer team represented a species and their evolution over the course of thousands of years. When I asked about the appropriateness of the analogy, she admitted that sometimes analogies are not useful: "it'd be a fun

analogy… but then, yeah, then you start to get into things that aren't real and sometimes that can create misconceptions" (Joanna, Interview 2).

Eileen also ran into trouble with one of her analogies because she utilized a source domain that was either unfamiliar to the students or poorly utilized. She used the concept of ratios in recipes as an analogy for understanding the ratios inherent in stoichiometry. She had her students make s'mores and then asked them questions that related ratios in recipes (as in the ratio of graham crackers to marshmallow to chocolate) to stoichiometry. Her students became confused when answering some of the questions. One question in particular, "How are ratios related to recipes?" stumped her students. During our lesson debrief Eileen mused:

> That question about how are ratios related to recipes? At first the kids were like, 'I don't know, well I don't know what this is asking me.' But then once we talked a little bit more about like, 'well what are ratios in math?' And they were able to explain; and then I asked them 'how is this related to what we just did with recipes?' and they were like, 'Oh, it's because you have a certain amount of something.' (Eileen, Debrief 10/22/12)

This was a case in which Eileen's desire to make the chemistry content more accessible (by using the analogy of a recipe to explain stoichiometry) caused her to lean perhaps too heavily on an imperfect analogy. Similar to Walkerdine's (1988) findings, in which students were only able to do math problems once they realized that the context (shopping) was not important and did not follow the parameters of shopping in the real world, Eileen's students had to decipher what the question about ratios in recipes was really asking them. Once they realized that there were ratios in recipes then they could

apply that knowledge to the stoichiometry equations. Thus, the deployment of an analogy actually created another layer of work for the students instead of elucidating the difficult concept of ratios in stoichiometry.

Using Student Knowledge and Curiosity to Direct Classroom Activity

There were three teachers, Rachel, Eileen, and Joanna, who used their students' resources generatively to direct the path of instruction or drive inquiry. The resources in these cases were students' interest and curiosity about certain topics, though that did not preclude the use of student knowledge. The function of curriculum directing was similar to building on student knowledge, as it allowed the teachers to tailor their lessons to their students' needs in addition to leveraging their knowledge or familiarity to build new knowledge. It was distinct from building on student knowledge in two ways: one, the teachers were using students' interest and curiosity in topics, in addition to their knowledge or experiences; and, two, the teachers were encouraging the students to pursue these items of interest in a way that directed the classroom activity and in some cases changed the curriculum. The goal was not only to construct knowledge, but also to let the students lead the way. This allowed for reciprocity between the students' knowledge and school knowledge, opening up a two-way street in which each could inform the other.

Three teachers talked about this type of relevance of content/context. Of the 104 instances in which teachers talked about incorporating student knowledge into the classroom, 11 were instances in which they described letting students' interest and knowledge guide the curriculum. There were only four examples of the teachers using student interest and curiosity to direct classroom activity: two from Rachel's classroom,

one from Eileen's, and one from Joanna's. All of these examples took place during their apprenticeships (the first phase of the study).

Joanna allowed the interest of one of her students to direct his activity in her class when she allowed him to work on a project while he was away from school, visiting family. The project, which she implemented in a biology class with her mentor during her apprenticeship, asked students to do secondary source research on a biome and a country in which it is located. This included looking up and reporting information about the country such as the languages spoken, literacy rate, religions practiced, and the names of famous artists, actors, and politicians. Joanna suggested that the opportunity to select the country that the students were researching made the project "more relevant to [the students'] lives" (personal communication, May 23, 2012). However, during our debrief I asked her what made the project culturally relevant and instead of talking about the class as a whole, she responded that the project would be "especially" relevant to one student in particular, who had chosen to do a project on El Salvador and was traveling to see family there whom he could interview as part of his research on the country:

> I have one student who's been absent these two weeks, because he went to go visit his grandmother in El Salvador, so I allowed him to pick whichever biome he wanted and the country he wanted to study with that biome. So he was going El Salvador, so he picked the rainforest, and he picked El Salvador to study, and granted he hasn't come back, so I don't know if he actually did the project, but that would be very culturally relevant to him… he was excited because… for the country's handout he thought he could ask his grandma about that country and use her as a source. (Joanna, Debrief 1&2)

The cultural relevance was likely present more for this one student than the others, but this is an example in which giving the students some autonomy to select a topic of research can invite the students to investigate something that is of personal interest to them. Additionally, allowing the student to use his grandmother as a resource is significant because it places value on ways of knowing, such as personal experience, that are infrequently prized in the science classroom (see Warren et al., 2001). This example differs slightly from the examples that follow because Joanna focused particularly on one student. However, she allowed him to explore a topic that was relevant to him in a potentially meaningful way.

Eileen and Rachel both let their students' interest and curiosity dictate their sexual and reproductive health lessons. Rachel described how she let her middle school students direct the instruction:

> [I] tailor[ed] the way we did sex ed around what the students knew and didn't know… I gave them surveys and I asked them what they wanted to learn about; I had… [them] rank parts of health that were addressing them [so that] we could talk about [those]. (Rachel, Interview 2)

This allowed her to focus on areas of sex ed that the students were interested in and "wanted to learn about."

Eileen did a similar sex ed lesson in which she implemented a "question and answer [session] during our sex unit, where kids just basically submitted anonymous questions. So we spent 40 minutes just answering [their] questions point blank" (Eileen, Interview 1). Eileen noted that at the end of the year the students called the sexual health unit one of the "most valuable" of the year (Eileen, Interview 1). Eileen explained that

she thought their interest in sexual health was a product of their age (7th and 8th grade), and that she often thought about being relevant to students' age group "health-wise" (Eileen, Interview 1). Both of these examples demonstrate the ways student experience, interest and, in this case, curiosity can direct curriculum to be more relevant to them.

Rachel also used her students' knowledge of their community and interest in issues that affected it to guide her community health project (described in the previous chapter). The last unit of the year in her middle school science class was health and she wanted the last project to be "fun" and "relevant" to the students (Rachel, Debrief 1). Rachel allowed the students to pick any of the communities to which they belonged, including the school community and the local community around the school, in which most of the students lived. The students were organized in small groups and tasked with selecting a community health issue (including mental and physical health) to investigate:

> I wanted it to be relevant to them, so I asked groups to do a brainstorm… So like [I asked], 'what's something you're interested in?' And I had to give them like a minute to come up with as many ideas as they could and try to cover the table with post-its. And then stack them up so that they can stack up the ones that were similar for lot of them; if there are four people on a group, sometimes four people wrote same thing. And then I just had each member of the team pick one they're most interested in and then they kind of like each person would like pitch their idea to the group… and then they could basically narrow it down from there. And some groups it was like the group basically decided pretty easily what they wanted and some groups… it was little more difficult so that they just came down to a vote or something. (Rachel, Debrief 1)

Rachel's description demonstrates how she allowed her students autonomy in selecting community health problem to investigate, which allowed them to make important connections between their experiences and science. The brainstorming activity and the democratic selection protocol she instituted meant that the students in the groups by and large were investigating a topic in which they were interested, and in many cases had themselves proposed. The ensuing projects were developed over the course of several weeks, during which the students researched their community health issues, created PowerPoint presentations describing the problem and solutions to it, and created a "product" that addressed the problem and ameliorated it in some way. This product was evidence of how the students' experiences were not just being colonized for the benefit of learning science, but were informing action inside the classroom and out. As discussed in the previous chapter, this is the notion of relevance of authentic purpose, in which students use the science they are learning to address an issue outside of school. By using her students' experiences and curiosity about their communities to direct their inquiry and framing it with an authentic purpose, Joanna encouraged the students to make meaningful connections between science and their lives.

These examples, Eileen and Rachel's sex ed lessons, Rachel's community health project, and Joanna's biome and country research project, comprised the instances in which the teachers leveraged their students' interest and curiosity to pursue science topics. Rachel's community health project seemed to have the most opportunity for relevance considering the students were able to pick any health problem that affected any community to which they belonged. This meant that while some students picked topics germane to their neighborhood, such as homelessness and pollution, other picked topics

that were relevant to their peer or age group, like drugs and childhood obesity. That the students were encouraged to pursue these topics over an extended period of time was significant for the value it implicitly placed on the students' insight into their own communities.

Discussion

Though these were new teachers (and in some examples they were still teacher candidates), they demonstrated commitment to relating the science content they were teaching to the lives of their students by incorporating their students' resources. The teachers employed their students' knowledge, experiences, and interests from a range of facets of their lives to make their science learning more interesting and enhance their understanding.

The teachers cast a wide net when identifying their students' sources of knowledge, and included sources such as school and universal experiences when describing their practice of CRP. In these instances, they created potentially rich learning opportunities for their students, but not always a platform to demonstrate their cultural knowledge or maintain their cultural competence. The teachers' inclination to draw from a wide variety of sources likely will help them to understand what does and does not work as they continue trying to marshal different student resources and reflect on their success with the students. Though CRP has sometimes been interpreted as drawing upon the knowledge and practices of students' ethnic or heritage communities, the teachers' tendency to draw from a range of sources is potentially valuable. As culture is a dynamic construct, constantly evolving, it is short-sighted to focus primarily on knowledge from students heritage communities and ignore other practices that might be part of emerging

communities (influenced by their heritage communities) with which the students identify (Gutiérrez & Rogoff, 2003; Paris & Alim, 2014).

While the teachers drew on a wide variety of sources from the students' lives, they did not appear to consider or elicit the meaning those sources held for the students. When they referenced "ethnic" food, or pop culture, or any of the other sources, they did not talk about the meaning of these sources to the students, or why they might be a source of cultural knowledge for their students. They seemed to be wary of labeling any experiences that the students may have had as being cultural in nature. This could reflect a positive inclination not to generalize about their students based on incomplete knowledge of their cultures. Also likely is that it reflected their confusion about what was actually culturally relevant to their students. Many teachers expressed uncertainty about the kinds of experiences their students had that would be appropriate to call upon in CRP. Eileen explained that while she lived in the same neighborhood as her students, she still did not know what kinds of resources they had from their heritage community because she herself was not Latina (Eileen, Interview 2). In several instances, the teachers indicated that they would allow the students to make connections between their lives and the science content, but did not indicate how they anticipated that happening. Several teachers alluded to allowing students opportunities to bring in their own experiences, and it may be that by creating an opportunity for students to make their own connections they were hoping to include them in the work of making cultural connections. Gauging by their vagueness, it appears that the teachers were unsure about the funds of knowledge that their students brought to the classroom, and thus sharing that responsibility with the students would be reasonable.

The teachers identified four functions that the students' resources played in their classes: using student knowledge to concretize content knowledge; using student knowledge to build content knowledge; leveraging student knowledge to present content through analogies; using student knowledge and curiosity to direct classroom activity. All of these, aside from directing classroom activity, placed primacy on the science content and viewed the students' knowledge, experiences, and interest as a means to better teach that content. Thus, the emphasis was on science content, and not cultural maintenance. In fact, in some cases, the students' resources were obviously functioning as "hooks" to draw students into learning the science content, sending the message that their cultural knowledge was of secondary importance. The use of student knowledge to guide classroom activity was the only function in which students' resources were treated with significance similar to that reserved for science content. Using students' knowledge, experience and interests alone to determine the science content being covered or the manner in which it is presented may be an unrealistic goal. Nevertheless, when paired with a source of knowledge that is meaningful to students, it has the potential to encourage both student learning (as it springs from topics students are interested in and already have some familiarity with) and cultural maintenance (because it does not use students' resources purely in service of a predetermined curriculum).

Chapter: 6: Relevance of Practices

Previous findings chapters have addressed how teachers in this study tended to interpret CRP in ways that were similar to relevance of context and/or content and relevance of authentic purpose. The third interpretation of relevance suggested by Enyedy and colleagues is relevance of practices, described as an interpretation of CRP in which the practitioner focuses on the "process rather than the content of instruction" (Enyedy et al., 2011, p. 277). As the culture of school has long been situated within white, middle-class culture, students who belong to racial/ethnic minority communities and those who are poor often experience dissonance between the ways of communicating, participating, and interacting they experience at home and those they are expected to use at school (Heath, 1982; C. D. Lee, 2007). Relevance of Practices is an essential interpretation of CRP because it focuses on the process of instruction and thus sets a foundation of cultural relevance for students even when teachers are not explicitly making connections between students' outside of school knowledge to the classroom content. The ways in which teachers may choose to make their instruction more culturally relevant is manifold. Some of these moves include (a) focusing on students' repertoires of practices that have not traditionally been valued in the classroom, and (b) creating a classroom atmosphere that fosters strong student-teacher relationships.

By considering the repertoires of practices that students bring with them into the classroom, and the strengths those repertoires afford, teachers can begin to develop hybrid repertoires of practice with their students (Enyedy et al., 2011; Gutiérrez, 2008; Warren et al., 2001). These hybrid practices are negotiated locally (explicitly or tacitly) by the teacher and her students and through this process of negotiation, classroom

practices, students' cultural practices, and disciplinary practices coalesce into a set of practices for classroom use. Utilizing repertoires of practice includes the incorporation and esteem for students' language practices, such as fluency in a language other than Dominant American English (Paris, 2009), like Spanish or African American English.

Relevance of practices also encompasses the way in which teachers relate to their students and the atmosphere they cultivate in their classroom, as these are vital parts of the process of instruction. This includes seeing themselves as members of the local community, establishing a "connectedness" with their students, and creating a community of learners through which students may collaborate (Ladson-Billings, 1995b). While establishing connected relationships with students is not one of Ladson-Billings' three main tenets of CRP, it is a secondary principle that supports the three main tenets of academic success, cultural maintenance, and critical consciousness.

In this chapter I describe the ways in which the teachers in this study talked about practices, or the "process of instruction," in their classrooms. One teacher in the sample, Camille, talked explicitly and consistently about CRP in terms of the process of instruction, and focused her practice of CRP on this type of relevance during the second phase of the study. Figure 4 presents the number of instances in which each teacher talked about CRP in terms of relevance of practices. Thus, after describing how the group to teachers talked about culturally relevant practices, I present the case study of Camille, highlighting her conceptualization of CRP, as she described it to me and enacted it in her classroom.

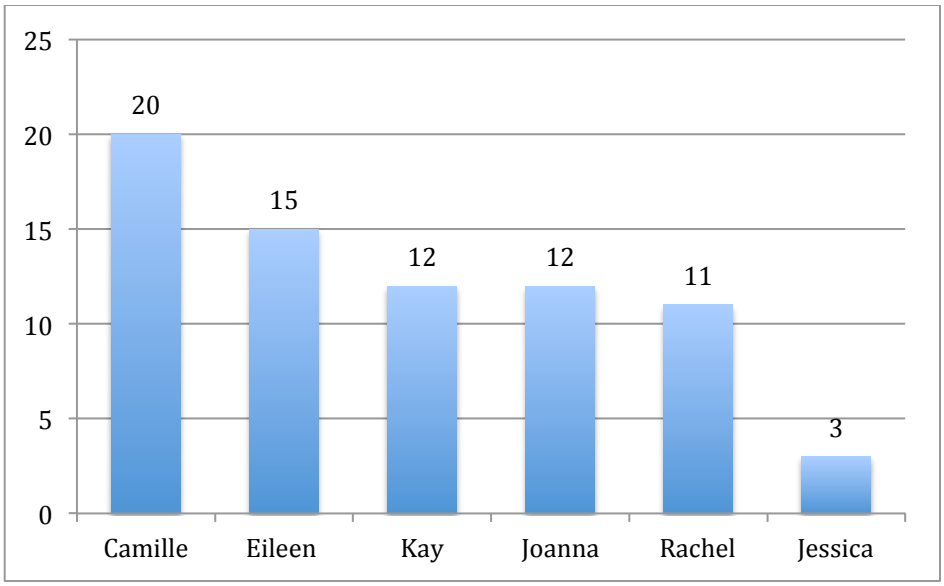

Figure 4: Instances of teachers talking about cultural relevance in terms of classroom practices

Relevance of Practices Across the Sample

The teachers talked about culturally relevant classroom practices in a variety of ways. These included building relationships with students and their communities, utilizing technology and new media as a mode of instruction, incorporating students' language practices into the classroom, and attending to students' perceived styles of learning and communication. **Table 5** presents the types of practices that teachers talked about as culturally relevant. As is evident from the table, Camille talked about all of the practices as part of CRP, while Eileen and Joanna talked about four of the five. Rachel mentioned three of the five practices, Kay two, and Jessica only one.

In the sections that follow I will describe how the teachers talked about cultural relevance in terms of attending to their students' learning styles, using technology and new media in their classrooms, and incorporating their students' language practices in their teaching.

Practice	Description	Camille	Eileen	Joanna	Rachel	Kay	Jessica
Building relationships with students	Fostering relationships with students. Most teachers talked about it as a means to practice CRP.	x	x	x	x	x	x
Attending to learning styles	Differentiating instruction according to students' learning styles (as identified by teachers). Often not explicitly connected to students' culture.	x	x	x	x	x	-
Using technology & new media	Incorporating technology into instruction. Often justified as being integral to youth culture, and thus culturally relevant for students.	x	x	x	-	x	-
Incorporating language practices	Incorporating students' language practices (particularly Spanish fluency) into instruction. Some teachers viewed bilingualism as an asset, some as an obstacle.	x	x	x	x	-	-
Attending to communication styles	Incorporating students' preferred modes of communication and interaction into the classroom.	x	-	-	-	-	-

Table 5: Types of practices expressed by teachers

Building Relationships with Students and their Communities

Ladson-Billings (1995b) has written about propositions that support her three main tenets, and one of these governs the way teachers structure social relations inside and outside of the classroom. This proposition involves teachers seeing themselves as members of the local community, establishing a "connectedness" with their students, and creating a community of learners within which students may collaborate (Ladson-Billings, 1995b). All of the teachers in the study talked about the importance of building relationships with their students because it would help them to make their classrooms and the science content more relevant. Aside from Camille, whose point of view will be presented in the case study later in this chapter, the teachers rarely spoke about

developing relationships with their students as part of CRP. Instead, they talked about it as a means to an end; how it was important to know their students well in order to make science content and classroom activities relevant to them. As Jessica explained, "how can you tell someone, 'oh, this is going to be culturally relevant to you' if you don't even know them?" (Jessica, Interview 1). Kay echoed this sentiment, reflecting that she could have created more culturally relevant analogies in her classroom if she had "know[n] my students better" (Kay, Interview 2).

Two of these teachers, however, did express the opinion that creating relationships with the community local to the school (i.e., the parents and the residents in the neighborhood) was an important part of CRP, and not primarily as a means to incorporating more cultural relevance. Eileen described how she lived in the same neighborhood as her students, even on the same street as some, and took the public bus to and from school with many of them. She mused:

> In some way I feel like it validates their experiences of like, 'Oh my teacher does something that I do on a regular basis, too.' … and a lot of my conversations with students about like what they want to be when they grow up or what their family is like or what they like to do outside of school, has happened when we're waiting for the bus… which has been really fun. (Eileen, Interview 2)

Eileen's desire to live in the neighborhood to be "more part of the community" helped her to be more responsive and sensitive to her students' lived experiences. She described how it allowed her to relate to her students differently than she might otherwise have been able. When she confronted a student, who was falling asleep in class, he told her that the wind the night before had kept him up most of the night and she reported, "I

remember thinking yeah, that's really how I felt last night, too… so if I didn't live in this neighborhood I'd feel like I wouldn't have understood what he was talking about" (Eileen, Interview 2). Eileen, however, had not yet been able to use this community connection to directly improve her CRP:

> In terms of actually bringing stuff into the classroom, I haven't really found connections there yet but it's only been a year and a half so I feel like the longer I live here hopefully the more I'll get to know like community issues… (Eileen, Interview 2)

Rachel similarly valued creating connections to the community her school served. While she was looking for a job during the spring of her apprenticeship (phase 1 of the study), she explained that she was interested in looking for a job on the east side of Los Angeles, where she lived, because she wanted to live near the school to be "more connected" to it (Rachel, Conversation 1). Rachel also suggested that getting to know her students' parents in a "non-pressured way" outside of teacher conferences or disagreements about grades would be important, though she noted that her school did not have an obvious avenue for doing that (Rachel, Interview 2).

Attending to learning styles

Five of the teachers in the study talked about differentiating instruction according to their students' learning styles (i.e., learning modalities) and how attending to those learning styles was culturally relevant for their students. The teachers identified this type of adaptation of instruction as culturally relevant because it related to their students' strengths and needs. They sometimes indicated that students' learning styles were related to their culture, but not always. Where this focus on learning modalities started to be

problematic was the assumption that particular groups of students were inclined to learn using certain modalities.

Camille explained after a chemistry demonstration presenting endothermic and exothermic chemical reactions that the demonstration part of the lesson was culturally relevant because her students "respond better to visuals" that are "more dramatic" than merely "writing on the board" (Camille, Debrief 11/30/12). Camille elaborated that with the demonstration she was trying to "reach out to different learning modalities." Eileen also discussed learning modalities as a way to be culturally relevant. She explained that, "the instructional strategy of using kinesthetic learning and having collaborative group work is really aligned with how my students learn" (Eileen, Debrief 11/27/12) when asked about how she had utilized CRP in a lesson that involved a series of mini-labs demonstrating gas laws. While Eileen associated using particular learning modalities with cultural relevance, she was ambivalent about how exactly it was culturally relevant:

> So I don't know if it has to do with their ethnicity or them just being young. Or what it is. But I have definitely seen that a lot of them, they learn the materials more in depth—they have a better understanding of it—when they can do something hands-on with it. (Eileen, Debrief 11/27/12)

Eileen labeled these practices culturally relevant because they seemed to work for her students, generalizing cultural relevance as "doing something different than traditional" (Eileen, Debrief 11/27/12). However, it seemed to be the fact that they worked with her students that caused her to identify them as culturally relevant, not because she had a notion of what would work based on their participation in a particular cultural community.

Rachel also talked about incorporating "different modes of learning" into her classroom through the use of "visuals" and "modeling" (acting out scientific processes), but when asked to explain why she would call it "culturally relevant" she conceded that it was "relevant to individuals" instead of "automatically… culturally relevant." She reasoned, "it could be really hard to be culturally relevant if you don't consider the fact they may not be really getting what you're talking about because of the modality that you're giving it in" (Rachel, Interview 2). Thus Rachel seemed to be stating that it was important to differentiate instruction in order to set the stage for CRP.

Kay indicated that understanding how her students "really construct and process things" (Kay, Interview 2) was culturally relevant because it would help her to target her instruction. She added, "remember, people from different countries have a… different way of thinking" (Kay, Interview 2). Though she did not specifically use the language of learning modalities (visual, kinesthetic, auditory, and tactile), Kay seemed to see a connection between understanding the way in which her students learned and thought and CRP.

Joanna spoke on several occasions of how paying attention and catering to her students' preferred learning modalities was culturally relevant. She explained that it was important to attend to "ways they learn best" and "how they produce learning" (Joanna Interview 1). In her opinion, some students may be "auditory learner[s], but they best express themselves through writing" and therefore changing classroom instruction to reflect those preferences was culturally relevant. She explained, "if you had a lot of writers in your classroom, then [you could] give more check-ins that are written" instead of utilizing "peer share" check-ins, which are verbal (Joanna, Interview1). Joanna, more

than the other teachers, seemed to subscribe to the idea of learning styles. This was a slightly strange understanding of cultural relevance, in that assigning students learning styles and using those styles in a prescriptive manner in instruction is problematic and contested, though still relatively common among practitioners (Klein, 2003). Joanna explained that she had "recently" read about learning styles in The Bell Curve (Herrnstein & Murray, 1996):

> In the book it talks about that Latinos are a very visual culture. That's like of the three modalities that that's usually the strongest. So I think bringing that into instruction could make it more culturally relevant to… modify the classroom instruction to the strength of your students. (Joanna, Interview 1)

Joanna acknowledged that the book was controversial because "it was just statistics and when you talk about statistics you can get into stereotypes."[9] A little later in the interview she returned to this idea of cultural learning styles and elaborated:

> … the fact that the Latino culture is more visual, could be a powerful tool but it could also be a limiting tool in that you don't utilize the other modalities because you're so focused on this one modality. So it can like help and hinder at the same time, which is like why stereotypes can be problematic. Because then you reach, oh okay, maybe you reach that certain population that it's true of, but then you don't reach other populations. (Joanna, Interview 1)

Joanna's concern with stereotypes did not seem to deter her from construing this "cultural style" as an *individual trait* (Gutiérrez & Rogoff, 2003) and using it as a justification for

[9] It bears noting that she seemed to view statistics as fundamentally unbiased. Additionally, it was shocking to me to hear the Bell Curve referenced in the context of CRP, as the two are patently irreconcilable.

prescribing a specific pedagogical approach. What was problematic to her was not the idea of a cultural learning style (she refers to it as a "fact"), but that these cultural learning styles might be different for different cultural groups and therefore be limiting in a diverse environment. Her inclination to teach to her students' strengths was a worthy one as it can avoid models of deficit, but by conflating cultural generalizations with students' individual characteristics, Joanna is limiting her students and minimizing their potential. Her impulse to teach to a cultural style disregards variation and change among individuals and their practices (Gutiérrez & Rogoff, 2003).

Using Technology and New Media

Four of the teachers talked about the use of technology and new media in their classroom as culturally relevant. They specified that they considered technology and new media to be relevant to "youth culture." Joanna posited, "youth culture kind of implies using technology" (Joanna, Interview 2). Both Eileen and Joanna repeatedly called technology "engaging" to youth and to them the engagement was both proof of its relevance and endorsement of its utility in the classroom. Joanna explained that when she used videos or computer simulations in her classroom, "that was relevant to their youth because they were very engaged… it helped a lot of the learners be able to relate to the content in a way that they're used to receiving information, in an engaging way" (Joanna, Interview 2). Eileen shared Joanna's reasoning, that technology was relevant because it was a familiar vehicle for information. Eileen explained that using the internet for research, using iPads in the classroom, and having kids post on blogs was all relevant because kids "are more engaged when they can use technology" (Eileen, Debrief

11/27/12). She also considered that part of the engagement with technology might be that it was something that her students knew and at which they felt "expert."

Camille also considered the use of technology culturally relevant, and in one lesson she shared a blog post on the science of ice cream with her students. She explained that using the blog post was culturally relevant in a variety of ways to youth culture: it was a medium that was "hip" unlike a text book and students themselves were involved in social media so it was more "familiar" way for them to receive information than old media. Camille also indicated that using a blog as a text in the classroom conveyed the "idea that people's voices are heard," thus extending the role of the expert beyond the textbook creators and other traditional sources of expertise and knowledge (Camille, Debrief 12/07/12).

Using technology as a culturally relevant means for presenting information seems promising as it certainly is how many youth communicate, consume information, and make sense of the world outside of the classroom. The drawback to this conceptualization of CRP is that these same teachers indicated that their schools did not have the resources to use technology regularly in their classrooms. So, while they indicated that the students' age group and the environment of technology and media in which they were growing up dictated the incorporation of technology into their classroom practice, at the same time they were indicating that doing so in a consistent manner was logistically impossible in their current environments. Additionally, the teachers' logic seemed to be, at least to some extent, that using technology in the classroom was culturally relevant because the students were engaged when they were using technology. This is faulty logic, as engagement does not automatically signify cultural relevance.

Incorporating Students' Language Practices

Four of the teachers talked about incorporating students' language practices in the classroom as a way to make their teaching more culturally relevant. Three of the teachers described how they thought about doing this with their own students, while the fourth, Joanna, referenced an article that described the incorporation of Haitian American students' facility with storytelling into a science classroom.[10] She did not talk about her experience incorporating her own students' language practices. Camille explained how she tried to participate in her students' use of slang, which is further discussed in her case study, later in the chapter.

For Eileen and Rachel, incorporating students' language practices meant incorporating their students' first languages in their classrooms. Both taught students who spoke Spanish as their first language, and they both talked about how to incorporate their students' knowledge of Spanish in their classroom. Eileen noted that Spanish was "not something that should just be totally shut down at school [because it's] also relevant." She suggested, "using things like Latin roots or connecting like Spanish vocabulary to English" as a way to leverage her students' language (Eileen, Interview 2). Eileen's approach to cultural relevance through attending to language practices was to think about ways to scaffold her students' English learning: "I feel like teaching them language strategies [is culturally relevant] because a lot of them are English language learners" (Eileen, Interview 2). Eileen used her students' Spanish language skills to improve their English, or as justification to focus particularly on building their English vocabularies, and thus there was no reciprocity between the home and school practices; English, and

[10] Likely Cheche Konnen's article on everyday sense-making (Warren, Ballenger, Ogonowski, Rosebery, & Hudicourt-Barnes, 2001)

academic English in particular, was her priority. Paris and Alim (2014) caution against this use of students' cultural practices, particularly language practices, in the service of learning Dominant American English (Paris, 2009), arguing that the goal should not be Dominant American English, but a facility in a range of forms of English, and other languages.

Rachel's approach to using her students' first languages in the classroom was more in line with this position on language practices. She did not talk about improving her students' English, but instead framed her students' first language fluency as an asset in its own right. During the project that explored community health issues, many of her students chose to make PowerPoint presentations to the school community and the parents. In order for the presentations to be accessible to all members of the community, particularly parents, a few students decided to translate them into Spanish, and one student wrote a Korean translation. Rachel remarked that many of the students were "excited" by the opportunity to use their native language in a school project, and that students who did the translation were particularly "engaged" by the task (Rachel, Debrief 1; Debrief 2&3). Rachel's treatment of her students' home languages differed from that of Eileen's in how it treated students' native languages purely as an asset instead of a leverage point, or part and parcel to a lack of English fluency.

The Case Study

Camille associated CRP with process of instruction with more frequency than the other teachers. While she was "unsure" (by her own estimation) about how to define CRP at the outset of the study (Camille, Interview 1), as she moved into her own classroom in a new school, experienced cultural differences with her students, and was influenced by

reading assigned in her master's seminar, she began to conceptualize CRP as being about practices instead of content or purpose. Camille was the only teacher to focus with such intensity on relevance of practices. Her story bears presentation because it depicts a teacher's conscious effort to change pedagogical practice and the resulting interpretation of CRP, which in many ways approximated relevance of practices. Therefore, this case study is not only an exploration of relevance of practices, but a story of change: a particular process of change that stemmed from a teacher's concrete experiences in her classroom and her implementation of her understanding of CRP. None of the other teachers in the study had such seismic shifts in their conceptualizations of CRP, nor did they report making similarly sustained efforts to change their practice. The data presented in Camille's case study come almost exclusively from the lesson debriefs and the participant interview during the second phase of the study, as it was during this time that she began to talk about CRP in this way.

Camille started off in the study with a metacognitive awareness of her lack of clarity regarding CRP: "I'm unsure [about what CRP is]. That is true. And I'm not ashamed of it because I think for me to admit it; it helps me take that action of trying to understand it more" (Camille, Interview 1). In the first phase of the study, when she described and defined CRP, she tended to talk about it in terms of how to build on the prior knowledge and experiences that students bring into the classroom (Relevance of content and/or context).

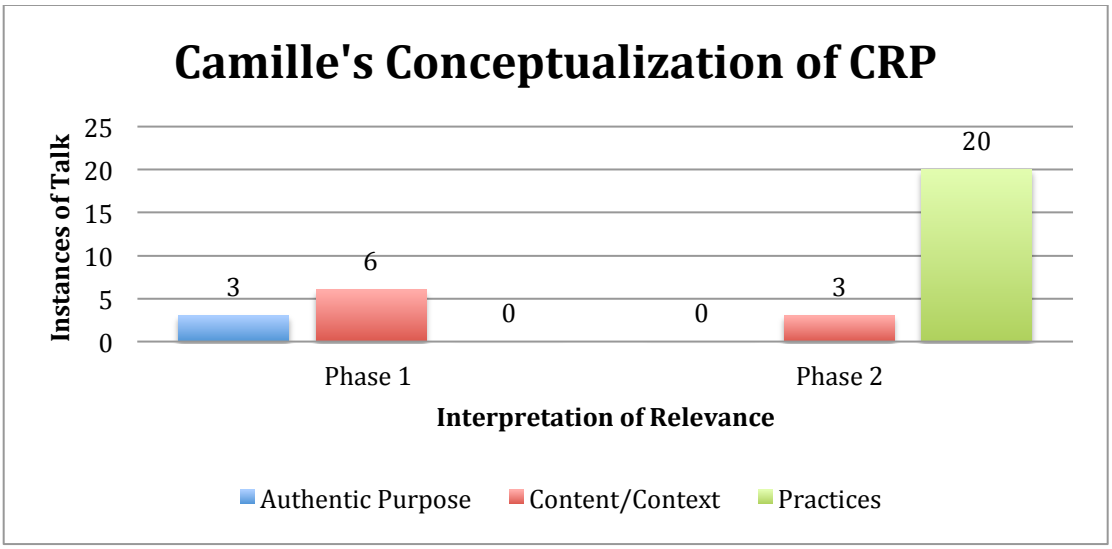

Figure 5: Camille's conceptualization of CRP over the duration of the study

Upon starting her teaching placement as instructor of record in her own classroom, however, her talk of relevance of content and/or context gave way to talk that closely resembled the ideas of relevance of practices (see Figure 5). In an effort to practice CRP, as instructor of record in her new school, Camille made a point to focus on understanding and communicating with the students in her classroom. As she explained in the first lesson debrief of the fall, "this year I'm going to focus on how to deliver." She continued, "… [this year] it might not be the content that might have to be culturally relevant, but like the way I deliver it to them, the way I speak to them, my demeanor in the class with them" (Camille, Debrief 10/18/12). This approach, Camille reflected during our final interview, had the potential to make CRP "more present in my classroom because it is with every student. It's not just [going to be] one day's lesson and then be it. It's going to be an everyday application" (Camille, Interview 2). Camille's description of focusing on the delivery instead of content/context echoes Enyedy and colleagues' description of relevance of practices as concentrating on the "process rather than the content of instruction" (2011, p. 277), and firmly positions Camille's conceptualization of

CRP within the sphere of relevance of practices. Her focus was on the communication and interaction practices she planned to use with her students. It also conveyed what she perceived to be the strength of a relevance of practices interpretation: that it is more flexible and generalizable, because it can be used "everyday" and not just in "one day's lesson," which is the potential drawback with an interpretation of relevance that is narrowly confined to relevance of content and/or context or relevance of authentic purpose, both of which are tied much more closely to the class curriculum.

Camille's Impetus for Conceptualizing CRP as Relevance of Practices

Camille's focus on culturally relevant practices came about as the result of the "cultural disequilibrium" (Bergeron, 2008) she experienced upon beginning the year at her new school. Cultural disequilibrium often occurs in situations in which teachers have radically different life experiences from those of their students, and refers to

> "not only the cultural mismatch that may occur between teachers and their students but also the sense of imbalance of confusion that can result when an individual attempts to grapple with situations or experiences for which he or she is not fully prepared." (Bergeron, 2008, p. 5)

Camille perceived a significant cultural gap between herself and her students, which became the first impetus for her to refine her understanding of CRP: "[It] helped me to find my understanding of culturally relevant pedagogy because I had that gap" (Camille, Interview 2). Reading an article about teaching African American students (Howard, 2002) was the second experience that helped to inform how she talked about CRP.

While Camille had mostly taught Latino students during her student teaching placement (the first phase of the study), her new school primarily served African

American students. She indicated that she felt that she shared more culturally with her students from the previous year, making the generalization: "Asians can relate better with Hispanics [because] we're more passive. We keep more things to ourselves" (Camille, Interview 2). Camille observed that Asian culture was "totally different than, especially, the African-American culture" (Camille, Interview 2), explaining that in Asian culture "it's being respectful when you hold your tongue, whereas… respect doesn't mean that you hold your tongue in African American culture" (Camille, interview 2). In another instance in which she was comparing her classroom from the previous year with her current one, Camille explained that her classroom was "a lot louder [this year]. Last year I was like pulling teeth to get them to speak. But here I'm trying to make them be quiet" (Camille, Debrief 10/18/12).

Aside from the differences of affect that Camille attributed to race, she also felt that her own high school experience was dissimilar to that of her students. She had attended a majority Anglo and Asian American high school in a suburb of the city, in which "at least 80-percent of the students were college bound," but she described the students at her current school differently: "Their priorities aren't going to college first" (Camille, Interview 2). This pronouncement is problematic for its generalization and its decontextualized understanding of the situation. Camille's experience of cultural disequilibrium seemed apparent in the problematic generalizations she made about her students, based on race and college matriculation. She also observed, "I don't know this culture that well. Like, I don't know this school culture, first of all, too well" (Camille, Debrief 10/18/13).

Camille provided an example of when her realization of these cultural differences crystalized. She explained that she had "made mistakes" at the start of the year when it came to understanding her students, which helped her to recognize the cultural differences between them. That became the impetus she needed to get to know them better, and her primary stated goal for her first semester at her new school was to get to know her students better:

> I made mistakes here and there just the language I used or… examples I used. I wasn't really sure what was appropriate. I'm not ignorant of… different races or anything like that, but I'm not of their race and I don't understand the different implications that words have or examples have. So, during the first week, I was able to [realize], 'oh, I need to really understand them better.' That was my first goal. (Camille, Interview 2)

Camille was aware that race and culture played an important role the manner in which her students' interacted with and experienced the world. She recounted one of these "mistakes" she made at the start of the school year, in which she had her advisory group participate in an ice-breaker activity to set a relaxed, casual tone. During the activity she asked the students about popular dance moves they might know. When she mentioned the dance move the "Crip Walk"[11] the kids responded negatively. She reported that they told her, "that's a really bad thing." Camille explained to me, "They took it very seriously and it is serious to them" (Camille, Interview 2). Through this interaction, Camille realized that her students were sensitive to the issue of gangs because "[In] their neighborhood they're surrounded by communities with gang members in them" (Camille, Interview 2).

[11] The Crip Walk is a dance move that originated with Crip gang members in Los Angeles, though it is now fairly well known in the rest of the country.

She also noted that her students refused to wear one of the school colors, red, because of its gang affiliations. She expanded,

> They have to be careful of [what] they say or do, and that's something I'm still learning. I don't know what's inappropriate in their neighborhood or I don't know what's acceptable in their neighborhood. I'm trying to learn what's appropriate. (Camille, Interview 2)

This instance demonstrates how Camille began to realize that she had a lot to learn about her students and their lives, in order to optimize her interactions with them and create a safe and comfortable classroom environment.

Given these perceived areas of cultural disconnect (school culture and racial/ethnic culture and their intersection), Camille decided to concentrate on her interactions with her students, trying to make them more culturally "appropriate" (Camille, Debrief 10/18/12; Interview 2). At the start of the school year Camille felt that she was spending too much time in her classroom raising her voice, managing her students' behavior, and making cultural missteps like the Crip Walk incident. She linked this to these areas of cultural disconnect. At around this time the seminar instructor assigned Tyrone Howard's (2002) article "Footsteps in the dark: African American students' descriptions of effective teachers." In this article Howard lays out three pedagogical strategies that he identifies as having a positive impact on the case study students' achievement, effort, and engagement: (1) establishment of a classroom culture that emulates the characteristics of family and home communities; (2) formation of "culturally connected caring relationships" between students and teacher; (3) use of certain verbal communication and affirmation practices. Camille indicated that this article

was influential to how she thought about "mak[ing her] interaction with [her students] more appropriate to their culture" (Camille, Interview 2).

Both Camille's experience of cultural disequilibrium and the timely assignment of the Howard article influenced how she thought about and enacted CRP in her classroom. Her conceptualization of CRP, with its emphasis on how she "deliver[ed]" her lessons, spoke to her students, and interacted with them is a version of relevance of practices, in which teachers aim to structure instructional interactions so that they reflect and incorporate the modes of interaction that students practice outside of school. Camille's approach to implementing relevance of practices with her students appeared to be two-part. First, she worked to structure interactions in the classroom so that her students would feel more inclined to participate in the way she wanted. Second, she tried to build rapport with her students and establish a personal connection with them.

Restructuring Classroom Interactions

Camille felt that a "starting" point for addressing the cultural differences she identified between herself and her students was to focus on her classroom practice, "the content might not be relevant, but how I deliver content [is], as long as it's culturally appropriate" (Camille, Debrief 10/18/13). In particular, she talked about altering the participation structure in her classroom, specifically around how students answered questions, as a way to make her classroom practice more culturally relevant.

Camille found she had a hard time getting her students to write down their answers to questions she asked during class. At the start of the year, she wanted her students to respond to the questions she posed to the class by writing down their individual responses in their notes or on their worksheets. She found, however, that when

she asked them to write down their answers they "would just do absolutely nothing. They wouldn't do anything because they didn't want to commit to their answer" (Camille, Interview 2). Camille attributed her students' reluctance to commit their answers to paper to two different, though perhaps inter-related, sources. The first was the students' preference for and strength in communicating verbally: "they do use verbal communication better than written communication" (Camille, Interview 2). The other was a fear of getting the wrong answer: "they hate making mistakes" (Camille, Interview 2). Nevertheless, it was important to Camille to have her students respond to the questions she asked in class, and in order to encourage them to do so she restructured the process of answering written questions, incorporating verbal communication and collaborative sense-making:

> … when my students talk to me or communicate their understanding, they do better verbally than a written portion, so what I saw was, there was a big difference in having them talk about their answers with their peers first and then writ[e] it down. Whereas when… I just had them write it down first, they would just do absolutely nothing. They wouldn't do anything because they didn't want to commit to their answer. So giving them that time to talk about it before writing, that's -- I found that to be a better way of communication… (Camille, Interview 2)

As the excerpt above demonstrates, Camille reported that she changed her classroom practice in order to incorporate modes of communication that she, as the teacher, valued, and those modes of communication that she perceived were more comfortable for her students. Doing so allowed for a set of practices to exist in the classroom that allowed the

students to interact in a way they found comfortable (using verbal communication and collaborative sense-making), while organizing their participation so that they still participated in a manner that Camille deemed essential in her classroom (committing answers to writing). Camille contended that when she started to restructure their participation in this way there was "a big difference in having them talk about their answers with their peers first and then writ[e] it down" and predicted that going forward this change in practice would result in a "higher participation rate" and her students feeling "more confident in what they write down" (Camille, Interview 2).

Given her experience using this participation structure in her classes, Camille described how she would use and extend this practice in the future. Envisioning how she could make a future lesson on reaction rates more culturally relevant, Camille explained how she would structure the lesson so that students would be asked to make predictions about what would happen when glow sticks were exposed alternately to hot and cold water. Instead of having her students "commit" to their predictions by writing them down, they would share them with their classmates:

> Normally I would have them write it down but what I would do is have them work in partners and share their answers first, so they don't have to commit to it. They won't be wrong or marked off points. Then after they come to a consensus with their partners, they can write it down. It's that slight change from having them work independently and writing down their answers about what they think will happen to, 'you can talk with your partners, come to an agreement and then write it down.' (Camille, Interview 2)

The approach of having students talk to one another (in pairs or small groups) and then write down their responses is the practice that Camille reported trying in her classroom. However, Camille suggested that if she were planning this lesson specifically to be culturally relevant then she would extend this practice from small group sense-making to whole-class sense-making. Camille described how after the students observed the reaction rates of the glow sticks she would have them write down their observations and complete the "explaining portion" together as a class:

> … on the board… we can come up with [a] definition together or a reasoning together instead of having [the students] come up with their own reasoning. Although I'd like to see [their individual reasoning], I think I'd get… a lot more students involved in that lesson… just by having them talk as a class. That verbal communication rather than having them just write down what they think or what I say…" (Camille, Interview 2).

Camille's explanation demonstrates how she would also allow her students to communicate their ideas orally instead of in writing, and permit them to construct knowledge as a class rather than individually, thereby addressing both of the sources (as perceived by Camille) of their reluctance to commit to an answer and write it down. This shows how Camille was willing to incorporate the students' preferred modes of participation and demonstrates Camille's willingness to compromise on some of the classroom practices that she deemed important (like the students producing their own individual definitions or reasoning).

The integration of practices the Camille described in the previous two excerpts is similar in some ways to creating a set of hybrid practices or a third space (Gutiérrez,

2008) in which students' practices and school practices can coexist, but it is different in one important way: Camille still places primacy on the classroom practice of writing down answers to her questions and is using her students' desire to (orally) vet their answers with one another in service of that goal. In this way, we might consider these additive practices, instead of hybrid practices, as she seems to be leveraging her students' practices in the name of a more normative classroom practice.

It bears noting, however, that Camille did not use this technique in her classroom in every instance. In a debrief from December, Camille explained that she was starting to allow the students to confer with one another first, before writing down their responses, and that she felt it was more "culturally relevant" to have her students "have a conversation instead of me telling them [answers]" (Camille, Debrief 12/07/12). She explained, however, that she had not employed that task structure during that particular lesson:

> I want to say [the lesson today] was culture[ally] relevant in the sense that in groups they were able to discuss [each of the questions] first. This period I didn't have them discuss. We just did it as a whole… I tried [it] with the first period [class]. (Camille, Debrief 12/07/12).

So, while Camille had identified allowing students to confer with one another before writing down their answers as being culturally relevant, she also explained how this was not always a feasible classroom practice. In this particular case Camille shared that she had not used this practice with the class I had observed because she was distracted by an (unrelated, personal event) event that had "shook [her] up" earlier in the day (Camille, Debrief 12/07/12).

While Camille identified this change in her practice as a move to be more culturally relevant, it is worth investigating how she understood it to be so. She indirectly attributed her students' desire to confer with one another before committing to an answer to their race. In her final interview, while describing her students' demeanor, she set up a dichotomy between the behavior of Asians and Hispanics on the one hand and African Americans on the other, characterizing them as "passive" and "vocal," respectively. Later in the same interview, when explaining why her students' preferred to confer with one another before committing to an answer, she characterized them as being more comfortable communicating "verbally." Thus it appears that her change in practice to prioritize verbal communication was at least in part a consequence of her perception of African American students as being particularly vocal. In this way, it appears that she understood her actions as culturally relevant because of the way she responded to a trait she believed to be true of African Americans, not just her particular group of African-American students.

On the other hand, she also ascribed their reluctance to write down their answers to their previous school experiences and the culture of schooling in which they had participated prior to and outside of her classroom. In her second classroom debrief of the second phase of the study, Camille expressed her frustration with the fact that her students preferred to wait for her to write the right answer on the board instead of writing down their own responses:

> The one thing that frustrates me most with my classes is they just copy everything down that I write and I really don't like that because I want them to think on their

> own. Especially… warm ups. They just write the question and sit there. And so, they wait until I write the answers. (Camille, debrief 11/30/12)

This was the first time Camille raised this issue, but she would revisit the topic in the subsequent debrief (Camille, debrief 12/07/12) and her second interview. In these later conversations Camille identified her plans for addressing this problem as culturally relevant. In this debrief, she explained the problem as one of school-wide culture:

> So, I think it's a school-wide culture that's not just specific to my classes. I talked to other teachers about it too and they say it's the same way. So most of the students just sit there and expect to copy it down and they think that being neat or having the right answer is they're learning, instead of them thinking. (Camille, debrief 11/30/12)

As she talked about the cause, however, Camille vacillated about who was ultimately responsible for this behavior, which she described as "learned" (Camille, debrief 11/30/12):

> It might be the teachers that they've had or it might just be them, but something. Like a mixture of two where [the students are] fine with just accepting that. That's something that I feel like could have been prevented, too. I think it could be a mixture. I'm not blaming it all on them. They probably had teachers who wanted them to copy it. (Camille, debrief 11/30/12)

Based on her comments, it is evident that Camille is undecided about whether shifting participation structures in her classroom responds to her students' culture (as based on her understanding of traits particular to their race), the school culture they have acclimated to throughout their school experience, or perhaps an intersection of the two.

During one of my classroom observations I witnessed an instance of Camille's frustration with her students not writing answers as she had asked them to. At the start of the class period Camille assigned a warm up question she had written on the board, "What is one difference that we see in the writing (i.e., 1s2, 2s^2, 2s^3…) of the e-configuration of Ne and Na?" After giving the students 6 minutes to answer the question, Camille commented, "A lot of you didn't even attempt to do this. Why is that?" One of her students answered, "You didn't give us enough time," as Camille began explaining the electron configuration of Ne and Na at the board. This instance complicates Camille's interpretation of her students' motivations for not writing down their answers. It may be that Camille's assessment of the situation was correct, and the students were using the lack of time as an excuse that might be more readily accepted than not wanting to write down an answer, or not knowing the answer, or being nervous about making an error. It is equally possible, however, that the students did not in fact have enough time to commit their answers to paper.

Building Relationships with Students

In addition to thinking about how to structure practices in the classroom, Camille also focused on the inter-personal communication she had with her students that went beyond classroom participation structures and norms. During our final interview, Camille reflected that one of her two goals for the first semester at the school had been to "relate with [my students]… understanding where they're coming from" (Camille, Interview 2). In order to build this kind of relationship with her students, Camille talked about (1) trying to relate to her students by using the language they used, (2) forging a personal bond by sharing more about her own life with her students, and (3) considering the

cultural appropriateness of classroom management strategies. Camille turned to Howard's (2002) article both for guidance as she changed her interactions with her students in order to build personal relationships with them, and as a way to interpret her current classroom management practices.

Language practices. Camille tried to relate to her students by mirroring some of their language practices. She expressed her belief that by doing so she was tapping into her students "ethnic culture" and "youth culture":

> I'm still finding the way where I can use their lingo. It's not going to be as cool as the way they use it or appropriate but I try and they see that. Like I said, I'm going to focus more on the interaction part with it where I am using their ethnic culture and their youth culture to kind of communicate with them. (Interview 2, Camille)

Camille implied that her students appreciate her attempts at relating to them through language, saying, "I try and they see that." Camille also explained that using the students' language practices had the additional benefit of "keep[ing] them attentive in my lessons." Camille further implied that using her students' language practices created a different power dynamic than that of a traditional teacher and student; she had a lot to learn from her students: "… their lingo… the way that they interact with each other, what they're really into nowadays is very different; I'm still learning them" (Camille, Interview 2). By learning from her students, about their communication and language practices, and challenging the traditional power dynamic, Camille may have allowed her students to relate to her differently. She explained that the result of using her students' language with them was that "they think I'm really silly… some kids call me cute." However, the

students' reaction to Camille's attempts at appropriating the students' language may not be as she intended them. Instead of allowing her to claim membership in the students' community (ethnic, youth or otherwise), it appeared to mark her as different and as a source of humor, based on her report that the students thought she was "silly" and "cute."

Personal connections. Relating to her students through language use was just one way in which Camille tried to forge a more personal connection with her students. She also tried to build relationships with them by getting to know them better on a personal level. In our first debrief of the fall semester (second phase of the study), she asserted that her students at her new school were different from those she had as an apprentice in the way they wanted to interact with her: "[This year] the way they interact with me is very different. They want to be like a friend" (Debrief 10/18/12). Whereas the previous year her students had treated her "like an adult, a teacher" her experience at her new school was that her students did not make a "distinction" between her and them "as much" (Camille, Debrief 10/18/12). While she did not seem particularly comfortable with this new dynamic, she indicated that she was trying to relate to her students in ways that they were comfortable with and desired. As we walked across campus with her class during the same classroom observation a student came up to Camille and hugged her. I noticed, at the time, that Camille hugged her back slightly stiffly, and later she explained to me:

> Like the student who… hugged me… I have to be receptive of that because she works really well--- She's not touchy, but she wants that kind of interaction. I mean, that's fine. Like I'm not the first to hug, but if she hugs me, I'm just like okay… I'm going to respond. (Camille, Debrief 10/18/12).

This excerpt demonstrates how Camille was actively trying to make sense of a pattern of interaction that she felt her students were pursuing and that she wanted to participate in, despite some discomfort.

Camille made sense of her students' attempts for personal interaction through the lens of Howard's (2002) article. After reading Howard's article she realized that she needed to make her "interaction with them more culturally appropriate" and that "they might think I don't care, and I did hear that a lot" (Camille, Interview 2). The commentary in the article provided a framework for Camille to make sense of the signals she was receiving from her students: their need for personal connection and their claim that she didn't "care" about them. Camille delineated her interpretation of the article, explaining that according to the article, "students felt like the teacher cared about them when they shared more about themselves… the teacher asked about the students' lives…" (Camille, Interview 2). Camille asserted that these realizations caused her to change how she interacted with her students:

> I'm not very open about sharing about myself but I did start asking the students, like, 'what did you do over the weekend?' You know, being more personal and 'what do you like to do?' It's general, but when students come for tutoring or… they're in my classroom, I just have that kind of personal conversation. I think those students, at least, kind of opened up and they started participating more in class, so I saw a change in that. (Camille, Interview 2)

Camille's explanation indicates that she adjusted her practice to solicit more personal information from her students in order to show she cared about them. She had not, however, started to volunteer information about her own life, as of the end of the study.

This reluctance to be "open" to sharing about her own life with her students may have been related to her identity as an Asian-American woman, and the cultural norms that she associated with being Asian: "We keep more things to ourselves" (Camille, Interview 2).

Camille perceived that her attempts to forge more personal relationships with her students were rewarded with an increased willingness to participate on the students' part. She described how students were more willing to participate after she had engaged them about their lives outside of school: "When they came in during snack… and we had that short conversation, the next period, they would be more open to volunteer. They'd be correct or incorrect, [but] they made that step…" (Camille, Interview 2).

Classroom management. Related to her desire to build strong personal relationships with her students and understand them better was Camille's ambivalence about how to best manage her classroom. In fact, improving her management was Camille's other goal for her first semester of teaching (her first goal being to get to know her students better) (Camille, Interview 2). One of the reasons she decided to focus on the practices interpretation of CRP instead of other facets or interpretations was that she was struggling with classroom management:

> The content might not be relevant, but how I deliver the content, as long as it's culturally appropriate. Maybe not relevant, but… appropriate… that's my way of starting. Because I can't get to content when I don't have the behavior issues [under control] and if I don't understand them, like what works for them (Camille, Debrief 10/18/12).

Camille cited "behavior issues" as the impetus for being culturally appropriate and understanding her students better. Camille was assigned the Howard article "at the time

that I felt like I wasn't getting across to them. I felt like I was not stern enough or I didn't have that good of a classroom management going on" (Camille, Interview 2). In particular, Camille was conflicted about how often she was resorting to yelling at students in order to manage the classroom: "I feel bad for yelling a lot of the time… I felt every time I yelled, I was being a horrible person" (Camille, Interview 2). Upon reading Howard's article, however, she concluded that her students were not put off by her yelling at them in order to keep them on task, "they take the yelling as me putting them back into check." She explained that the students in Howard's case study "felt like the teacher cared when they were yelling at them." In fact, she said, "the higher your voice is the more it seems like you care about the students, or that's what they perceive it as" Camille, Interview 2). She asserted that this kind of interaction was one they had with other authority figures in their lives, such as their parents:

> "I see the interactions they have with their parents when they come in for parent conferences and whatnot and I see their interaction where… it's not a bad thing to get yelled at." (Camille, Interview 2)

While Camille admitted that these revelations did not change how much she raised her voice in the classroom, it did make her feel less upset when she resorted to yelling:

> I feel bad for yelling a lot of the time… before the article, I thought I was being rude… after I read the article, I see that it's okay. Like, they take yelling as me putting them back into check. Whereas I thought yelling would be more of a punishment (Camille, Interview 2).

Whereas she had earlier felt guilty and frustrated about yelling at her class to get their attention or mete out discipline, she now felt it was "okay" and perhaps even expressed that she cared to her the students. Camille uses Howard's article to justify her yelling as culturally relevant, but it misses a crucial point, which is that the teachers in the article raised their voices at their students and were strict with them because they had high expectations for their behavior and academic performance. Camille seemed not as focused on the high standards that led to verbal reprimands, but on the reprimands themselves. Thus, it seems that she used the article as justification for a classroom management practice that she thought was inappropriate (at least to some extent), because she did not have another strategy for managing her students.

Camille, Relevance of Practices, and Deficit Discourses

By her own telling, it seems clear that Camille spent her first semester as an instructor of record thinking about CRP in ways that were similar to a relevance of practices approach. As has been demonstrated, her interpretation of CRP as relevance of practice stemmed primarily from her perception of a cultural gap between herself and her students and her need to better understand them. Nevertheless, it bears noting that the way that she spoke about these differences often sounded like she viewed her students through the lens of deficit. At times the pedagogical moves she was making seemed to be motivated by deficits she perceived in her students rather than their strengths. This is a peculiar construal of CRP, which at its heart is premised on valuing and incorporating students' practices as resources, not as problems to be eradicated.

In stating that she was focusing on the "delivery" of her lessons, Camille explained that compared to her students the previous year, her current students had a

"hard time" with the "skills portion" of the class. She cited "spatial coordination" as an example of a skill her students were lacking, and explained that she had to "present [material] in a way where it's efficient for them" (Camille, Debrief 10/18/12). This meant that she would sometimes draw the charts for her students instead of allowing time in class for them to do it. Similarly, one of Camille's expressed reasons for undertaking CRP in her classroom was that she felt she was challenged by her students' behavior and she was not managing the classroom well. Camille explained that because her students were different than those she had taught the previous year, she had to think about how to "reformat" her teaching to make sure her students learned to raise their hands to share (Camille, Debrief 10/18/12). It was apparent that Camille was invested in adapting her teaching for the good of her students, but identifying a practice among the students that needs to be remediated and using it as a basis for CRP is fundamentally different than using a student practice as a resource in the classroom. In basing culturally relevant practice upon her students' perceived deficits instead of focusing on the assets they have to enrich the classroom, Camille effectively turned CRP on its head.

Discussion

It is clear, from the way in which they talked about the practices their students brought into the classroom, that the teachers did not confine themselves to considering heritage communities when talking about culture. While some did point to students' ethnic culture when talking about practices (such as Joanna's reference to the visual strength of Latino culture), or their students' native language proficiency, many pointed to their students' youth as a salient culture they could reference by incorporating technology in their teaching.

The teachers' talk of students' learning styles as culturally relevant was interesting, and it seemed that generally they were not always linking learning style to participation in particular cultural groups (aside from Joanna's statement). This highlights how teachers considered instruction that was student-centered to be culturally relevant. CRP certainly does not preclude such pedagogy (Villegas & Lucas, 2002), but tailoring instruction to students' learning preferences does not automatically make instruction culturally relevant in the way of CRP. Nevertheless, the danger of generalizing about students' learning styles and relying too heavily on particular modalities in the classroom is real.

The way in which the teachers talked about students' language practices was varied. Eileen talked about the students' bilingualism in terms of helping them to improve their academic English, while Rachel used it as a way for students to demonstrate ability in her classroom, and contribute meaningfully to a project. These two ways of treating students' language practices demonstrate how easily a deficit discourse can creep into teacher talk (Hyland, 2009; Philip, 2011), but also how it is possible to talk about the same issue as a resource for student learning.

Camille demonstrated a multi-faceted approach to culture that came across in her discussion of CRP as relevant practices. She seemed to be working through how to think about the practices her students brought to the classroom and how to value and incorporate them. However, her tendency to assign personality traits to her students (and herself) based on race was problematic. This caused her to attribute particular strengths and practices to her students based on race and/or ethnicity instead of starting with an examination of their practices. She also seemed to rely at times on naturalized axioms, or

"taken for granted assumptions" (Philip, 2011, p. 305) about her students, such as their disinterest in attending college, instead of digging into the factors that might contribute to a lower college matriculation rate. These tendencies fundamentally worked against Camille's pursuit of CRP.

Camille used Howard's article as a lens for making sense of her yelling at her students and as a guide for forging personal relationships with them. She took some of the article's recommendations to heart and they had significant influence on her practice, although the student population was not quite analogous to her student population (the students in the article were younger and lived in a different part of the country). This is an example of how essentialization can easily happen among teachers, when they perceive a culture gap that they feel ill-equipped to navigate, or when they are desperate for some sort of guidance in using CRP.

This is not to say that Camille adhered to the article without reason. Her interpretation of Howard's article worked for her in her context. It pushed her to develop deeper relationships with her students but also allowed her to make sense of (and justify) raising her voice at her students. Armed with insights gained both from her personal experience with her students and her interpretation of Howard's article, Camille made strides to change her practice with her students. She reported that she was engaging in more personal interactions with them, such as conversations about their lives outside of school, and even hugs for those students who initiated them. On the other hand, in the case of the way she managed her classroom, specifically in how often she raised her voice at her students, she indicated that she did not actually change whether or not she raised her voice or how often she yelled at the class. In this case, Camille used her

interpretation of Howard's article to justify her existing practice despite her conflicted feelings about it.

The teachers, aside from Camille, thought about CRP in terms of curricular connections, not building relationships with their students or ways of interacting with them. Instead, they talked about building relationships with their students in order to be better able to practice CRP.

Chapter 7: Challenges to Practicing Culturally Relevant Science Pedagogy

The previous chapters have examined the first research question asked in this dissertation: "How do the teachers conceptualize Culturally Relevant Pedagogy in science?" Generally, the ways in which they conceptualized it fell into three categories: relevance of content and/or context, relevance of authentic purpose, and relevance of practices. The previous findings chapters have demonstrated that while the teachers were able to describe and even implement CRP, they were not always able to do so successfully or fully. This chapter explores the second research question posed by this study: "What challenges did the teachers face in trying to implement CRP?"

The teacher participants all expressed enthusiasm about CRP, this was a criterion for participation, but they also often expressed the feeling that they were not able to use CRP as often or as well as they would like. Furthermore, my analysis of their conceptualizations and practice, as presented in the previous three chapters, demonstrated that while they were making productive strides toward CRP, they were not always successful or consistent in their efforts. It emerged that there were many factors that impacted the teachers' use of CRP, some that they described explicitly to me in our interviews, and others that were implicit in their conceptualizations of CRP and that emerged only during data analysis. Broadly, the difficulties that the teachers faced in using CRP stemmed from their varied understanding of CRP, elements of the school environment in which they taught, and their relative inexperience as new teachers.

Conceptualization Factors

Although it may seem tautological and obvious that the teachers' confusion about CRP was evident in their conceptualization and practice of it, it is worth looking at what

exactly the teachers struggled with when talking about and using CRP. Most of them were frank about their confusion surrounding CRP. Jessica, Joanna, and Camille all asked me on at least one occasion how I would define CRP, demonstrating their uncertainty.[12] Camille in particular expressed confusion:

> [One,] I don't know how to define [CRP], two, I don't know where to start. Yeah, honestly… because I can't define it… it's hard for me… So from my perspective it's really hard for me to implement this and put into a classroom. (Camille, Interview 1)

Joanna expressed a similar sentiment, explaining (understandably) that she got confused with the different types of culturally attuned instruction:

> I still kind of like confuse different concepts, like how funds of knowledge relates to culturally [relevant] pedagogy, they kind of like blend together, but I know they are two distinct ideas but… I can't like distinguish them but I think they are like still related. (Joanna, Interview 1)

Eileen, was also unsure about how to implement CRP, and did not consider her use of analogies to be CRP until an instructor in the teacher education program labeled it as such for her. Kay, while she was relatively assured of her understanding of CRP as using food, music, and items from daily life to enliven and concretize the science content, came to the conclusion, toward the end of her first semester teaching, that CRP was "so much more than Cheetos. It's drawing on home lives" (Kay, Conversation, 11/15/12). While the teachers demonstrated that they experienced some confusion regarding CRP, they

[12] I did not supply a definition in these instances, explaining that the purpose of the study was to understand how they interpreted it.

also seemed to be moving toward a deeper understanding of it as they talked about and practiced it as novice teachers.

Compounding their confusion regarding CRP was the issue that the teachers generally found it hard to define culture. Camille expressed the opinion that "culture is a very vague thing because… I feel like it doesn't have a concrete definition" (Camille, Interview 2). When I asked each of them about their own cultures during the second interview, Jessica, Joanna, and Eileen had difficulty initially describing their own culture. Joanna explained that she found her own culture hard to describe because it was so similar to "mainstream culture," which she designated as "Christian, white, middle class, heterosexual" (Joanna, Interview 2). When I asked Jessica to describe how she thought about her culture she responded, "My own culture? I don't know; that's an interesting question" before explaining that she identified mostly with "American culture":

> I think if I go back to my original definition of culture [as being about ethnicity], I feel like I'm not really that, if I think about [it] ethnicity-wise. I feel like on some levels I'm not really that strongly tied to my culture, because my dad was born here and then my mom, she was from Honduras, but then she came over here and there's really no strong Honduran community here; or she didn't really have that much other family here. So then, I feel like in some ways, I just grew up being more so American, like kind of having an American culture, so I guess I would identify with that, but then really what is that? (Jessica, Interview 2)

Jessica's ambivalence about how to define her own culture points to the complexity of cultural identification and suggests that she would also have trouble understanding her

students' cultural identification and thus how to appropriately incorporate their culture in her classroom.

Eileen also evidenced some uncertainty about describing her own culture, and pronounced the prompt to think about her own culture to be "a hard question to answer", though she explained that she identified with her Chinese heritage and the "communal mindset" that accompanied it. At the same time, however, she seemed to be uncomfortable with identifying as an "Asian girl" because of the "stereotypes" with which that identification was laden. She was frustrated that people minimized the effort and hard work she put in to be successful in math and science, based on their assumption that she would be academically successful as a result of her race (Eileen, Interview 2).

Given that many of them found the concept of culture to be somewhat problematic, it is not surprising that many of the teachers expressed uncertainty about how to identify and tap into the cultural communities to which their students belonged. On occasion they would suggest that a particular activity or discussion prompt could allow for students to contribute knowledge from "home" without a concrete suggestion for what that knowledge or experience would be. Such was the case with Joanna when she asserted that her question asking students to describe how an animal interacts with the environment built on students' "knowledge from home" (Joanna, Debrief 11/14/12). Joanna in particular tended to assume that by allowing the students brief opportunities to relate the content to their own lives, she was using CRP. She explained that in a lesson on the cardio-vascular system she wanted to give the students the opportunity to bring in knowledge from their lives outside the classroom: "If they've ever had anyone have a cardiac-related disease… they could pick up on that. So it's just leaving it open-ended if

they wanted to bring any knowledge in" (Joanna, Debrief 10/11/12). It seemed in these instances that Joanna was not building upon or referencing cultural knowledge she suspected her students had, but trying to allow for the possibility that one of her questions might connect to something meaningful to them.

Another way this ambivalence about culture manifested was a focus on "real world connections" instead of the knowledge or experience of particular cultures or communities. All of the teachers (excluding Camille who never mentioned this phrase) talked about making "real world connections" as being culturally relevant. Jessica explicitly defined CRP as "making more real world connections" (Jessica, Debrief 1). The danger with this is that the "real world" as understood by the teachers might not coincide with the "real world" as experienced by their students. Moreover, most of these "real world connections" referred to mainstream culture, which should not be the focus of CRP. When the teachers used the phrase "real world connections" they tended to be talking about any way that the science content related to the world outside of their science classroom. Making some sort of connection to the world beyond the classroom was, for Rachel, a step toward CRP:

> … at this point in my like teaching practice I think I may have a slightly more rudimentary goal and understanding… which is basically to try to connect the science to kids' everyday life and therefore hopefully connect to at least part of their culture by connecting to their experiences and then kind of to be able to kind of hopefully, eventually… get more of a handle on how to make it more culturally relevant. (Rachel, Interview 1)

In this way attempting to make these "real world connections" may have been productive for its goal of relating science to the world outside of the classroom, which could be built upon by the teachers to develop CRP.

That the teachers did not (in most cases) belong to the same heritage or ethnic communities as their students was likely a contributing factor in their tendency to incorporate "real world connections" instead of their students' cultural knowledge and practices. Most of the teachers expressed uncertainty about how to leverage their students' knowledge as members of particular ethnic communities because they were not members of those communities. Eileen explained:

> I feel like the more traditional understanding of culturally relevant pedagogy in terms of like, race and ethnicity, that kind of culturally relevant, I haven't incorporated as much partly because I feel like I'm not familiar with it. Like, I'm not a Latino person and even though I'm trying to live in the community and stuff, it's still like, I don't really know what communication styles are used at home and that kind of stuff… I don't know what those [assets] are and I'm not sure how I would go about finding out what that is. I feel like if I were familiar with that then the next question would be how do I incorporate that into the classroom but at this point I don't even know what the first step of that would be. (Eileen, Interview 2).

This excerpt shows how although Eileen lived in the same neighborhood as her students, she still felt at a loss as to how to effectively tap into their wealth of cultural knowledge and experience given that she belonged to a different race and culture. This was a feeling shared by Rachel and especially Camille for whom the cultural gap she felt with her

students caused her to reevaluate her conceptualization of CRP. Notably, Kay, Jessica, and Joanna did not talk about cultural differences between themselves and their students, nor did they talk about similarities they shared with them culturally, either.

Not only was it challenging for some of the teachers to understand how to identify and tap into their students' culture, the contexts in which these teachers taught were fairly diverse, and the diversity in the classroom had the potential to complicate their use of CRP. Joanna described how focusing on one culture in a culturally diverse classroom could be problematic: "maybe you reach that certain population that, it's true of but then you don't reach other populations [in the class]" (Joanna, Interview 1). Camille, Eileen, and Kay shared this concern, and all described the complexity of using CRP in a diverse classroom. Camille summed up the conundrum succinctly:

> … in a classroom, even the smallest classroom [of] about 22, I would say there are so many students… that come from different backgrounds or… that have different culture in their lives. So it's hard for me to gear [instruction] to one culture. (Camille, Interview 2)

Eileen also found figuring out how to be culturally relevant amid a variety of cultures challenging:

> So I think one of the aspects that's really hard is to think about what culture… I'm trying to make relevant, you know, because from like an ethnic point of view there's a lot of ethnic diversity in my classroom… so it's hard if I'm going to do some project that's relevant to Latino culture, then my Korean and Filipino students, they're just kind of like, 'oh, okay, I guess this is what we're doing.'

So… it's hard to pinpoint… what cultural relevance actually looks like in my classroom. (Eileen, Interview 1)

Kay expressed her realization that even in contexts that were not super-diverse it was not productive to consider students of similar ethnic communities as a part of a monolithic culture. She explained:

I find that even in a group of Hispanic students… each student is different… Just because we're all Hispanic, I always kind of thought, oh, they're all going to like this one thing because they're all Hispanic. Well, it's not true because each of them bring individual experiences, cultural [experiences]… (Kay, Interview 2).

The teachers were somewhat bewildered as to how to use CRP in their diverse contexts. Their consideration of this complication, however, signifies the hard work they were doing to make sense of the pedagogy within their own diverse school contexts.

In response to the challenge of using CRP in diverse contexts, some of the teachers tried to look beyond their students' participation in their heritage communities to find elements of shared culture. Camille focused on her students' love of food (candy, in particular), while Eileen looked to the students' participation in youth culture and adolescence for common ground, admitting that part of the motivation for leveraging youth culture was that she was not sure how to effectively use her students' ethnic culture (Eileen, Interview 1). In fact, all of the six teachers included leveraging youth culture in their conceptualization of CRP. Identifying elements of culture that they understood to be relevant to more than just a segment of their students was likely a productive move on the part of the teachers. Though heterogeneous student populations are common in many urban areas of the United States, there have been exceedingly few studies done on CRP in

diverse classrooms (Cochran-Smith, Davis, & Fries, 2004), and the problems faced by these teachers are representative of those that face many teachers who work in diverse classrooms using CRP. The few studies that exist have called for creating classroom context as part of cultural relevance (Wyatt, in press) and embracing heterogeneity as a strength and fundamental to learning (Rosebery et al., 2010). This is an area of study that warrants further research, as our classrooms and schools become more and more diverse.

Vagueness regarding CRP and culture (both culture in general and the specific cultures of their students) was an obstacle in the teachers' practice of CRP, as was the diversity of their classroom. The teachers had a difficult time identifying culture and leveraging cultural knowledge in the classroom, which was only compounded by their diverse contexts, which caused them to struggle to figure out how to be culturally relevant to the myriad of cultures in their classrooms.

School Factors

The local and national contexts of schooling within which the teachers worked also impacted their use of CRP. All of the teachers in the study were teaching in contexts in which high stakes standardized tests, such as the California Standards Tests (CSTs), Advanced Placement tests (APs), and school sanctioned benchmark exams, were a constant source of apprehension. Their students' results on these tests were considered a direct reflection of their teaching, and were used, in some cases, by their administration as a barometer of their success as new teachers. Trying to use CRP amid the pressure and struggle to attend to, and in many cases "teach to," standards and tests, proved problematic to some extent for all the teachers. Each of them expressed the feeling that using CRP and covering all of the science content required to keep on pace was difficult.

During the second phase of the study, Rachel was teaching AP chemistry and AP biology at a science magnet and felt a lot of pressure to prepare her students for the AP tests: "I'm just feeling like the pressure to kind of right now… to prepare for those tests which are not really culturally relevant" (Rachel, Interview 2), and thus she felt she had less time for CRP. While she did not talk about feeling pressured by testing during her apprenticeship, it bears noting that she used the month after CSTs to institute her culturally relevant community health project. Furthermore, she felt that the middle school science content demands were significantly less rigorous than in her high school AP and honors courses (Rachel, Interview 2).

Jessica felt the pressure to prepare her students for the CSTs both while she was an apprentice and as the instructor of record. As an apprentice, she was mindful that how her students did on the CST had an impact on her mentor's evaluation, "if the students don't perform well on the CSTs, that's going to reflect bad on her" (Jessica, Interview 1). As a new teacher she cited "so many standards that you need to go over" as something that made using CRP challenging, also noting that "time is always an issue" (Jessica, Interview 2). Kay reflected that she felt she would be able to focus more on CRP and getting to know her students better once they had taken their standardized tests and "we don't have the standards, the pressure anymore" (Kay, Interview 2). Kay and many of the other teachers expressed the belief that part of the reason that CRP made covering standards and preparing for standardized tests difficult was that CRP was best aligned with project-based learning, and they generally felt that assigning projects took a lot of class time away from learning science content.

Joanna and Eileen experienced the pressures of testing acutely at their school. They taught at a particularly standards and assessment focused charter school, during the second phase of the study, and experienced a lot of overt pressure from their school's administration to get their students to excel on assessments. It was school policy to post the California science standards they were covering in the day's lesson on the white board at the start of each class. In Eileen's class (and perhaps in Joanna's as well, though I did not see it), each student had their own "standards list" that enumerated all the standards covered for each test so that they would know what exactly to study for before an assessment. Both Eileen and Joanna explained to me that they were not supposed to assign any project or homework that did not directly align to one of the standards covered in the course. While they were free to occasionally introduce content not covered by the standards (and thus the CSTs), they were not permitted to assess the students on that information. Additionally, the school's administration required them to use a predetermined lesson plan format that allowed for little variation in the structure of the lessons they taught.

Both Eileen and Joanna described how, as new teachers, they were under particular pressure from their administration to get their students to perform well on both the benchmark exam instituted by their charter school network and the CSTs. Joanna explained to her cohort at one of the masters' seminar meetings that when her students took the benchmark exam in the fall, 89% placed as proficient or advanced. Joanna was proud of this, but the charter school administration was not; their campus had placed third among the 13 campuses in the charter school network and the administration was putting pressure on the science teachers to improve their students' scores. She indicated that

Eileen was also feeling pressed to increase performance (Seminar Fieldnote, 10/10/12). The other high stakes test for their charter school was the CST in the spring, and Rachel later explained to me how the administration prioritized standardized test scores over other instructional goals:

> I think there's a lot of pressure for the students to perform on [the CST]. And there's a lot of pressure on the teachers to make the kids perform because they're evaluated on that. And it's sort of this like two-faced administration where they on one hand tell you, 'no teach things that are engaging and don't teach to the test.' And then on the other hand like they severely judge you on how well you teach, especially as a first year teacher, they're like well [the test scores are] really all we have to evaluate you with. (Joanna, Interview 2)

Joanna's feeling was that taking risks and trying innovative pedagogy was not supported unless it efficiently and directly contributed to high test scores. Eileen echoed this feeling:

> My current school is very data driven and very, you know, CST-focused. And so it seemed like a lot of the things that we talked about within UCLA, like valuing English language learner strategies or like culturally relevant kind of stuff, like my school, right now, doesn't really care about. (Eileen, Interview 2)

Beyond feeling pressed to have her students perform on the standardized tests, Eileen felt a lack of support from her administration. She explained that after assessments she liked to take time to talk to her students about "what other things are you good at besides school to tell them like whether or not you scored well or not… this is not a base of who you are as a person." But she worried about how the school would view this:

> If an administrator were to walk in at that time I feel like they'd be like, why are you doing things like this, this is not standards aligned or whatever. So I feel like that's been really hard just because there are very few other teachers at that school who push for things like that (Eileen, Interview 2)

Eileen and Joanna were not the only ones to feel a lack of support for using CRP, Rachel also felt that at her "very old fashioned" school it was "harder to do something completely different like, culturally relevant pedagogy" and that she did not have anyone with whom she could collaborate to use CRP on the faculty (Rachel, Interview 2).

Most of the teachers interpreted the standards and content driven environments in which they worked as incompatible at least to some extent with CRP, which they generally felt involved projects and activities that developed over a longer time frame. Considered in this light, it is not surprising then that many of the teachers had difficulty implementing CRP and that they often chose to make quick reference to students' lives and knowledge instead of using those resources in more radical ways, such as directing inquiry or critiquing societal issues.

It is disappointing that the teachers saw incompatibility between learning content standards and using CRP, because it points to the attitude that CRP is valuable more for its ability to motivate and engage students than actually help them to understand science, though as presented in previous chapters, the teachers seemed to value it for both aspects. It also indicates that to some extent CRP was considered good practice but of lower priority than other types of pedagogy, and not always the most effective or efficient way to teach students the required science content.

Factors Relating to the Teachers' Inexperience

A final factor in the teachers' use of CRP, and perhaps most significant, was that these teachers were new teachers with very little classroom experience, professional development, and interaction with students under their belt. The teachers' relative inexperience as apprentices and brand new teachers was possibly the most significant for how it compounded the other factors (those related to their school environments and those related to their understanding of CRP). This study took place while these teachers were apprentices and novice teachers, ending only after the first semester of their very first year as inservice teachers. They were at the very beginning of their teaching careers, and thus at the steepest part of the learning curve as inservice teachers. We should expect their practice and conceptualizations of CRP to be not yet fully formed and realized, just as we would expect their use and conceptualizations of inquiry or student-centered pedagogy to continue to develop and mature. The teachers reasonably viewed knowing their students, in a deep and meaningful way, to be key to using CRP in their classrooms. This idea came up again and again in our interviews (both prompted and unprompted). Joanna highlighted how as a novice teacher she would benefit from experience with her students:

> You have to get to know your students to see what is relevant to them and that takes… a while. I mean you start in the beginning of the year, and you make progress, as time progresses, but I think the more of veteran teacher you are you know more of the things that are relevant to your students. So you get better at it in time… So you are getting to these individual students and then you also like as the years progress you are getting to know typical things that engage students, or

typical prior knowledge the students are going to have to tie in to the classroom. (Joanna, Interview 1)

Joanna's comment shows how she felt that she would only get better at CRP with more experience with students. Since these teachers were just beginning their careers they did not yet have the benefit of years of experience with students that a veteran teacher would.

Many of the participating teachers expressed the sentiment that using CRP was only one of many competing priorities to which they were attending as new teachers. Rachel explained that she felt as if she were "juggling" the need to teach "rigorous science content… make it culturally relevant" and "make all activities inquiry based" (Rachel, Interview 1). Rachel's feeling of being overwhelmed as a new teacher was not an anomaly. One barrier to using CRP that many of the teachers vocalized was that it was challenging and time-consuming to plan. Kay, Rachel, Joanna, and Jessica all noted that it took a lot of time to prepare a lesson using CRP and that it was harder to plan for than lessons that did not include CRP. Jessica opined that it was "really hard to come up with something [culturally relevant] on the fly" and "I see [CRP] working better with projects, and you know with projects it always takes more time to do the planning" (Jessica, Interview 1). Rachel explained that using CRP took more planning than doing a more traditional lecture, "[CRP] takes a lot of time to plan but somehow planning a lecture is easier because I can find some PowerPoint that's pretty good, modify it a little bit or use some resources from the book" (Rachel, Interview 2). Joanna reflected that with experience, the planning for CRP would get easier: "next year I'll have better projects than this year because I've had more time to think about it and brainstorming on it. So yeah, I think like that sort of creativity takes time" (Joanna, Interview 2).

As novices, the teachers were constantly feeling pressed for time and ideas to plan lessons. All of the teachers aside from Kay indicated that they wanted resources in other teachers with whom to collaborate, or a bank of culturally relevant lessons from which they could choose lessons to try. The teachers who suggested that having collaborators in other teachers would help them practice CRP, wanted another person with whom to brainstorm lessons or talk through the concept of CRP. The teachers who said they needed concrete examples of lessons or activities using CRP wanted to see what a successful lesson or teacher looked like in order to learn from them. Camille explained that she wanted some example videos of lessons using CRP:

> I think if I saw it in action, if I saw it take place, and… maybe… real teachers could give me [an idea of] how it works in their classroom regardless of content, science would be nice, just so I could maybe use that lesson but yeah, I think if I could see more examples of culturally relevant pedagogy. (Camille, Interview 1)

Camille's desire for an example she could see communicates that she had never seen CRP in practice before. Joanna was similarly thirsty for resources in the form lesson plans and information about her students:

> I think [it would help to have] resources of great lessons that have culturally relevant aspects to them, so to see like examples of how teachers have utilized the culture of their students to make the instruction more powerful. Maybe some tips about different ways to go about integrating culturally relevant pedagogy into the classroom. Or a list of like typical experiences that students in your area have had [so that] you can utilize that information to tie in to the classroom. (Joanna, Interview 1)

Jessica also wanted lessons that used CRP, but she suggested that it would be useful to develop them in one of the teacher education courses: "I think that it would have been helpful if maybe we would have had an assignment or something related to [using CRP]… [like] come up with links that make things as culturally relevant as possible" (Jessica, Interview 1). Joanna also expressed this desire, suggesting,

> It would be great if in class we had more time to like maybe develop a hypothetical culturally relevant lesson. So to try doing it and then get feedback… or just to have some time in the class with like a group of three people, and try to design a hypothetical culturally relevant lesson and just like go through the thinking and the planning process. (Joanna, Interview 1)

The teachers in the study were new teachers at the very beginning of their careers. Their inexperience with their students, science classes, lesson planning, and the school community were all factors in their feeling challenged to practice CRP. As they build deeper relationships with their students and their students' community, and become more proficient in the lesson planning involved in CRP, it is likely that they will find using CRP in their classroom less challenging.

Discussion

Many of the teachers in this study expressed some confusion about what CRP was, or how to usefully define culture. All of them described using CRP as being in conflict, to some extent, with the high stakes testing environments in which they all taught. Many of the teachers also felt that their school administrations and other teachers at the school were decidedly uninterested in CRP and even opposed to implementing any pedagogy or introducing any content or skills that were not directly indicated by the

standards or standardized tests. All of the teachers expressed the feeling that using CRP took a lot of time and effort in the planning stages, which they often felt they did not have as new teachers.

Understanding the factors that stood in the way of these teachers' use of CRP is important because of who these teachers were: apprentice and novice teachers who were committed to CRP and had been trained in a teacher education program that was devoted to social justice and education in urban schools. They had read articles on CRP and related asset pedagogies, and discussed issues of equity, access, and culture in their classes. Nevertheless, they encountered difficulty in using CRP as they embarked upon their teaching careers. Recognizing the factors that hindered them in their pursuit of CRP not only contextualizes their personal trajectories and moments of struggle, but also pinpoints where we, as researchers in the fields of teacher education and CRP, need to support our teachers. Ladson-Billings (1995b, 2001) asserts that teacher education must work to attract a particular type of people to the teaching profession in order to train culturally relevant educators, but what of the teachers, like those in this study, who want to use CRP, but are not always able to do so? These teachers faced moments of challenge as well as success in the midst of school environments that they often perceived as inhospitable to or incompatible with using CRP. I would argue that merely attracting a certain type of person and teaching them about the concept of CRP only takes them so far in their journey towards cultural relevance.

The experiences of these teachers demonstrate their struggle to understand CRP in practice and yet conveys the productive strides they made as very new teachers to become culturally relevant pedagogues.

Chapter 8: Discussion

In this chapter I will summarize the main findings of the study and discuss the implications for preparing teachers to use CRP. While the teachers evidenced ideas of CRP that aligned in salient ways with relevance of authentic purpose, relevance of content and/or context, and relevance of practices, they also found CRP challenging and oftentimes left out crucial elements of CRP. I explore both those successes and challenges here and the implications they have for teacher education.

Interpretation of Relevance by Teacher

The findings chapters have been organized by interpretation of relevance (Enyedy et al., 2011) and this structure did not allow for an examination of each of the teachers' conceptualization of CRP (aside from the case study of Camille). To address this omission I offer Figure 6, which presents the number of instances of talk in which the teachers expressed ideas similar to each of the interpretations of relevance. The number of instances of each teacher talking about their conceptualization of CRP ranged widely from 29 instances (Jessica) to 55 instances (Kay). This variability was the result of the differing conversational styles among the participants (Kay, for example, was quite loquacious) as well as the number of lesson debriefs we were able to do. It is notable also that while some of the teachers had particular interpretations that they tended towards, others talked more evenly about the three interpretations of relevance.

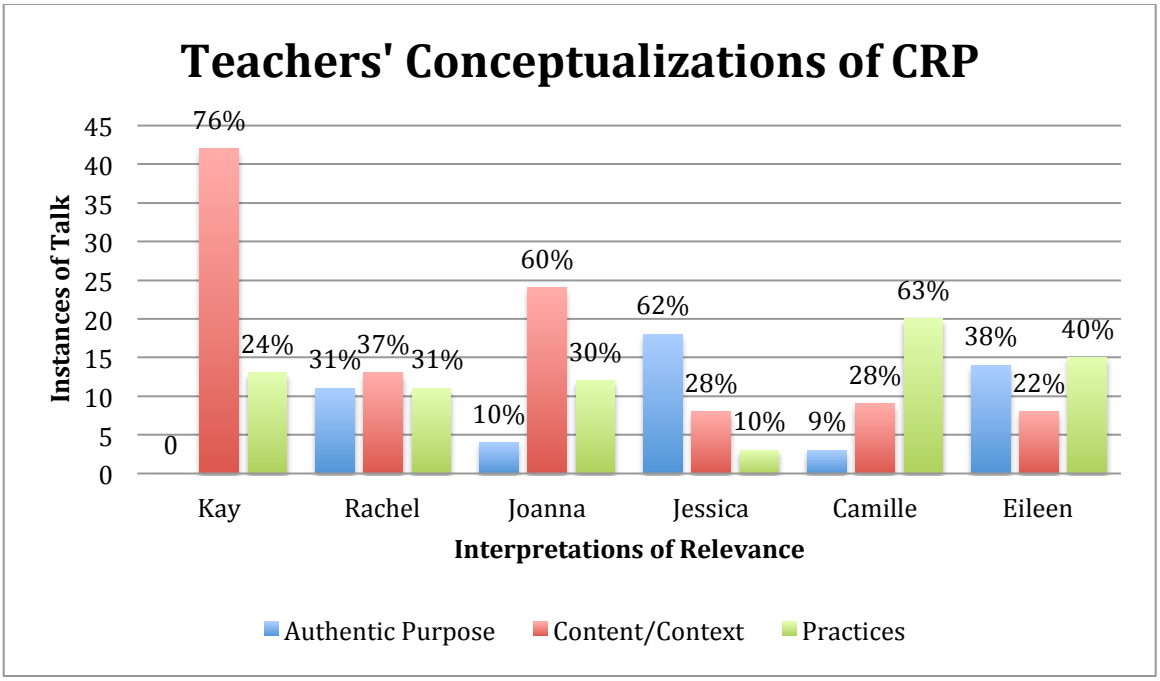

Figure 6: Teachers' expression of the three interpretations of relevance as percentages of their overall talk about CRP

Kay and Joanna talked primarily about CRP in terms of relevance of content and/or context. For Kay, this often took the form of contextualization of science content through the use of Spanish language music, or references to pop culture, such as movies or celebrities. Often expressing the opinion that science could be "dry" she seemed to want to enliven her students and increase their interest and understanding by incorporating their interests and culture into the classroom. Joanna's use of students' resources differed from Kay's. Instead of identifying the students' cultural resources and then incorporating them in the classroom, Joanna tended to ask open-ended questions of her students, with the intent for them to make their own connections to the content. This presents an opportunity for students to make meaningful connections to the science content, though there is still the possibility that the students will not know what to do with the opportunity, or will be uninterested in taking it. Nevertheless, involving the students in the work of CRP in the way that Joanna seemed inclined to do may be a

useful strategy for teachers who are still getting to know their students and do not have a handle yet on what cultural sources would be salient for them.

Jessica was partial to authentic purpose. She often talked about CRP as being about what the students could learn in class that would be useful to them in their personal lives. It may be that one of the classes Jessica taught was more conducive to looking at the real life implications of science: aside from biology, she taught a bio-medical class that was not constrained by the standards requirements of other classes. Jessica was one of the teachers who often mentioned "real world connections" in her talk about CRP. Connecting the science content to life outside the classroom was important to Jessica and thus she made connections between the science and the world beyond the classroom, but did not encourage a critical look at the socio-scientific topics associated with the science.

Camille favored relevance of practices, as was presented in her case study in chapter six. She talked about CRP as the "delivery" rather than the content of lessons, and focused on building her relationships with her students and incorporating their language and communication practices (as she understood them) into her classroom.

Eileen was split between authentic purpose and practices in terms of her talk of CRP. This is surprising, because her use of analogy (which falls under content and/or context) was particularly important to her as part of her culturally relevant practice. Her focus on practices was largely a reflection of her talk about building relationships with her students and their community.

Rachel did not appear to favor one interpretation of CRP over another. She talked about the three with almost identical frequency. Her evenhandedness was a reflection of the community health project that she did during her apprenticeship. The project used

students' resources to address community health issues, selected by the students. The use of students' interests and knowledge to select the health issue was the relevance of content and/or context, and the framing of the project as addressing a community health issue was the relevance of authentic purpose. During the project, Rachel regarded the students' bilingualism as an asset. She encouraged her students to use their language skills to translate the presentations they made so that they would be more accessible to those in the community, particularly parents, many of whom did not speak a lot of English. Thus, Rachel's community health project is a good example of a project that incorporated all three interpretations of cultural relevance, as Enyedy and colleagues intended.

Even in this very small sample, there is considerable variation across the participants in how they interpret CRP. Relevance of authentic purpose and relevance of practices were each favored by one teacher; two favored relevance of content and/or context. One teacher was split between authentic purpose and practices (with less talk about content/context), and another teacher was evenly split across all three. It is telling that even in this small group of teachers, who all participated in the same teacher preparation program, there is no most preferred interpretation of relevance. Additionally, even though Kay and Joanna both talked primarily about relevance of content and/or context, they tended to interpret it in different ways. It is encouraging that all of the teachers (aside from Kay) were talking about all three interpretations of relevance, as incorporating all three in concert is ideal (Enyedy et al., 2011). The fact that by and large all of the teachers were aware of all three interpretations of relevance means that as they improve and strengthen their practice of CRP, they will be refining their understanding of

the different types of relevance, instead of needing to think about cultural relevance and CRP in entirely new ways.

Drawback of this study

It is appropriate here, before a final summary of the findings of this study and the implication, to address a significant drawback that affects those findings: the lack of student perspective. Given IRB protocols and permissions, interviewing and otherwise collecting data from the students in the teachers' classes was not feasible. However, it was difficult at times to interpret the teachers' assertions about culturally relevant practices they were using in their classrooms without the students' experience of those practices and interactions.

Findings

In the following section, I will briefly summarize the findings of this study in order to address their implications.

Relevance of Authentic Purpose

The teachers in this study talked about framing their lessons in a greater purpose by encouraging their students to see how the science classroom knowledge could be useful or relevant to them in their lives outside of school. They explained to me that creating projects and contexts in which science knowledge might have utility to their students outside the classroom, was culturally relevant. This was not, however, always made evident to the students. The bid to make science relevant through purpose was not explicitly conveyed to the students the majority of the time, but was a way that the teachers reflected on their own practice and made sense of it as culturally relevant.

Notably, the teachers were focusing on the directional flow of knowledge: the usefulness of science knowledge in the students' lives outside the classroom. The teachers did not, however, tend to select social justice issues as topics to be addressed, nor did they bring a critical lens to the issue if it did pose an opportunity as an issue of social justice. There was encouragement for the students to act upon the issues (as with the examples from Eileen and Rachel), but without the framing of the purpose as one of social justice, a lot of the essence of relevance of authentic purpose was lost. Thus, the students were not being encouraged to develop their critical consciousness. The teachers' appropriation of relevance of purpose without integration of critical consciousness is in line with other work in this area that suggests that critical consciousness is difficult for pre-service teachers to develop (Gay & Kirkland, 2003). As Philip's (2011) work with new teachers demonstrates, even teachers committed to the principles of social justice education may not always marshal their own critical consciousness when thinking about issues concerning their students, and revert to accepting the status quo. These teachers' tendency to omit social justice issues and critical consciousness is not altogether surprising.

Relevance of Content and/or Context

The teachers demonstrated commitment to relating the science content they were teaching to the lives of their students by incorporating their students' assets. The teachers employed their students' knowledge, experiences, and interests from a range of facets of their lives to make their science learning more interesting and enhance their understanding. They cast a wide net when identifying their students' sources of knowledge, and included sources such as school and universal experiences when

describing their practice of CRP. In these instances, they created potentially rich learning opportunities for their students, but not always a platform for them to demonstrate their cultural knowledge or maintain their cultural competence. The teachers' inclination to draw from a wide variety of sources likely will help them to understand what does and does not work as they try marshaling different student resources and reflect on their success with input from their students. Though CRP has sometimes been narrowly interpreted as drawing upon the knowledge and practices of students' ethnic or heritage communities, the teachers' inclination to look for sources of knowledge beyond their students' heritage communities may represent a more dynamic approach to culture and cultural knowledge, as long as students' heritage communities' ways of knowing and practices are not disregarded in favor of these.

A danger in focusing too much on students' interest in pop culture and sports is that they may not constitute communities in which the students actively participate and that are thus meaningful and important to the students' identities. As I did not talk to students for this study, it was difficult for me to ascertain whether or not the sources of knowledge that the teachers were referencing were in fact culturally relevant for the students. It is crucial to understand students' cultures and thus their cultural practices as multi-faceted and emergent. Paris and Alim (2014) advise that students' cultural practices are constituted through their participation with both their heritage or ethnic communities and other communities of practice important to them. They use the terms "heritage practices" and "community practices" (Paris, 2012) to refer to and differentiate between practices learned in heritage communities and practices learned in other communities of practice:

> These terms are based in contemporary understandings of culture as dynamic, shifting, and encompassing both past-oriented heritage dimensions and present-oriented community dimensions. These dimensions in turn are not entirely distinct but take on different salience depending on how young people live race, ethnicity, language, and culture. (Paris & Alim, 2014, p. 90)

The teachers demonstrated that they had a fairly dynamic view of culture that valued the communities of practice that students belonged to in addition to their heritage communities, though they were not always confident in selecting cultural knowledge for inclusion in the classroom.

The teachers identified four functions that the students' resources played in their classes: using student knowledge to concretize content knowledge; using student knowledge to build content knowledge; leveraging student knowledge to present content through analogies; using student knowledge and curiosity to direct classroom activity. All of these, aside from directing classroom activity, placed primacy on the science content and viewed the students' knowledge, experiences, and interest as a means to better teach that content. Thus, the emphasis was on science content, and not cultural maintenance. In general, the teachers were placing priority on the science knowledge to be learned, not the students' knowledge from other sources. Using their students' knowledge, experiences, and interests to contextualize or concretize science content, or build scientific knowledge were the most common ways of understanding of relevance of content and/or context. These approaches to incorporating student resources built one way bridges from students' experiences to science content that were colonizing instead of culturally sustaining (Paris, 2012).

Relevance of Practices

The teachers talked with some frequency about CRP as a process of instruction or a way to incorporate students' practices. In their talk about incorporating students' practices there was evidence of teachers essentializing their students in terms of their learning styles and perceived heritage community practices. It seemed that the teachers had a difficult time understanding what practices of the students to include in their classrooms or even how to identify practices that the students could contribute. At the same time, the cultural disequilibrium that Camille experienced (partially as a result of essentialization) ended up pushing her to get to know her students better on a personal level and tailoring her classroom practices to incorporate some of the practices she felt her students were more comfortable with. The resulting interactions have the potential to lead to Camille away from such essentialization in the future, which would aid her development as a practitioner of CRP.

The teachers' talk of students' learning styles as culturally relevant was widespread, and it seemed that they were not consistently linking learning style to participation in particular cultural groups (aside from Joanna's statement). This highlights how teachers considered instruction that was student-centered to be culturally relevant. CRP certainly does not preclude such pedagogy (Villegas & Lucas, 2002), but tailoring instruction to students' learning preferences does not automatically make instruction culturally relevant in the way of CRP. Nevertheless, the danger of generalizing about students' learning styles and relying too heavily on particular modalities in the classroom is real.

The way in which the teachers talked about students' language practices was varied. Eileen talked about the students' bilingualism in terms of helping them to improve their academic English, while Rachel used it as a way for students to demonstrate their assets in her classroom, and contribute meaningfully to a project. Eileen's approach to her students' language practices demonstrates how easily a deficit discourse can creep into teacher talk (Hyland, 2009; Philip, 2011). Eileen was not alone in talking from a deficit perspective. This perspective seeped into the talk of many of the teachers in their talk about CRP (not just relevance of practices).

The teachers, aside from Camille, thought about CRP in terms of curricular connections, not building relationships with their students or ways of interacting with them. Instead, they talked about building relationships with their students in order to be better able to practice CRP. This is not to say that they only wanted to get to know their students in order to make science culturally relevant. It is likely that they thought having positive relationships with their students was important in its own right, but not a part of CRP. Camille, on the other hand, thought about CRP in terms of strengthening her relationships with her students, considering those relationships an end in their own right.

Challenges to CRP Faced by the Teachers

The teachers encountered various challenges to using CRP in their classrooms. In particular, they demonstrated that they were still not completely comfortable defining CRP, and furthermore they displayed uncertainty about identifying culture (that of their students and their own). Moreover, the schools in which they taught, with their focus on standards and test scores caused them to feel pressured to stick to a pre-ordained curriculum and delivery method that precluded CRP. This argument was somewhat

surprising, given the fact that they also expressed the idea that CRP encouraged student understanding. It shines light on the complex and contradictory views the teachers held about CRP: it was good for student learning, but it also did not efficiently prepare students for learning the standards covered on the standardized tests.

That the teachers in this study were new teachers, at the very start of their careers, was also a significant challenge to them as they tried to enact CRP. Their newness to the business of teaching meant that they were overwhelmed by all the demands made on their time and attention. To them, it often seemed like developing and enacting culturally relevant lessons and pedagogy seemed too much to handle. This is an important finding because it indicates that they generally viewed CRP as an additional "layer" or something to add to their practice, not a foundation for their practice, as is implied by the term "pedagogy." The teachers also yearned for more direct support in creating culturally relevant lessons, or examples of lessons utilizing CRP.

Implications for Teacher Education

The findings regarding the productive and successful steps the teachers took in implementing CRP and also the obstacles they faced in doing so, have implications for teacher education. I suggest an asset-based approach to teacher preparation in CRP, built upon the understandings and productive moves the teachers evidenced in this study. I begin by enumerating some of the teachers' productive and positive understandings and practices, introduce the areas in which they still needed support, and then suggest elements to incorporate into teacher preparation to improve teachers' conceptualization and practice of CRP. Notably, the good moves these teachers were making and the areas in which they need more support were not science specific, and thus the

recommendations that follow are applicable to teachers of any subject. Additionally, while these recommendations are modeled off the data for these six participants, I believe that the problems they encountered and the recommendations I suggest are not particular to these six teachers and their experiences. The problems they encountered are not new to the field, and thus the recommendations I make for teacher education need not be confined to the teachers in this study or the teacher education program that trained them. I use the productive elements of their conceptualizations of CRP to demonstrate how to build upon their strengths, but the recommendations are still suitable even for teachers who might not have these same strengths.

	Productive Elements of Teachers' Conceptualizations of CRP
+	Investment in using CRP
+	Focus on using student knowledge in class
+	Utilization of a range of student knowledge in class
+	Commitment to getting to know students in order to practice CRP

Table 6: Teachers' assets in their conceptualizations and practice of CRP

The teachers evidenced some very positive and productive elements in their conceptualizations of CRP. Table 6 presents the elements that can be built upon to further improve teacher preparation, but does not encompass all the productive elements of the teachers' conceptualizations of CRP. The teachers who participated in this study did so because they were interested in CRP and wanted to discuss it with a researcher and think about it within the context of their practice. This, first and foremost, is important because it indicates that the teachers had the inclination to work on their conceptualizations and practice of CRP in order to improve them. Furthermore, all of the six teachers talked a lot about how to incorporate students' knowledge, experiences, and interests into their classrooms, and gave many examples of how they had tried to do so, and how they planned to continue to do so in the future. The variety of ways in which

they talked about incorporating their students' knowledge demonstrates that this was an element of CRP that appears to have been particularly intuitive for teachers, and their tendency to cast a wide when incorporating students' knowledge resources was also positive. Finally, all of the teachers viewed getting to know their students as important to practicing CRP, which is unequivocally an integral part of CRP.

	Areas for Growth and Support
-	Incorporating social justice
-	Identifying cultural knowledge held by their students
-	Prioritizing student knowledge
-	Avoiding the essentialization of students
-	Fostering cultural relevance among heterogeneous groups of students
-	Abandoning deficit perspective
-	Creating a library of culturally relevant lessons from which to draw upon

Table 7: Areas in which the teachers need help in their conceptualization and practice of CRP

The areas in which teachers need further preparation in practicing CRP are presented in Table 7. They include the need to incorporate topics of social justice into the classroom, the need for help in identifying cultural knowledge held by students, and incorporating it into lessons in a way that does not dismiss it in favor of science content, and the need to avoid the pitfall of essentializing students, which can occur when teachers try to use their students' assets (knowledge resources and cultural practices) in the classroom. The teachers also need more support in using CRP in culturally heterogeneous classrooms and abandoning the deficit perspective that seemed to creep in to some of their talk about their students. Finally, many of the teachers yearned for examples of culturally relevant lessons and instruction in order to build their practice. Table 8 presents elements to include in teacher education to enhance teachers' CRP preparation.

Recommendation	
Actively prepare teachers for CRP with practice-based instruction (methods course)	**Needs addressed:** -Incorporating social justice -Identifying cultural knowledge held by their students -Prioritizing student knowledge -Avoiding the essentialization of students -Fostering cultural relevance among heterogeneous groups of students -Creating a library of culturally relevant lessons from which to draw upon
	Builds upon teachers' + Investment in using CRP + Focus on using student knowledge in class + Utilization of range of student knowledge in class
Support teachers to "research" their students (inquiry project; research methods course)	**Needs addressed:** -Identifying cultural knowledge held by their students -Fostering cultural relevance among heterogeneous groups of students -Abandoning deficit perspective -Avoiding the essentialization of students
	Builds upon teachers' + Investment in using CRP + Commitment to getting to know students in order to practice CRP
Develop teachers' critical consciousness (social foundations course)	**Needs addressed:** -Incorporating social justice -Prioritizing student knowledge -Abandoning deficit perspective
	Builds upon teachers' + Investment in using CRP

Table 8: Recommendations for teacher preparation program

Recommendation 1: Active Preparation in CRP

My first recommendation is that teachers participate in preparation for CRP that is practice-based instead of literature focused. It is apparent from their interviews that these teachers appreciated and valued the education in asset pedagogies (including CRP) that they received through their teacher preparation program. I used the word "received" in the previous sentence because their interactions with CRP were relatively passive: they learned about it conceptually, by reading articles and sometimes following up those

articles with class discussions (in their methods courses or seminars). None of the teachers reported to me that they had been given the opportunity to try out culturally relevant practices or design and enact culturally relevant lessons, nor did I observe these sorts of activities. Many of the teachers suggested this as a way to improve their practice.

The teachers demonstrated underdeveloped ideas about how to put CRP into practice because they had not developed conceptualizations of CRP in practice. Their training in CRP was theoretical, and they were hard pressed to put the ideas into practice in a living, breathing classroom. This finding may sound obvious, but if we want to train culturally relevant pedagogues then we need to help them develop their understanding of CRP through practice.

The teachers' suggestions of collaborating with their cohort to write culturally relevant lessons and trying out lessons and reflecting on their success are sound suggestions. In her critique of two teacher education programs committed to social justice education, McDonald noted that they were committed to "the conceptual over the practical" (McDonald, 2005, p. 428), so mine is not a novel critique of these teachers' teacher education program. I do not, however, want to advocate for what Sleeter calls the trivialization of CRP: "reducing it to steps to follow rather than understanding it as a paradigm for teaching and learning" (Sleeter, 2012, p. 569). The necessity is for teachers to regard CRP as a paradigm, or foundation, for their teaching and not as an extra layer that can get added on top whenever possible. I, suggest that a focus on the practice of CRP should help teachers to develop practices of leading classroom discussions, soliciting student input, and identifying students' cultural resources. The teachers should have time to plan culturally relevant lessons with their fellow preservice teachers, enact

them with students, and reflect on that experience.

Teachers tend to need to dedicate more time and effort to planning lessons with CRP than those without (Morrison et al., 2008), and the teachers in this study echoed that sentiment. Setting aside time in a methods course to plan collaboratively off loads some of this burden. Trying out the lesson (or segment of a lesson) with students in their student teaching classrooms would allow the teachers to see how students respond to the lesson, and they can take those experiences back to the methods course and share them with their peers and the instructor. By discussing with their peers the lesson they implemented and how it went, the teachers would engage in active reflection on their practice. Ideally, the teachers would reflect upon (a) the lesson or practice(s) they undertook, (b) why they decided to try it, and (c) how they felt it went. By reflecting in this manner, the teachers would be pushed to articulate their thinking behind the attempted practice, and to reflect meaningfully on the experience and the successes and/or challenges that came with it. If these assignments of planning a lesson and reporting on its implementation occurred throughout the methods course, the teachers would benefit from multiple instances of articulating their thinking and reflecting on their practice. The conversations around the thought processes behind in-practice decisions would allow the teachers to reflect on their own decision-making processes and compare them to those of their peers. In subsequent iterations, they would also have the chance to refine their use of particular practices or try new ones.

Providing the time and space in a methods course for teachers to try out CRP and reflect on the experience builds on the teachers' inclination to incorporate CRP in a curricular fashion, and it would address many of the areas in which the teachers need

support (see Table 8). Additionally, it would allow the teachers to pool their resources and begin to create a library of lessons upon which they could draw as instructors of record.

Recommendation 2: Training Teachers as Researchers of their Students' Lives

Duncan-Andrade and Morrell (2008) recommend that teachers must become "researchers" into their students' lives so that they are better able to teach them. Encouraging teachers to research their students would help them to identify (cultural) assets that their students can contribute to the classroom. Getting to know their students better would also help them to understand the commonalities among students' assets and experiences and thus how to use CRP with heterogeneous classrooms. Additionally, understanding their students better and realizing their assets would also help them to avoid the pitfalls of essentialization and deficit. By knowing the students better, the teachers would hopefully recognize the variation among their students, and understand their assets rather than focus on perceived deficits.

I suggest support for this type of research take place within the context of an inquiry project or research methods course, in which teachers develop interview and focus group protocols, and surveys to learn more about their students. Learning more about their lives, interests, experiences, and aspirations will inform the teachers about what makes their students unique, what commonalities draw them together, and what will be culturally relevant for them. Reflecting on what they learn about their students could inform the lessons they plan and implement as part of the practice-based CRP preparation the teachers would participate in as part of the methods course. "Researching" the students' lives does not necessarily require in-depth interviews, and oftentimes, formal

interviews may be uncomfortable for students. In these cases, well-planned class discussions (structured much as focus groups are) may be more appropriate. As the teachers get to know their students better, they can follow up with the students about what is working for them in the classroom, and solicit their opinions and experiences as they plan and implement culturally relevant lessons. It is crucial for teachers to consider their students' experiences of CRP as they are developing their practice. The case of Jessica, whose students were reluctant to learn or talk about diabetes in class because they knew people who had the condition, is a good example of where eliciting the students' reasoning for their reluctance could have helped her to develop her practice.

Recommendation 3: Developing Teachers' Critical Consciousness

Another issue that needs to be further addressed in teacher preparation is the development of teachers' critical consciousness. In order to support students' development of critical consciousness, the teachers themselves must develop their own critical consciousness. The teachers in this study tended not to apply a critical lens to the issues raised in their classrooms. In terms of relevance of authentic purpose: they did not tend to select social justice issues for their students to address, nor did they bring a critical lens to the issue if it did pose an opportunity as an issue of social justice. Additionally, they tended to prioritize science knowledge over the cultural knowledge students offered, using the student resources in service of science learning, but ignoring the value of those resources. Finally, for some teachers, there was evidence that although they were committed to social justice, they still harbored some deficit thinking about the abilities of their students and the communities in which they lived. Helping the teachers to apply a critical lens would be productive in all of these areas.

By developing the teachers' own sense of critical consciousness, they would be better positioned to select social justice topics around which to frame investigations and lead their students in thinking critically about the historical, social, and political origins of those issues. It might also help the teachers to recognize that while science knowledge might ultimately be privileged in their classroom, it does not have to be exclusively this way, and that this is a construction of school that the teacher can actively resist in small ways in order to make her classroom more culturally relevant for her students. Finally, encouraging the teachers to strengthen their critical consciousness would help them to reflect on the assumptions they make about their students and the damage those deficit perspectives have the potential to do.

To help teachers' develop their own critical consciousness, I suggest structured discussions in which the teachers explore their own identities and cultural membership with their peers. While learning about the existence of sociocultural boundaries and the impact they can have on people's (particularly their students') lived experiences is important, it is equally important, however, for the teachers to analyze their own cultural and social membership and the relative privilege those may (or may not) afford. Through introspection about their own identities and experiences and taking a critical look at the inequalities faced by many in our society, teachers will be encouraged to develop a critical consciousness and will ultimately be better prepared to appreciate and work with students who may be socioculturally different from them (as was often the case in this study).

In the end, what we can learn from this study is that practicing CRP is possible for inexperienced teachers. While many of the predictable challenges threatened to block the

teachers from fully realizing their potential as culturally relevant pedagogues, they still made productive and meaningful moves in their conceptualizations and practice of CRP. As brand new teachers, these productive strides should not be overlooked, and both their successes and challenges can inform the field as to how to improve the preparation of culturally relevant teachers.

Appendix A

Interview Script: First Interview
(Semi-structured protocol)

[opening script]
"Thank you so much for taking the time to talk with me today. I want to ask you some questions to understand your thinking on what makes for good science teaching. There aren't any right or wrong answers, of course, I'm really just interested in what you think. As we go, I will probably ask you to explain things if I'm not sure I understand what you mean, or I might paraphrase something you say to be sure I understand. My aim is really to understand as clearly as I can what you think, ok? You can stop the conversation at any time, just let me know. It should take about 40 minutes or so. Do you have any questions for me before we start? [answer them.] OK! Let's begin."

1. Tell me what you think good science teaching looks like.
    a. [for each feature they mention of "good" teaching, try to unpack and/or ask for examples.]

2. How do you think about making science relevant to your students?
    a. Can you give me an example of a lesson or activity you've done that you think exemplifies your approach to relevance?

3. How do you think about cultural relevance with respect to science teaching?
    a. What do you think of about that word "culture" in culturally relevant pedagogy?
    b. Can you give me an example of a lesson or activity you've done that you see as culturally relevant?

4. What does culturally relevant pedagogy mean to you, with respect to science teaching?
    a. What are the sources of your thinking about cultural relevance (e.g., courses, personal experiences, teaching experiences)?
        i. [for each source they mention, ask them to clarify how it informs their idea of CRP].

5. What benefits, if any, do you see for students from culturally relevant science teaching?

6. What aspects of culturally relevant pedagogy do you think are particularly challenging or hard for your own science teaching?
    a. What makes [each aspect they list] particularly challenging?

7. What aspects of culturally relevant pedagogy do you think make, or could make, your science teaching easier?

    a. How does [each aspect they list] make your teaching easier?

8. What support do you think you, or teachers like you, need to take on culturally relevant science teaching?
    a. [for each thing they list]: how would that help?
    b. Who has been supportive of your effort to use CRP? How?
    c. Who would you like to be more supportive of your effort to use CRP? How?

9. Do you think science has its own culture? How would you describe it?

10. What do you think you need to know about your students to use culturally relevant pedagogy?

Appendix B

Interview Script: Second Interview
(semi-structured protocol)

Intro script: Congratulations on completing your first semester of teaching! That's a big accomplishment. I am going to ask you some questions about the semester you just finished and your ideas about Culturally Relevant Pedagogy and how you used it in your classroom. Please remember there are no right or wrong answers. If you didn't get to use CRP, I'd like to know why, and if you did I'd like to hear you reflect on the experience. Do you have any questions for me before we begin?

1. Could you list your top 3 or so goals for this first semester of teaching? (probe for explanation of each goal)
    a. Do you think Culturally Relevant Pedagogy fit with these goals? (probe for how it did or did not fit)

2. Think back for a moment on this semester, and reflect on your use of Culturally Relevant Pedagogy.
    a. If you tried to use it, can you please describe what you did? (probe for how they thought it went).
    b. If you didn't use it, why did you not? (probe for barriers to usage).
    c. (Asked if they indicated that they would have liked to do it better, more, etc.) What would help you to do it better or use it more?

3. Have your ideas about Culturally Relevant Pedagogy changed over the course of this semester, or since last year? How?

4. This is the description of Culturally Relevant Pedagogy that you came up with in your group during the Impact seminar. [*present description*]. Do you agree with it? Is there any way that you would amend it so that it better reflects your ideas about Culturally Relevant Pedagogy?

5. OK, so it sounds like you think about Culturally Relevant Pedagogy as being about [*summarize elements in participants' response to question 4*). Can you describe what strategies you would use to hit upon these elements?

6. Now choose any topic or student understanding you like and describe for me how you would use the strategies you just listed as part of the lesson plan.
    a. Would you use a lesson like this now that you've done this exercise? Why or why not?

7. How do you think about your own culture?

8. What does the phrase "social justice educator" mean to you?
    a. Do you identify with that description?

Appendix C

Interview Script: Lesson Debriefing

Thanks for having me today.

1. Please talk me through your thought process in planning this lesson.

2. What elements of culturally relevant science pedagogy, if any, were included in this lesson?

3. Were they planned for or did they happen organically?

4. How did you feel they went?

5. How did the students respond to (a) the lesson as a whole and (b) the CRSP elements?

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