

**A Case Study Analysis of Rural Middle School Science  
Teachers: The Perception of Culture to Inform Pedagogical  
Practices in the Classroom**

by

Rashida Esi Askia, M.Ed

A dissertation submitted to the Graduate Faculty of  
Auburn University  
in partial fulfillment of the  
requirements for the Degree of  
Doctor of Philosophy

Auburn, Alabama  
December 14, 2019

Keywords: culture, science education, pedagogical practices,  
teacher perceptions, culturally relevant pedagogy

Copyright 2019 by Rashida Esi Askia

Approved by

Joni M. Lakin, Chair, Associate Professor, Educational  
Foundations, Leadership and Technology  
Ivan E. Watts, Co-chair, Associate Professor, Educational  
Foundations, Leadership and Technology  
Carey E. Andrzejewski, Associate Professor, Educational  
Foundations, Leadership and Technology  
Hannah C. Baggett, Assistant Professor, Educational Foundations,  
Leadership and Technology

## Abstract

Since the early 1980's, a push for equitable learning practices has resulted in the creation of culturally centered pedagogy to counter educational disparities targeting marginalized populations across disciplines—particularly within the Black/African American community. More recently, scholarship centering on race in science education, language and culture integration in science, and justice-centered science pedagogy have been examined and utilized to address the achievement and opportunity gaps in science across racial/ethnic groups (Larkin, Maloney, & Perry-Ryder, 2016; Lee & Luykx, 2007; Lynn, 2006; Morales-Doyle, 2017; Nasir & Hand, 2006; Underwood & Mensah, 2018). With the steady rise in cultural diversity within the current demographics of the American school system, issues surrounding equity-based instruction illuminate the need for learning environments to enact practices that are inclusive, culturally relevant, and understood by teachers across multiple disciplines (Brown, Boda, Lemmi, & Monroe, 2019; Goldenberg, 2014; Johnson, 2010; Milner, 2014). Within this qualitative case study, attention is given to teacher epistemology of culture and how one's understanding of the concept informs and guides one's pedagogical practices in middle school science classrooms. Teachers within this multisite case study reflect on their use of cultural referents, also noted as “real world connections,” to meet the academic needs of their students.

Drawing from the theory of culturally relevant pedagogy, Gloria Ladson-Billings (1992, 2009, 2010, 2014) positions learning at the helm of cultural and social connectedness to reduce the gaps in achievement which persist among Black students and their peers. Although an abundance of scholarship surrounds teacher understanding and use of culturally relevant practices across disciplines (Aronson & Laughter, 2016; Boutte, Kelly-Jackson, & Johnson,

2010; Johnson, 2010; Morrison, Robbins, & Rose, 2008; Underwood & Mensah, 2018), a dearth of research exists, specifically examining teachers' understanding of culture to aide in their successful enactment of culturally inclusive and relevant pedagogy in the science classroom.

This qualitative multisite case study examined how teacher epistemology of culture guided their pedagogical practice in middle school science classrooms. Gathering empirical data from interviews, classroom observations, transcripts and document analysis, presented opportunities to gain insight into how teachers perceive and utilize cultural components in the science classroom. The sample of participants included 6th-, 7th-, and 8th-grade teachers who taught life, earth, physical science, or a combination of the three science areas. Research suggests that for teachers to employ instruction from a cultural lens, some knowledge and understanding of how culture is defined and interpreted is warranted to avoid a cultural mismatch (Gay, 2000; Howard, 2017; Siwatu & Poloydore, 2010; Stephens, Townsend, Markus, & Phillips, 2012). Findings from this study showed cultural understandings coupled with various pedagogical approaches were used by middle school science teachers to bridge student understanding in science. From a stance embedded in community-based associations, student social and academic needs, and an array of worldviews, teachers chose specific components within culture to address science content. Within this study, the following became evident: for teachers to understand how to enact culture in science education, it was necessary for teachers to understand culture and how science fit into the lives of their students. Scholarship supports the notion that science and culture are not static; learning is shaped by our experience and interactions.

## Acknowledgments

I would like to acknowledge Dr. Joni M. Lakin, my dissertation chair, a person who has supported me through every hurdle, conference proposal submission and presentation. I thank her for her guidance and support throughout my journey, and for her continuous encouragement during my time at Auburn University. She, like my co-chair, Dr. Ivan E. Watts and my committee members, Drs. Andrzejewski and Baggett, each challenged me in many ways throughout my program to dig deeper and to take ownership of my own learning. I am grateful and appreciative of the members of my committee for your words of wisdom, encouragement and guidance. Thank you to my immediate and extended family members, friends, colleagues, and editor, Dr. Engrid Roy who made this dream a reality as well.

My experience as a classroom teacher sparked the desire to pursue a doctorate degree. It became the struggles and successes in the classroom that motivated me to seek more information to become a more informed teacher, leader, role model, and advocate for my students. My work is dedicated to all my former students who have inspired me along the way. I encourage others who are currently weighing the option to pursue an advanced degree to enhance the educational practices in K-12—take the leap of faith. After 11 years in the classroom as an elementary and middle school teacher, I decided to focus on completing my degree. And although my journey was difficult, I am happy I stayed the course and completed my program of study.

## Table of Contents

Abstract .....	ii
Acknowledgments.....	iv
List of Tables .....	vii
Researcher Positionality.....	viii
CHAPTER 1 .....	1
Science Education .....	3
Disparities in Education .....	5
Culturally Relevant Pedagogy .....	7
Race & the (Mis) Education of African American Youth.....	7
Problem Statement .....	8
Purpose of Study .....	9
Research Questions .....	11
Definition of Terms .....	11
Summary .....	12
CHAPTER 2 .....	13
Conceptual and Theoretical Framework .....	14
Disparities in Education .....	15
Challenges to Science Education in K-12 Environments .....	18
The Role of the Teacher in Addressing Culture .....	27
Culturally Relevant Pedagogy .....	30
Summary .....	36
CHAPTER 3 .....	37
Case Study .....	38
Ethical Considerations .....	41
Participants .....	44
Data Collection .....	46
Data Analysis .....	50

Credibility of Study .....	52
Transferability .....	52
Part One of Study .....	53
Summary .....	55
CHAPTER 4 .....	56
Extending Part 1 of Study .....	58
Participant Biographies .....	59
Themes & Teacher Attributes .....	65
Teachers' Understanding of Culture in the Classroom .....	67
Themes: Teacher Pedagogical Practices .....	71
Theme One: The Role of the Teacher is Believing in Students .....	72
Theme Two: Skills First. Mastery Second: Creating Opportunities for Students .....	74
Theme Three: There is No "I" in Team: We All Have a Role to Play .....	73
Theme Four: Lights. Camera. Action: Know Your Students .....	77
Learning Tasks & Directives .....	78
Cross Case Analysis .....	80
Addressing the Research Questions .....	88
CHAPTER 5 .....	89
Reconnecting Part 1 of Study .....	90
Approaches to Learning .....	91
Embracing Culture .....	92
Addressing the Research Questions .....	93
Discussion .....	103
Limitations .....	107
Implications for Future Research .....	108
My Journey .....	109
Summary .....	112
References .....	114
Diagram 1: .....	57
Appendix 1: Teacher Consent Form .....	146

## List of Tables

Table 1: Teacher Participants .....	46
Table 2: Categories & Questions Guiding In-Depth Interviews .....	48
Table 3: Classroom Observations Hours .....	50
Table 4: Teaching Demographics .....	60
Table 5: Themes .....	66
Table 6: Learning Tasks: Frequency of Teacher Directives during Observations .....	79
Table 7: Themes .....	91
Table 8: Teacher Participants' Definitions of Culture .....	93

## **Researcher's Positionality**

The conceptualization of the research process begins with the researcher and their perspectives of the world. My research interests and research paradigm for this study are rooted within a relativist-constructivist perspective. A paradigm is explained as a “set of beliefs that represent a worldview that defines, for its holder, the nature of the ‘world,’ the individual’s place in it, and the range of possible relationships” (Lincoln & Guba, 1994, p. 107). As a relativist-constructivist, I believe that people learn and evolve in the world as a result of their interactions, associations, and experiences with others—providing multiple perspectives and many truths associated with how people learn and how people are taught. By definition, “with multiple interpretations of experiences come multiple realities—there are as many different realities as there are people...to understand the subjective experience of reality and multiple truths” (Levers, 2013, p.2), relativism in social research leaves room for interpretation of one’s experiences. Learning about others positions researchers like myself to create environments that others can learn from, but also grow from. With regard to this study, I explore the experiences of teachers and their epistemology of culture to understand how everyday examples are enacted to enhance student knowledge in science.

My ontological perspective as a relativist supports my perception about reality, how people learn, and that multiple realities exist—shaped by meaning, context, and experiences. Due to my position about reality, my epistemology is rooted in a notion that knowledge is obtained through an emic approach—using observations and interviews to interact with people to gain a much-needed understanding of various perspectives. Lastly, my methodological framework informs the rationale of my study and how the data I uncover is analyzed. Using a qualitative approach to research, I conducted a case study to analyze data detailing an individual’s



disposition about a concept. For the sake of this study, employing a case study approach was the best approach to view how middle school science teachers participating in a STEM grant located in a rural region of a southern state utilize *culture* to inform pedagogical practices in science. The benefit of understanding the pedagogical practices and experiences of teachers are key elements within this study; the ability to enhance teacher practices in the classroom have proven to benefit student understanding and further provide examples of how cultural dimensions are implemented within science education in a middle school setting.

My own experiences as a teacher and working with teachers in various capacities influenced my reasons for conducting this qualitative multisite case study. Early in my career, I did not plan to become a teacher. As an undergraduate student, I studied computer science, psychology, and education in preparation to create purposeful and engaging educational video games for kids in grades Kindergarten through eighth grade (K-8). After a summer internship at a Department of Energy (DOE) funded research laboratory, I discovered that my talents would be better utilized in the classroom. My experience as a teacher came with many challenges. My understanding of ‘who’ I was teaching, or ‘what’ I needed to teach did not mirror what my teacher education program taught me. My experience as a P-8 educator resulted in self-reflection and research to understand how teachers—provisionally licensed, in-service, and/or pre-service teachers—pull back the layers of their students, the curriculum, and pedagogy to educate diverse student populations from a cultural lens. Even in my own practices, I felt culturally detached from my students. I thought the best way to meet their needs was to change who I was as a person to be accepted as their teacher. However, I soon learned that this instructional approach was not what my students needed or required. Being able to relate to another person does not require that a person change their identity to be accepted or

understood—it requires a sense of cultural awareness and knowledge that accepts people for who they are, and uses that knowledge to enhance instruction and the lives of others. Noted by scholar Asa Hilliard (2000), “we must acknowledge that there are many cultures in the world...the problem/opportunity for schools is how we take the diversity that exists and create an environment of harmony rather than an environment of chaos” (p. 245). We need to remain aware of the dynamics that shape and influence education in order to become the agents of change that earnestly seek to make a difference in this world.

## **CHAPTER 1: INTRODUCTION**

Whether one teaches science, math, or social studies, both teaching and learning are rooted in cultural associations. Making connections through familiar and/or similar experiences is cultural. Storytelling, an artistic form of expression, is understood through a cultural lens (Boutte & Hill, 2006). A climate that stimulates the mind to comprehend, analyze, evaluate, and synthesize information must be created from a cultural perspective. Teaching from a sociocultural perspective becomes the format that sets a path for lifelong learning (Aronson & Laughter, 2015; Gay, 2000) and establishes classrooms as a “community of learners” (Ladson-Billings, 1995a, p. 480). From this perspective, educational structures embed cultural markers and concepts such as culture, equity, race and social justice into learning environments are likely to create an atmosphere that embraces differences, fights oppression, and hones in on assets-based instruction (Aronson & Laughter, 2016; Brown & Crippen, 2016; Hilliard, 2000; Howard, 2010; Ladson-Billings, 1995a).

The explorative meaning of culture and its cultural markers in kindergarten through 12th-grade (K–12) education are not new challenges or emerging topics in academia. In the late 1970s and into the 1980s and 1990s, scholars examined the essence of culture, race, and pedagogy to counter the narratives within education to enhance instructional processes and student achievement for historically marginalized populations (Banks, 1977,1988; Gay, 1994; Irvine, 1989; Ladson-Billings, 1995, 1999). Concepts such as race and culture are often referenced as "homogenous, bounded, or unitary," (Chokr, 2006, p. 1) and are notably referenced as a singular component linked to specific group of people—particularly minorities or people of color. The often-made misconception about race and culture is that these concepts are exclusive to specific

communities. Historically, race and culture have been constructs within society that highlight what's wrong with African American learners and not what's good with them (Boutte & Hill, 2006; Ladson-Billings, 1995). Ladson-Billings' theory of culturally relevant pedagogy is garnered on the premise of wanting to cease the narrative of "what is wrong" with Black children, but highlight, support, and praise "what is right" with Black children. Scholarship by Marva Collins (1982) and more recently Ladson-Billings (1992, 1995, 2014) have shown the social capital of the Black child is what makes their experiences and associations in the classroom unique and their contributions to the learning environment purposeful (Howard & Reynolds, 2008; Milner, 2006; Yosso, 2005).

Due to many assumptions of the nature of culture within societal structures, culture has, unfortunately been oversimplified to pictures, token symbols of individuals within a community, catchphrases, and food demonstrations (Easton-Brooks, 2017; Sleeter, 2011). Sleeter (2011) explained the essence of cultural relevance from the perspective of others is more than "cultural celebrations, trivialization [of one's culture], essentializing culture, and substituting cultural for political analysis of inequities" (p. 12). To trivialize one's culture, existence, and value, is to "ignore [the] issues of power and equity" (Sleeter, 2011, p. 12), preventing cross-cultural communication to provide meaningful and purposeful instruction for marginalized populations (Ngo, 2010; Sleeter, 2011). Dismissing how culture becomes an extension of one's identity omits how cultural associations (i.e., language, customs/traditions, race) can be used to marginalize people of color, rather than seen as a component to engage and enhance one's learning.

Culturally centered practices in education have taken on many identities to advance the work of cultural diversity and race-based instruction in K–12 settings. Scholarship supporting multicultural education (Banks, 2016), culturally relevant pedagogy (Ladson-Billings, 2014),

culturally responsive teaching (Gay, 2011), reality pedagogy (Emdin, 2011), and culturally sustaining pedagogy (Paris, 2012) have positioned culture, relationships, and dispositions at the core of quality education over rote memorization and standardized instruction. Each of the aforementioned frameworks have noted the enactment of cultural knowledge as a central component to enhancing content instruction. In other words, the essence of cultural representations and understanding of culture has refocused the public-school system's role in educating minority populations that have been socially and historically overlooked (Boutte & Hill, 2006; Ladson-Billings, 21992; Milner, 2010; Sampson & Garrison-Wade, 2010; Tate, 2001).

For culture to have such a profound influence on how we live, what we experience, and how information is perceived, it becomes imperative for teachers to adopt practices that bridge student understanding from a cultural lens (Gay, 2000; Hollins, 2011; Howard, 2003). To deny this component in everyday instructional practices further marginalizes students of color and the persistent disparities that hinder student achievement (Quintana & Mahgoub, 2016).

### **Science Education**

Viewed as a cultural entity, science taught from a cultural lens positions student and teachers to see themselves and others within the content (Emdin, 2011; Sleeter, 2011). Adjapng and Emdin (2015) acknowledged that integrating culturally relevant approaches within science will help students "view themselves and a culture which they value as a part of the classroom, but also [encourage] independent self-education of science content" (p. 68). Building from the scholarship of Ladson-Billings (1992, 1994, 1995), the theory of culturally relevant pedagogy refers to cultural connections being used as content bridge builders within the curriculum to make what may appear to be barren seem stimulating and engaging.

Science, as well as other disciplines, can enlighten learners' senses when practices are enacted that encourage students to think, debate, challenge the status quo, and voice their perspectives (Codrington, 2014; Emdin, 2010; Ladson-Billings, 2000). Historically, within science education, science teachers in K–12 settings have used standardized or traditional instructional (i.e., one size fits all educational motto) practices to engage students in the classroom (Korkmaz, Thomas, Tatar, & Altunay, 2017; Odom & Bell, 2014). However, the approaches used by educators to engage learners in STEM (science, technology, engineering, and mathematics) have not been effective for all culturally and linguistically diverse learners. Traditional practices are considered Westernized or Eurocentric practices used to teach students (Boutte & Hill, 2006; Lee & Luykx, 2007)). Research posits that traditional methods of instruction and approaches are no longer sufficient to engage all learners in science.

Ladson-Billings (1995) coined an instructional process—culturally relevant pedagogy—that she found enables teachers to capitalize on the experiences of their students, world perspectives—using the unique characteristics and subtleties of both teachers and students to enhance learning and student engagement within the classroom environment. Ladson-Billings has noted the importance of students being supported in school and being able to see themselves as “agents of change”—advocates within their own community. She established that successful teachers of African American students instill a sense of self, love, appreciation, and integrity within instruction that is often absent from classroom instruction. Unlike culturally centered pedagogical practices, traditional teaching methods can often exclude culture and lived experiences from the curriculum, particularly the experiences of Black children (Gay, 1975; Ladson-Billings, 1995; Jordan-Irvine, 1990; Howard, 2003; Young, 2010).

As evident in the literature (Adajong & Emdin, 2015; Emdin, 2011; Ladson-Billings, 2014; Mensah, 2014), culture cannot be disassociated from learning nor can the notion of culture and its importance be disguised and reduced to food, fun, fashion, and folklore (Banks & Banks, 2004; Sleeter, 2011; Young, 2010). Thus, the American education system's failure to recognize the ways that culture and experience construct students' knowledge across disciplines can impede a student's learning (Ginsberg & Wlodkowski, 2007).

### **Disparities in Education**

According to the American Psychological Association (APA) Task Force (2012), a disparity refers to "unjust or unfair differences" (p. 11). There are three distinct causes of the disparities that marginalized populations face in attaining an education: (a) biased treatment based on ethnic or racial identity, (b) confounding differences in social class and status, and (c) varying responses to the educational needs of racial and ethnic groups (APA Task Force, 2012). While not all *differences* in education are considered *deficits*, understanding how some educational practices can impact student outcomes across racial and ethnic groups should be seen as actions that can perpetuate negative narratives--creating and sustaining *disparities in the classroom*. Research (APA, 2012; Aud et al., 2010) asserts that dismissive instructional practices can perpetuate the persistent inequalities that impact educational attainment across various student groups.

Historically, disparities in education have been, and still are, inherently present and divisive among ethnic groups and class systems in the United States (Banks, 2016; DuBois, 1995; Woodson, 1919). Although court rulings, such as *Brown v. Board of Education* in 1954, have illuminated the unequal learning opportunities provided to African Americans, systemic and oppressive pedagogical approaches across content areas—particularly in science education--

exist and persistently impact the relevance, rigor, and quality of education of African Americans (Morales-Doyle, 2017; Quinn & Cooc, 2015; Tate, 2001).

Since the 1980s, scholars have addressed the opportunity gaps between Whites and African American students by offering solutions rooted in cultural awareness (Au & Jordan, 1982; Banks, 1977; Emdin, 2011; Jordan, 1985; Ladson-Billings, 1992). Instructional practices immersed in cultural knowledge have been introduced as a viable solution to eradicate the divisive practices that bind instruction to a one-size-fits-all model.

Current studies from the National Assessment of Educational Progress (NAEP) address the academic achievement levels of students from different ethnic groups and portray a dismal reality of African American student achievement. NAEP assessments, while valid to establish student progress using standardized measures, it however, does not assess student growth and understanding from a culturally adaptive lens. Across content areas, particularly in science, African American students have performed at a deficit—a 20 to 30% achievement gap—compared to their peers from other ethnic groups (NAEP, 2009, 2013, 2017). The National Center for Education Statistics (NCES) notes that by the year 2026, public school systems will see higher numbers of African American, Hispanic, Asian/Pacific Islander, and multiracial students in elementary and secondary schools, calling for instructional approaches that allow variations of race to become integrated into school lessons (Hussar & Bailey, 2018).

Thus, utilizing the CRP framework provides a viable solution to re-center children and what they know into the learning process. The underlying notion of creating culturally relevant science curriculum is to position students to see the value of science while simultaneously helping students recognize the ways that science is and will remain a part of their lives. The CRP



framework reframes the delivery of science content in addition to changing the narrative that science communities have many correlations with race, ethnicity, and culture.

### **Culturally Relevant Pedagogy**

Culturally relevant pedagogy (CRP) is posited as a practical and fair way to improve teachers' educational practices. It empowers students through self-appreciation and validates one's skills (Ladson-Billings, 1994). According to Jordan-Irvine (2009), CRP

“builds on the premise that learning may differ across cultures and teachers can enhance students' success by acquiring knowledge of their cultural backgrounds and translating this knowledge into instructional practice...maximizing student learning...and acting as a form of effective teaching in culturally diverse classrooms" (p. 3).

Stemming from a constructivist lens and an extension of multicultural education, CRP uses the environment, the community, and the students as parts of the learning process.

Operating under three foundational tenets, culturally relevant pedagogy (1) values student abilities—seen and unseen (i.e., academic success), (2) cultivates cultural competence and integrity (i.e., cultural competence), and (3) exposes students to a world outside of their purview (i.e., sociopolitical consciousness) to maximize learning (Ladson-Billings, 1992, 1995, 2009).

### **Race and the (Mis) Education of African Americans**

To understand and acknowledge why the concept of culture and cultural competence are necessary for teachers and students to grasp, is to further understand the social and historical implications of how race and culture overlap in educational settings. Race, as is culture, have become central components to the achievement of African American students in core areas such as math and science. It becomes difficult to engage in conversation about cultural relevancy without acknowledging the importance of race within education. Historically, race has been used

to measure aptitude success; using racial differences as a way to hinder the success of African Americans in a male and/or white dominated profession(s) (Ash & Wiggan, 2018; DuBois, 1920; Lee & Buxton, 2008; Martel, 2018; Wynter-Hoyte, Braden, Rodriguez, & Thornton, 2019; Tate, 2001). Although race is a social construct, race has been persistent in its association with dropout rates, special education referrals, and stagnant educational successes—all of which have targeted and have negatively impacted African American students (Anastasiou & Keller, 2014; Artiles & Trent, 1994; Ash & Wiggan, 2018; Au, Fox, Kewal-Romani, 2010; Barton-Vasquez, 2018; Harry & Klinger, 2014). With an overwhelming representation of White female teachers in K-12 settings and an overwhelming percentage of students in K-12 settings being of minority backgrounds (NCES 2015), questions have risen to the efforts made to effectively teach minority students. The cultural mismatch between teachers and students has promoted the resistance and evasion of race and other concepts that continue to marginalize African Americans (Annamma, Connor, & Ferri, 2013). The underrepresentation of minorities in STEM professions also question the efforts to change that narrative (Atwater et al., 2013)—which warrants a closer look into the understanding and use of cultural dimensions in science education and in spaces that have historically experienced inequities in education.

### **Problem Statement**

On a national level, African American students are performing lower than students from all other ethnic groups (Educational Testing Service, 2016; NCES, 2015; NAEP, 2017). To improve science education and narrow the achievement gaps between students from varying racial and ethnic populations, content must be centrally immersed within the cultures to which students feel connected, particularly for students who identify as African American (Atwater et al., 2013; Emdin, 2011, Parson, 2005; Mensah, 2013). Research as shown the significant changes

in the learning environment when African Americans are disengaged in the learning process and fail to see themselves or versions of self reflected within the content being studied (Atwater et al., 2013; Emdin, 2011).

The United States Census (2019) notes that African Americans hold less than 7% of the STEM jobs in the United States. While there are many reasons for this, at the macro level, this statistic is said to reflect the lack of exposure and student engagement that takes place in the classroom during a student's elementary, middle, and high school years (Byars-Winston, 2013; Carlane & Johnson, 2007; Stiles, 2016). As a result, disengaged and disinterested students in science are leading to disengaged and disinterested adults in science (Christensen & Knezek, 2017; Stiles, 2016). To combat this narrative in science, teachers must take an approach in which they address their students' cultural and linguistic differences (Atwater et al, 2013; Parson, 2005; Stiles, 2016)

### **Purpose of the Study**

For nearly four decades, CRP practices have presented multiple pathways for prospective and practicing teachers to meet the needs of culturally diverse populations. In the last decade, several researchers (Aronson & Laughner, 2015; Esposito & Swain, 2009; Patton, 2011) have illuminated school systems and teachers employing variations of culturally centered practices across disciplines. Preparing teachers to become culturally relevant and adopt practices within the CRP framework has been noted as a possible approach to narrowing achievement gaps (Ladson-Billings, 1992a, 1994, 2009, 2014) across disciplines in urban settings (Aronson & Laughner, 2016; Boutte & Hill, 2006; Brown et al., 2019; Esposito & Swain, 2009; Goldenberg, 2014; Milner, 2010; Morales-Doyle, 2017; Morrison et al., 2008; Tate, 2001), however, a more in-depth qualitative analysis is required to understand the “funds of knowledge” teachers in rural

settings take into their classrooms that will offer a glimpse into practices that are aligned with the CRP and highlight teacher understanding of culture (Jackson & Boutte, 2018; Moll, Amanti, Neff & Gonzalez, 1992; Monzo & Rueda 2003; White & Reid, 2008). A deeper understanding of teachers' knowledge and awareness of culture and the ways culture is visible in the classroom can help practitioners and researchers understand the components of CRP that are effective in rural middle-school science classrooms as well.

Framing the ways that teachers conceptualize and contextualize culturally relevant practices is becoming a focal point within science. While (1) the obstacles that teachers encounter while trying to understand and implement CRP across disciplines have been examined before and (2) incremental progress with integrating one or more CRP premise has been documented (Aronson & Laughner, 2015; Esposito & Swain, 2009), there is an absence in the literature explicitly addressing teachers' understanding of culture to further support a teacher's ability to successfully implement the CRP framework in K–12 settings. Exploring what teachers understand about culture and how prior experiences inform their instructional practices can substantiate specific struggles and successes teachers encounter when attempting to enact culturally centered education models in science. The current study is an extension of a pilot study examining teachers' understanding and use of inquiry-based pedagogical practices and the 5Es to engage students in the learning process. Noting “real-world” connections and examples as a means to bridge student understanding in science, teachers chosen for this study provided details during pilot study interviews that described their epistemology of culture. However, the misalignment of education theory and science practices in part one of the study yielded further examination of teachers' perceptions and utilization of “real-world” and cultural frameworks to engage and enhance student performance in science.

## Research Questions

The following research questions guided the current study:

- (1) How do middle school science teachers define culture?
- (2) How does teacher definition of culture manifest in science instruction in the middle school classroom?
- (3) What evidence of culturally relevant practices are observed in a sample of teachers selected for high potential for enacting culturally relevant pedagogy (CRP)?

## Definition of Terms

The following terms and their definitions will be used throughout the current study.

*African American/Black American:* A term used interchangeably to reference an American of African ancestry.

*Culture:* The integrated pattern of shared values, beliefs, languages, worldviews, behaviors, artifacts, knowledge, and social and political relationships of a group of people in a particular place or time that people use to understand or make meaning of their world, each other, and other groups of people (Atwater, Lance, Woodard, & Hillsman, 2013).

*Culturally relevant pedagogy:* A type of instruction used to develop critical consciousness of students and others through which teachers position students to develop and sustain cultural competence, challenge the status quo, and maintain academic success (Ladson-Billings, 1992); abbreviated throughout as CRP.

*Disparity:* An unfair or unjust practice that differs between race, gender, ethnicity, or social group (APA Task Force, 2012).

*Race*: A social construct that has historically marginalized minority populations and used to identify people of color as “different” creating a “social distance between different racial groups” (Quintana, 2007).

*STEM Education*: Interrelated subjects--science, technology, engineering and mathematics—used to co-construct knowledge and create environments in which students can investigate and find solutions to varying problems (Kenner, 2014)

### **Summary**

African American students, just like all other students, deserve fair chances and the same educational opportunities often afforded to White American and Asian American student populations. Students being denied access to equitable education options due to external factors such as a lack of cultural awareness or societal influences can hinder student progress and educational attainment across disciplines, but also have the ability persists the disparities that negatively impact people of color (Gay & Howard, 2000; Irvine, 2003; Ladson-Billings, 2014; Sleeter, 2011). Teachers take on many roles that place them at the forefront of enacting change in the classroom. Therefore, becoming and remaining culturally competent (e.g., understanding the nuances of culture) is an advantage for any teacher at any grade level or within any discipline to have (Gay, 2013; Ladson-Billings, 1992, 1994, 2009, 2014). Making *culture* a part of the everyday classroom conversations that take place in school settings, positions the CRP framework as guide, not a universal checklist (Cochran-Smith, 1995). Here in Chapter 1, a brief look at the disparities and gaps that exist in education was presented as well as the introduction of CRP as a viable solution to narrow this gap.

## CHAPTER 2: LITERATURE REVIEW

This chapter provides an overview of previous scholarship examining culturally relevant pedagogy (CRP) across disciplines, particularly within science. Over the past four decades, a multitude of studies in education have documented the inception of CRP and other culturally centered practices in K–12 learning environments. Many researchers have focused on the culturally relevant practices of teachers in urban settings, special education, literacy, and evaluation processes (Aronson & Laughler, 2015; Au & Jordan, 1981; Borrero et al., 2016; Botcheva et al., 2009; Brown & Cooper, 2011; Esposito & Swain, 2009; Morrison et al., 2008) and self-reporting measures of cultural competency among principals, teachers, school counselors, and other education personnel (Nelson et al., 2008).

The purpose of the current study is to explore how middle school science teachers define and use *culture* to inform their pedagogical practices. As a bridge builder toward students' interest, knowledge, and success, CRP is an introduction toward understanding and enacting specific practices (i.e., academic success for all students, cultural competence of self and others, sociopolitical consciousness, inquiry-based instruction) across disciplines. Early efforts toward cultural competence cannot be employed if an understanding of “culture” is not met. Sleeter (2012) and Ladson-Billings (2014) have called for more comprehensive, yet explicit example(s) of teachers' relationship with CRP and how it is being integrated across disciplines.

The field of education consists of two main components: teaching and pedagogy. Teaching “seeks to influence competency and methods, describing what a teacher should be doing in the classroom to be culturally responsive” (Aronson & Laughler, 2015, p. 4). Pedagogy “seeks to influence attitudes, describing a posture a teacher might adopt that when fully embodied, would determine planning, instruction, and assessment” (Aronson & Laughler, 2015,

p. 5). Understanding how teachers perceive culture from their lens to support student learning in the science classrooms can become the first step to supporting how teachers enact culturally relevant instruction science. Understanding a concept such as culture, a concept that plays such a significant role in instructional practices, cannot be overlooked. To dismiss the relevance culture espouses within science disregards the connection science has to the community for many learners and society as a whole (Brown et al., 2019; Emdin, 2009; Sleeter, 2012; Sleeter & Grant, 1988; Villegas, 1988).

### **Conceptual and Theoretical Framework**

Using the conceptual and theoretical framework of culturally relevant pedagogy (CRP) (Ladson-Billings, 1995a, 2001, 2011, 2014) the current study explores the intersection between culture (i.e., cultural knowledge), teaching practices and beliefs, science content, and the experiences of middle school science teachers in a rural southeastern state. My ontology as a relativist positions elements of constructivism—knowledge construction through interactions and experiences—in alignment with how I see the world and how meaning is constructed--through social interactions; interactions that shape a persons’ understanding of the world. From a qualitative lens, studies that examine teacher perceptions aim to address the “how” and the “why” of ones’ practice. Considering this, the examination of culture and teaching practices in three science classes (i.e., Earth and Space Science, Life Science, Physical Science), culturally relevant pedagogy is appropriate to examine student learning and how academic success, cultural competence, and sociopolitical consciousness are supported through cultural dimensions in science. According to Ladson-Billings (1995a, 2009), to examine the “what” of teaching, is to believe that student learning is supported with teaching practices that are relevant and purposeful.



Culturally relevant pedagogy (CRP) has positioned culture, student learning, cultural competence, and sociopolitical consciousness at the core of how people learn and transform within an environment. The CRP framework postulates that good teaching is not an anomaly or a step-by-step process used to achieve success among African American students (Ladson-Billings, 1992). The CRP framework is more of a heuristic tool—a combination of techniques—that offers insight into common practices used by effective teachers (Ladson-Billings, 2009) from a cultural and social perspective. As an interpretive framework, culturally relevant pedagogy mimics a constructivist learning environment—providing meaning and insight into an experience from a personally informed and subjective lens (Merriam & Tisdale, 2016; Vygotsky, 1934, 1978). Holistically, frameworks providing insight into the experiences and practices of middle school science teachers are used to combat disparities in the classroom.

### **Disparities in Education**

The American Psychological Association (APA) Task Force on educational disparities (2012) concludes that a disparity is an "unjust or unfair differences" (p. 11). Educational disparities can surface in ways that do not directly reference students' race, ethnicity, or socioeconomic status. For example, an increase in teacher-to-student ratios can be viewed as an "unjust or unfair difference" between schools with large class sizes versus those with smaller class sizes. This known disparity in many urban and rural class settings can inadvertently impact the quality of teaching and support students receive (Anastasiou & Keller, 2014) which also impact achievement gaps.

Achievement gaps between minority students and their White counterparts continue to persist in education, particularly those students who identify as Black or African American (National Assessment of Educational Progress [NAEP], 2017; National Center for Educational

Statistics [NCES], 2015; Educational Testing Service [ETS], 2016). The widening achievement and performance gap span across disciplines, grade levels, and minority groups, becoming one of many concerns surrounding the American education system today and how African Americans are being taught. (Baker, Farrie, & Sciarra, 2016; Barton & Coley, 2010; Milner, 2014; Skiba, Chung, Trachok, Baker, Sheya, & Huges, 2014). The persistent achievement and opportunity gaps are an unfortunate result of systemic educational barriers that have become overwhelmingly prevalent in urban and rural settings (Guerrero, Shahnazarian, & Brown, 2017; Ladson-Billings, 1995). Although support systems to strengthen teaching methodologies, such as culturally centered practices, have been examined, teachers of both nonminority and minority students can perpetuate educational disparities in K–12 settings by lacking the skills and cultural knowledge needed to effectively teach students from marginalized backgrounds (Milner, 2014; Sleeter, 2011).

According to Au, Fox, and Kewal-Ramani (2010), minority populations have increased in schools systems nationwide, yet progress within these groups, specifically amongst African Americans, lag behind that of all other minority populations and their white counterparts. Unlike the degree to which some ethnic and minority groups encounter obstacles in the classroom, African American students face obstacles and added disparities such as stereotype threat, distinct social capital markers, and inadequate resources that directly impact student achievement and academic progress (Baker-Doyle & Petchauer, 2015; Collins, 2009; Conley, 1999; Jones et al., 2016).

More specifically in science, recent reports documenting the stagnant increase of science test scores for African American students (Department of Education, 2011, 2015; NAEP, 2009, 2013, 2017; NCES, 2015) support the notion that students of color may need alternative

instructional methods to narrow the achievement gap between African American students and their White American, Asian, Native American, and Hispanic student counterparts. Prominent scholars in the field suggest providing students of color with ample opportunities to engage in meaningful and authentic scientific practices in their classroom will socially construct knowledge in a realistic, yet applicable scientific setting (Atwater et al., 2013; Barron & Hammond, 2008; Lakin & Wallace, 2015; Minner et al., 2009; Munce & Fraser, 2012; National Research Council, 2000).

As scholars in the field seek to alleviate educational disparities that impact access and opportunity for African American students, gaps in education continue to impact student achievement through disproportionate placement levels in special education, the lack of Advanced Placement (AP) courses, suspension rates, and a variety of disciplinary actions against African Americans and other student populations (Anastasiou & Keller, 2014; Artiles & Trent, 1994; Barton-Vasquez, 2018; Harry & Klinger, 2014).

The statistics outlining the disproportionate gaps between African American students and those from other ethnic groups are astounding. Au, Fox, and Kewal-Ramani (2010) report that African American students: (1) are at higher risks of being suspended from school in grades 6 through 12; (2) are retained in elementary and secondary school at higher rates; (3) have lower graduation rates as compared to students from all other ethnic groups; (4) have lower reading and math proficiency percentages; (5) are less likely to test into AP classes; and (6) have higher drop-out rates between ages 16 and 24 years (Aud et al., 2010). Statistics like these illuminate the inequalities many African American youth encounter—further supporting the need of instructional methods that seeks to close the gaps that academically and socially divide Black/African American learners from other ethnic groups.

From the 1970s to the present, various reports have detailed the disparities targeting poor and marginalized populations (APA Task Force, 2014; Education Next, 2016; Children's Defense Fund, 1975). Given the reality of persistent disparities in education (e.g., excessive disciplinary action, placement in special education, a lack of educational opportunities), inquiries question how prepared teachers are to effectively educate students from varying educational, ethnic, and cultural backgrounds. Defined as an "unjust or unfair differences" (APA Task Force, 2012, p. 11), disparities in the classroom or learning environment have resulted in three perspectives: (1) biased treatment based on ethnic or racial identity, (2) confounding differences in social class and status, and (3) varying quality in responses to the educational needs of racial and ethnic groups. For this study, focusing on the varying responses to address the educational needs of racial and ethnic groups are warranted.

Quintana and Mahgoub (2013) assert that disparities in education are partly due to the varying cultures and languages present in the classroom. Understanding how students of color respond to learning approaches is needed to accurately address and lessen the number of African American students being placed in special education. The danger in unnecessarily placing African American students in special education leads to biases and stereotypes that stigmatize African American youth and reinforces negative perceptions (Bryan, 2017; Milner, 2014).

Sullivan and Ball (2013) suggest that researchers must take a more in-depth look into the intersection of instruction, culture, history, educational attainment, and opportunity in the realities and lived experiences of students. This approach can more accurately identify students who require a more hands-on method to teaching and learning.

## **Challenges to Science Education in K–12 Environments**

### **Achievement Gaps in STEM and Science Education**

The widening achievement gaps in science between African American students and those from other ethnic groups are not new. In their annual report card, the NAEP (National Advancement of Education Progress) showed significant differences in students' science scores across grade levels and between ethnic groups (2017). The report exposed the widening achievement gap between African Americans/Blacks and their White, Asian, and Latino counterparts in science and in other disciplines. Additionally, other research has shown the underrepresentation and low science achievement levels of African American students vs. White students (Meyer & Crawford, 2011). The achievement gaps reported by the NAEP warrant a closer examination into the practices both hindering and promoting students' success in science.

To establish the need for cultural representation and cultural knowledge in science, the American Association for the Advancement of Science (2007, 2012, 2017) posits that “best practices” within science coursework foster an understanding of societal issues that impact science. The term “best practices” is primarily focused on altering instructional practices until they effectively meet the needs of the learner, ultimately shifting from teacher-led classrooms to student-centered classrooms (Zemelman, Daniels, & Hyde, 2012). Zemelman and colleagues noted best practices are beyond traditional methods of instruction, allowing learners to guide their own learning conduct their own modes inquiries and evaluate their academic progress (Zemelman et al., 2012). Culturally relevant educational practices frames learning to use cultural dimensions, home and school experiences, and society to shape ones' frame of reference.

Hollins (2015) echoes these sentiments by stating:

Although teachers are entering classrooms with a lack of experiential knowledge of students who are a part of different ethnic, racial, and socioeconomic demographics, the work of educating diverse populations must be addressed and fulfilled across the nation. Year after year, the work of classroom teachers gets compounded with the numbers of things that must be implemented in the classroom to be the needs of all learners. However difficult this process can become for some teachers, the ability to reach all students and

teach students is doable. "Paying attention" to the smallest of details about the cultural structures within communities that honor the cultural realities of the learner is important to the social, physical, emotional, and academic growth of the child. (p. 1)

Unfortunately, as the achievement gap continues to widen between White and Black/African American students in areas like math and science (NAEP, 2017; NCES, 2015), the decline in students' STEM participation has caused some to question how students will meet the global demand within science, technology, engineering and math (Henricksen, Jensen, & Sjaastad, 2014; Korkmaz, Thomas, Tatar, & Altunay, 2017; Murphy 2009; Wright, Standen, & Patel, 2010) if students fail to learn and engage in science.

### **Can Teachers Address Culture?**

In recent years, the term *culture* and culture-conscious approaches have been defined and referenced as a much needed addition to the curriculum across disciplines (Atwater et al., 2013; Emdin, 2011; Ladson-Billings, 2014; Nieto, 2017, Paris, 2012; Sleeter & Carmona, 2016).

Although understanding culture can become a complex task for people to grasp, Atwater et al. (2013) describe culture as a combination of

...shared values, beliefs, languages, worldviews, behaviors, artifacts, knowledge, and social and political relationships of a group of people in a particular place or time that people use to understand or make meaning of their world, each other, and other groups of people. (p. 7)

So although teachers *can* address culture, it is more important to determine whether or not they *will* address culture.

Many teachers are not taught to consider and integrate race, culture, diversity, or social justice frameworks into their lessons; therefore, they enter culturally diverse settings lacking the skills needed to augment their lessons as cultural demographics across the nation continue to shift (Ash & Wiggan, 2018; Potts & Schlichting, 2011; Quinn & Cooc, 2015; Sleeter, 2011). However, it is crucial that teachers remain cognizant of their students' culture and their own

worldviews and the ways the instructional approaches they choose can blend those perspectives for the students' good.

Hayes, Juarez, and Escoffery-Runnels (2014) extended the literature on culturally relevant pedagogy by exploring the pedagogical practices of two African American teachers. Both teachers, using their upbringing and cultural knowledge of others to bridge student understanding, saw it as their responsibility as educators to help Black males navigate an unjust system. One participant noted, "Oftentimes, I have to go into the classroom and do damage control. We have White female teachers who are afraid of [Black male students], and they look for an excuse to kick these brothas out of class" (Hayes et al., 2014, p. 7). This participant added that while teaching students history is important, mentorship is equally important in helping students move to the next level (Hayes et al., 2014), making such educational practices highly important. Increased awareness to save the "souls of kids" was evidenced (p.7) as teachers focused more on encouraging and supporting youth than on standardized testing. Teachers within the study conducted by Hayes, Juarez, and Escoffery-Runnels (2014) acknowledged that in order to teach culture, one must understand the essence of it first. Developing the skills needed to serve students from culturally diverse backgrounds is essential to becoming an effective teacher (Lucas & Villegas, 2011).

Ladson-Billings (1995) argues that teachers who support culturally relevant frameworks and who successfully teach African American students find ways to connect with students from backgrounds different from their own as opposed to waiting for instructions from someone else. Borrero, Flores, and de la Cruz (2016) found that building community relationships, being self aware of their viewpoints and the viewpoint of others, and understanding pedagogy were some of the tools that allowed new teachers to enact a CRP framework. In another study of preservice

and in-service teachers and their perspectives on CRP, teachers used “multiple perspectives and intersectionalities” that were authentic to students’ lived experiences to counter dominant narratives and avoid “essentializing” one’s culture (Borrero, Ziauddin, & Ahn, 2018). Scholars have found that essentializing culture can hinder student progress and inhibit discussions regarding race, hegemony, and power (Borrero et al., 2018; Gorski, 2016; Sleeter, 2011).

### **The Relevance of Culture in Science Education**

Meyer and Crawford (2011) suggest that science rooted in inquiry and coupled with "explicit guidance" may help frame science as a "cultural way of knowing and provide students with opportunities to negotiate understandings about science with their cultural perspective" (p. 20). A culturally relevant approach to science instruction can promote pedagogical practices that cater to students who have been historically and systemically underserved and misguided by implicit or confirmation biases (Staate, 2015). Meyer and Crawford (2011) found that using culturally relevant examples with young participants yielded a better sense of science comprehension.

The intent of understanding culture in science and its presence within the culturally relevant pedagogical framework is for teachers’ to be aware of nuances and complexities that aid in the acquisition of knowledge. To support students in the learning environment is to understand the cultures that shape one’s action, values, and belief systems also means addressing the socioeconomic and sociopolitical structures that impact people of color (Ladson-Billings, 2014).

From a cultural perspective, science, as well as other disciplines, can enlighten students’ senses when educators use practices that get students to think, debate, challenge the status quo, and voice their perspectives (Codrington, 2014; Ladson-Billings, 2000). Research exploring teachers’ beliefs and cultural understanding (Gay, 2010; Ngo, 2010; Sleeter, 2011) shows that



meaningful and purposeful learning occurs when students are engaged and invited to actively participate within the learning structure. Therefore, the possible impact of cultural frameworks on science should not be ignored.

Meyers and Crawford (2011) argued that learning can be both inclusive of science content and can accurately represent students' social and cultural developments. Scholars contend that while not losing the rigor associated with content mastery, culturally centered practices do not negatively impact the content or education students receive, but rather enhance their learning opportunities and engagement (Au & Jordan, 1981; Gay, 1995; Ladson-Billings, 1992; Mohatt & Erickson, 1981). As Meyers and Crawford (2011) stated, scholarship consistently shows that science-infused instructional practices provide “greater opportunities for establishing greater relevancy in learning experiences” (p. 20) and establishes basic science applications of building knowledge and cultivating curiosity by leading students to inference-making, data analysis, critical thinking, and reflective moments with peers (Atwater et al., 2013; Byee, 2014).

Boutte, Kell-Jackson, and Johnson (2010) examined teacher efforts to use culturally relevant pedagogy to support the learning of African American students in science. Wanting to increase students' critical thinking skills, the author gravitated to the CRP framework to help her students' learn about cells, DNA, and Integumentary systems. Using vocabulary words and personal references to develop analogies, students learning about cells found learning terminology with the lesson to be “less convoluted” and found success in science—which was a first for many students. This approach increased test scores by a minimum of 15%. Through “dialogic exchanges” students were able to use their experiences to create meaning during the cell activity. The use of culturally relevant practices to teach about cells granted an opportunity

to brainstorm others ways to bridge student understanding in science. Using “ethnoscience problems” like the investigation of prostate cancer among African American males to zinc aligned with premise three of the CRP framework—using sociopolitical connections—to teach about cells. Boutte, Kelly-Jackson, and Johnson (2010) noted:

“educators need to remain open to refining and transforming their thinking. Culturally relevant teaching is a continuous quest, not a destination....teachers engage in culturally relevant pedagogy not solely to reduce the “achievement gap” or as a trend, but because it is an ethical and educational imperative that all students be effectively taught in light of pervasive and persistent educational trends” (p. 15).

As noted by Povenmire-Kirk (2015) developing cultural competence is not a destination it is a journey. Ash and Wiggan (2018) noted in their research of culturally relevant science: to address the inequities that negatively impact the educational attainment of African Americans, there must be an on-going development of culturally centered practices that become immersed in everyday practices of the scholar.

The relevance of culture in science education disrupts the status -quo and sustains pedagogical practices that are affirming and informative (Larkin, Maloney, & Perry-Ryder, 2016; Wynter-Hoyte, Braden, Rodriguez, and Thornton, 2019). Teachers who adopted equitable practices “demonstrate a connectedness will all student and encourage [students] to learn collaboratively (Kelly-Jackson & Jackson, 2011, p. 209).

Science as a cultural entity requires that students and teachers explore science content from a cultural lens--making sense of familiar science concepts and procedures from a sociocultural perspective. Meyer and Crawford (2011) highlight science-based instruction coupled with “explicit cultural guidance” as a formula for enhancing science content knowledge among minority populations. Infusing culturally relevant approaches within science instruction

can promote pedagogical practices that cater to students who have been historically and systemically underserved (Staate, 2015).

Meyer and Crawford (2011) tasked 5th-grade bilingual students from various ethnic backgrounds and with varying degrees of English proficiency with fossil observation. The students identified and measured fossils and made inferences about their findings. The students were placed into small groups and discussed misconceptions about scientists, “what scientists do,” and how their actions in the classroom mirrored the stages scientists follow to render specific outcomes. As Meyer and Crawford (2011) found, providing students with examples of cultural relevance yielded better science comprehension.

In science education, cultural relevance when coupled with instructional practices that are suitable for culturally diverse populations, are effective among African American students (Lee, Buxton, Lewis, & Leroy, 2005)., Laughter and Adams (2012) studied the sociopolitical consciousness and critical analysis of teachers and students by examining the culturally relevant practices in an urban middle school science classroom. This study (Laughter & Adams, 2012) presented science in a multitude of ways that encouraged the students to speak out and made them more interested in science and social justice issues. However, this strategy did not seem to have the same effect on every student. The lack of student input and involvement during lessons limited student perception about science.

Mensah (2011) examined the practices of preservice teachers currently taking core science courses at a local institution. Pre-service teachers participating in this study were required to create a grade level appropriate science lesson. The chosen science topic was pollution. Due to the nature of the study and the setting of the school, participants relied on each other for guidance. Through collaboration, these teachers were able to plan effective lessons,

learn and implement various teaching strategies, and assess students accordingly. Employing culturally relevant practices in this methods course helped the teachers make informed decisions related to student progress and science achievement (Mensah, 2011). Developing science modules through a sociocultural lens provides insight into the work required to narrow the gap between failure and success within science education (Tytler, 2007). Thus, students' growth within any discipline is dependent on their teachers' knowledge, perceptions, and perspectives (American Association for the Advancement of Science, 2017; Mager-Nager, & Shachar, 2017; Zemelman, Daniels, & Hyde, 2012).

Inclusion for students can take many forms. In a study conducted by Boutte and Hill (2006), scholars examined African American communities and how inclusion and acceptance developed for African American students--particularly. Using Black culture as the basis for understanding culturally relevant teaching, cultural institutions such as the barbershop and the beauty salon were used to affirm students, to empower students, and to educate them about society, community wealth, and wisdom. The barbershop "is a place where [African American] talents, opinions, and skills are recognized and appreciated" (Boutte & Hill, p. 312). In the barbershop, Black men discuss life, its challenges, their successes, and their failures—and yet, they remain supported within that institution. Boutte and Hill (2006) found that lessons were learned through countless exchanges from patrons who frequent the gathering spot. The barbershop and its connection to the Black community were used as a conversation starter for the Black males in Mr. Hill's classroom. The lesson for his students was to understand the longevity and success of Black businesses like the barbershop in the community. Conducting interviews, administering questionnaires, and conducting observations students were able to make home-to-school connections by comparing the cultural institution with the school. Students worked

together to create presentations, shares stories, and support one another. Students were able to have a voice and share their thoughts while doing this research project. Students found their voice find, because for them, the barbershop didn't discriminate. This is an example of students using their voice and working together to achieve a goal (Gay, 2010). Building knowledge around the barbershop took a "knowledgeable other to spark a child's interest and get an idea in motion" (Gay, 2003, 2010), and in this case it was the teacher who studied the culture of the Black community and created a lesson that many valuable lessons.

### **The Role of the Teacher in Addressing Culture**

In the landmark study by Ladson-Billings (2009), teachers had an influential role in the success of Black children when placing students and their needs—social, cultural and academic—at the center of instruction. Ladson-Billings (2009) found that years of teaching experience did play a role in the teachers' success with Black students. However, when coupled with transformative displays of empathy and performance, teachers were able to support students' academic needs and increase student interest. Ladson-Billings also argued that successful teachers possessed three fundamental characteristics to bridge connections and increase student knowledge: (1) a genuine belief in student success across color lines; (2) culturally competent in relation to students, self, and others; and (3) consciousness of the sociopolitical elements that directly and indirectly impact people of color as well as others. In other words, teachers who have high student expectations, who are culturally aware of the ways race impacts identity and adaptation within society, who create platforms that challenge the social, economic, political, and cultural structures from a global and domestic perspective are at an advantage when attempting to reach students who have been neglected by the American education system (Milner, 2012, 2016). Referenced and reinforced as a form of "good teaching,"

Ladson-Billings' culturally relevant pedagogical (CRP) approach to instruction (1995) re-centers students' perspectives and their prior knowledge as vital components of student success and effective teaching. Unfortunately, teacher bias and/or a teachers' inability to form cultural connections contributes to the disparities seen, unseen, and overlooked within education (Milner, 2012).

### **(Mis)Informed Notions of Culture: Deflect, Blame, and Defend**

Henfield and Washington (2012) examined the perceptions and experiences of 26 teachers in a school with a growing Black student population. Teacher participants felt conflicted when handling issues surrounding Black youth and felt that it was the school's responsibility to provide the "prerequisite information" they needed to handle these Black students' social, academic, and cultural needs. As seen in the literature (Ladson-Billings, 1995), teachers may struggle to connect with students from racial and cultural backgrounds different from their own, and simply being aware of diversity is not enough to promote change in an education system that has, and continues to, marginalize Black Americans (Dantas-Whitney & Ulveland, 2016; Griffin, Watson, & Ligget, 2016). As a result of this cultural mismatch, teachers can perpetuate ideologies that support color-blind, culture-blind, or deficit patterns of thinking about the ability of Black Americans (Bonilla-Silva, 2006; Ford, 2004; Henfield & Washington, 2012; Thompson, 2004).

Forms of omission (i.e., disregard of cultural existence and differences) and perspectives about culture can prevent individuals from addressing disparities in education that inherently rob minority students of quality, equitable education (Bonilla-Silva, 2006). Henfield and Washington (2012) concluded that "Whiteness" as an ideological and cultural perspective (Lea & Sims, 2008; Solorazana & Yosso, 2001; Wise, 2008) has countered the cultural experiences of minority

students by upholding a “culturally neutral meritocratic schooling” environment (p. 150).

Henfield and Washington (2012) further noticed that teachers did the following: 1) used racial differences to divide students, 2) noted times of regret for not “seizing the moment” to address cultural misconceptions, and 3) often blamed the administration for not training them to combat and address culture as a way to make connections among students.

Despite scholarship that highlights the successful implementation of culturally centered practices across disciplines (Aronson & Laughter, 2013; Esposito & Swain, 2009; Morrison et al., 2008), many teachers have not embraced this framework as a viable solution to neutralizing the disparities embedded in the American education system (Bryan, 2017; Milner, 2014; Sleeter, 2011). A lack of understanding of what culture entails and what the CRP framework embodies has led many teachers to attend to the needs of Black youth by leaning on weaker, less impactful instructional practices.

### **CRP and Teachers**

Embracing culturally relevant frameworks is not just about teaching, but also about the promotion of equitable learning environment and social justice (Sleeter, 2011). Because of the pervasiveness of deficit thinking, it is imperative to explore the reasons that teachers believe what they believe in addition to the everyday choices teachers make that are shaped by culture, history, and societal associations with colorism, racism, and social justice reform or regression (Floria-Ruane & Williams, 2008). Floria-Ruane and Williams (2008) suggested that to become a “good teacher” is to understand the “life narratives and compositions” that shape one’s understanding of self and others (p. 20). As teachers strive to become proficient in their fields, they must also work to understand the pedagogical practices needed in culturally diverse settings and must view these practices from a lens of compassion and humanity.

Scholars note that misconceptions and oversimplification of social constructs such as culture can lead to practices that are biased toward people of color—particularly African Americans (Borrero et al., 2018; Hermessi, 2017; Milner, 2007, 2012; Parhar & Sensoy, 2011; Staata, 2015). The lack of cultural knowledge that Milner (2007) referenced as the “unforeseen dangers” in education makes it difficult for teachers to adhere to a culturally centered framework if teacher preparation and teachers’ ideologies are rooted in power, and/or privilege (Andrzejewski et al., 2018; Darling-Hammond, 2000; Dover, 2013; Hollins, 2011; Sleeter, 2004, 2011).

### **Culturally Relevant Pedagogy**

Broadly defined in the field of education as a fluid and complex construct (Atwater et al., 2013; Milner, 2014; Howard, 2018), *culture* is ultimately conceptualized to be a system of beliefs, values, behaviors, and actions that are based on a series of socially constructed events within one’s environment and through the interactions one encounters and experiences with others. The danger in the assumption that culture is uniform disregards individuals from multicultural backgrounds and perpetuates a color-blind (Cobb, 2017; Borrero, Flores, & de la Cruz, 2016; Kohli, 2012), culture-blind society (Landsman & Lewis, 2011). Culture can be defined as “a shared understanding by a significant number of members of a social group” (D’Andrade, & Strauss, 1992, p. 230) and a representation of “specific values, traditions, worldviews, behaviors, and social and political relationships shared by a group of humans” (Atwater et al., 2013, p. 7).

Aligned with Ladson-Billings tenets of CRP—academic success, cultural competence, and sociopolitical consciousness—participants in Ladson-Billings study of effective teaching practices (2009) used a variety of approaches to support the learning and success of African



American youth. Referenced as a “form of good teaching” and a “vehicle for learning” (Ladson-Billings, 1995, 2009, 2014), CRP presents teachers with another pathway to engage, motivate, and enlighten students about themselves, those who look like them, and others throughout the learning process. Examining the CRP framework in K–12 learning environments illuminates the need for more sufficient options to reach populations historically neglected and disregarded within the education system. Thus, CRP is a framework that can reach every student, regardless of cultural identity, when teachers can implement the three premises during instruction. Ladson-Billings (1995, 2014) noted that the three tenets of CRP are necessary to bridge our understanding of the content, societal frameworks, and appreciation of self and others for students who are culturally and linguistically diverse from the dominant culture.

### **Criterion 1: Academic Success**

Ladson-Billings (1995) noted academic success in her CRP framework requires that “teacher’s attend to students’ academic needs, not merely [to] make them “feel good,” [but] to get students to “choose” academic excellence (p. 160). Challenging students to use their skills to positively impact self and others is a characteristic of criterion one of this framework. One way to challenge students to embrace the skills they have is setting expectations for each student. Scholarship has noted that high expectations support academic success in academic or nonacademic settings (Banks & Banks, 1997; Ladson-Billings, 1992a; Morrison et al., 2008; Parson, 2005). Teachers who employ strategies to support academic success and student learning understand that students need a variety of opportunities to succeed as well as support, love, and high expectations (Ladson-Billings, 1992a, 1994, 1995). Hill (2012) examined the actions of two English teachers, one novice and one veteran. By establishing rules, high expectations, and values within the structure of the class, student learning and academic success, teachers were

able to take ownership of their learning. For example, teachers used varying approaches to learning to characterize post-secondary educational options and careers as attainable feats in life. Teachers also used varying learning approaches to support and maximize learning by making sense of new concepts. It became these approaches to learning that supported student success in and outside of classroom.

In a case study exploring culturally relevant science education in a summer youth program for African Americans, students engaged in Lab Out Loud (LOL) learning initiative to introduce STEM professionals to youth of the same race, ethnicity and culture (Garvin-Hudson & Jackson, 2018). Students “maintaining cultural integrity and academic excellence” is what Ladson-Billings (1995) references at the core of the CRP framework (p.160). Students in this study were able to interact with individuals who have succeeded in various STEM careers highlighting that success is possible with support and encouragement. Through this connection students used science journals to document their learning experiences and reflect on their growth throughout the program. Student leaders within this Upward Bound program utilized these activities to encourage and support students as they recognized the meaning of science in their lives.

Boutte and Hill (2006) examined how teachers create learning communities in environments such as the barbershop. Conducting interviews and observations students were able to use their experiences going to the barbershop to assist in the learning of entrepreneurship, Black businesses, and the historical context of the barbershop for African American males. The barbershop is seen as the hub of the Black community for African American males (Boutte & Hill, 2006). Using collaborative learning to engage and support students, Boutte and Hill noted this collaborative learning approach as method to “pour into each other’s cup of knowledge” as

students learned to work together to achieve a common goal. Understanding why cultural learning institutions as the barbershop thrive in the Black community rests on the notion that it affirms student abilities using “accountable talk” (p. 318) that was then used to encourage and motivate students in the classroom. In this study, Mr. Hill aimed to “normalize high achievement” and show his students that success is evident when students are presented with culturally relevant teaching. Scholarship suggests that successful teachers become “cultural translators” for black students, integrating “style” of voice and dress to enhance learning (Irvine, 1989).

### **Criterion 2: Cultural Competence**

The second component of CRP is cultural competence. Cultural competence enhances the ways in which a person perceives himself or herself and others (Povenmire-Kirk et al., 2015). Cultural competency becomes a system of behaviors, interactions, and ways of communication utilized to present a variety of situations and effectively teach students from diverse backgrounds to value self and others. Too often individuals enter the teaching profession with preconceived thoughts or mindsets about the children they choose to educate. However, the ways in which teachers decide to validate and affirm the knowledge and experiences students bring with them—not trying to alter or conform students to a standard—can make a difference in how a student connects with and responds to the teacher and his or her peers.

Becoming culturally competent is not a destination, but a journey (Povenmire-Kirk et al., 2015). In the Hill (2012) study, teachers used student experiences, the community, and the culture of their class to create learning experiences that captured the essence of each student. It became a consistent practice to use students and their experiences to teach. Cultural competence

takes time and requires that an individual reflect on his or her feelings and practices before teaching these practices to students (Povenmire-Kirk et al., 2015).

Aspects of black culture in a barbershop setting (Boutte & Hill, 2006) were illuminated in an English class of 15 African American males. What was a typical bi-weekly trip to the barbershop for a haircut, also was presented as a topic in which students in Mr. Hill's class could be considered experts in the making. Wanting to teach about writing and research skills that were aligned with the state standards, Mr. Hill presented a topic with which students could connect, but could also learn more about (i.e., how to establish and run a successful business, respect and honor in the community, conducting interviews and building relationships). Selecting barbershops throughout the community, students developed research practices and learned about the "wealth of information and wisdom of their communities" (p. 320). Using "students' culture as a vehicle for learning" presented opportunities for students to bridge their understanding of various meaning and practices (Ladson-Billings, 1995, p. 161).

### **Criterion 3: Sociopolitical Consciousness**

The third component of CRP is sociopolitical consciousness. Sociopolitical consciousness allows an individual to stay empowered through activism. Through social awareness and civic responsibility, teachers can assess real-life problems and bring those problems into the classroom to establish meaningful connections—empowering students through social awareness and activism. The Equity Alliance (2016) examined student interest in panhandlers who harassed the students for money as they walked to school each morning. After building a complete class project that included the students identifying liquor stores and panhandlers in a one-mile radius of the school, this research was presented to a local congressman for answers and possible solutions. This is an example of students exercising their

voice to achieve a community-based goal (Gay, 2010). In situations like this, it takes a “knowledgeable other to spark a child’s interest and get an idea in motion” (Gay, 2003, 2010).

The CRP literature and the use of cultural knowledge (Aronson & Laughter, 2013; Esposito & Swain, 2009; Howard, 2003; Morrison et al., 2008) emphasize the importance of the three foundational elements of CRP framework to combat deficit perspectives in today’s classroom. Ladson-Billings (2014) and Gay (2014) summarized this competency of critical consciousness to recognize the positive and negative influences social, political and economic structures can have on the lives of people from multiple background and from multiple vantage points.

Milner (2014) conducted a study to examine “purposeful teaching” a term Milner associated with culturally relevant pedagogy to explain how teachers exceed in the classroom using sociopolitical consciousness has a tool to enhance learning (p.11). Observing the actions of Mrs. Shaw, a middle school teacher, she stresses her role as a teacher to “empower her students to “serve” and to “change” their communities in order to improve conditions for the masses” (p.12), she used the community as a common point of reference. Mrs. Shaw used storytelling to remind students that “purpose” is about “[making] contributions to society beyond their current situations...and beyond their community” (p. 13). Although students did not know much about the world beyond their community, Mrs. Shaw engaged in conversations to share her life experiences and why it was important for her to return to the community, because to her it was home. As a social studies teacher she used race to enlighten her students of how much race played a crucial role her life and within the community. As an African American woman she felt that, “in the Black culture [to serve and to change/improve communities]. It was our mission and responsibility in our families and our churches and our home” (p. 13). For Mrs. Shaw improving

the community meant improving things that were inequitable and then challenging to think of ways to improve those same things.

Ladson-Billings (1992) established the tenet of sociopolitical consciousness as one of three premises to support “good teaching” for African American students. It was designed to challenge the status quo that marginalizes people of color and encourages learners to “engage the world and others critically” through conversation (Ladson-Billings, 1995, p. 162) and also to challenge how practitioners define and assess good teaching across disciplines.

### **Summary**

As one of many frameworks to employ effective teaching practices and support student learning, CRP has been used to address the stagnant progress of African American students and to enhance the understanding of culture for teachers. The use of the following terms: culturally appropriate (Au & Jordan, 1981), culturally congruent (Mohatt & Erickson, 1982), culturally compatible (Jordan, 1985), and culturally sensitive solutions (Villegas, 1988) and culturally responsive (Gay, 2000), were used as pedagogical approaches to inform others of the “cultural characteristics” of children who have been marginalized (Howard & Rodriguez-Minkoff, 2017). These frameworks promoted successful strategies to support the home and school interactions that a child encounters throughout his or her life. Researchers examining the relevance of culturally centered practices (Banks, 2007; Emdin, 2011; Ladson-Billings, 1995; Howard & Rodriguez-Minkoff, 2017) have explored the intersection of culture and education to prepare for and address the disparities that impact the methods used to educate Black/African American youth. Understanding the significant role culture has in the classroom helps to explore how teacher epistemology of culture can impact instruction. This study seeks to further explore culture in science and its alignment with the CRP framework.

## **CHAPTER 3:**

### **METHODS**

The current study is an exploration of rural middle school science teachers' teaching practices and the many ways *culture* is used and understood to inform these practices. Culturally relevant pedagogy (CRP), "a pedagogy that empowers" (Ladson-Billings, 1995a), will be used to identify pedagogical practices that are aligned with the CRP framework and to further illuminate the varying ways science teachers promote academic success, cultural competence, and sociopolitical consciousness to enhance student learning in the communities in which they teach. To gain insight into these teachers' practices, I (1) explored through a multi-site case study analysis their personal and professional experiences, their pathways to teaching, and their definitions of culture; (2) examined their responses provided regarding the practices they use in their science classes to keep students engaged; and (3) probed the intersectionality of culturally relevant practices, teacher practices, and the science curriculum through a variety of data sources. In education, a case study is designed to examine a problem arising from certain practice in a field such as math, science, or reading. A case study explores a problem through one or more cases (i.e. individual or groups) that are within a bounded system (i.e., school, geographical location, program).

My study examined teacher understanding of culture and use of cultural references (i.e., traditions, rituals, language, music, everyday life experiences) to impart knowledge and enhance science understanding for marginalized and often disenfranchised populations. The increased demand of competent professionals in science (Byars-Winston, 2013; Stiles, 2016), the damning student achievement rates in science of African American students (NAEP, 2015; NCES, 2017), the increase of diversity in K-12 settings (Anastasiou & Keller, 2014; Au et al., 2010), the

overwhelming dismissive actions in teachers education programs (Darling-Hammond, 2006; Trent et al., 2008), standardized instruction taught by an overwhelming representation of White, middle class female teachers (NCES, 2015), and the absence of culturally diverse science curriculum highlighting the impact race and culture in science (Emdin. 2011; Underwood & Mensah, 2018) lead to conducting this case study analysis.

### **Case Study**

A case study methodology approach was chosen for this study based upon its characteristics: 1) participants were centrally located in a southeastern state, 2) teachers were certified in science—specifically 6<sup>th</sup>, 7<sup>th</sup>, or 8<sup>th</sup> grade science, and 3) participants were actively involved in the same STEM partnership program. For this study, a case study helped to gather data on teacher perceptions of culture and how their pedagogical knowledge, cultural knowledge and personal experiences guided their classroom instruction.

Case studies can be either simple or complex, examining one or more individuals, within a site or at multiple sites, to gain a better understanding of what is being investigated (Merriam, 1998, Merriam & Tisdell, 2016; Merriam & Grenier, 2019). Denzin and Lincoln (2018) note qualitative research as,

“...a situated activity that locates the observer in the world. Qualitative research consists of a set of interpretive, material practices that make the world visible. These practices transform the world. They turn the world into a series of representations, including field notes, interviews, conversations, photographs, recordings and memos to the self. At this level, qualitative research involves an interpretive, naturalistic approach to the world. This means that qualitative researchers study things in their natural setting, attempting to makes sense or interpret phenomena in terms of the meanings people bring to them...[involving] the studied use and collection of a variety of empirical materials—case study, personal experience, introspection, life story, interview, artifacts, and cultural texts and productions, along with observational, historical, interactional, and visual texts—that describe a routine and problematic moments and meanings in individuals’ lives” (p. 10).



## **Qualitative Case Study**

Several studies have utilized case studies in qualitative research to understand the perceptions of teachers and cultural relevancy across disciplines (Adams & Glass, 2018; Borrero, Ziauddin, & Ahn, 2018; Rozansky, 2011; Vincent & Kirby, 2015). Specifically, a case study design properly adheres to understanding a phenomenon across one or more cases (Merriam & Tisdell, 2016), is “designed to bring out the details from a viewpoint of the participants by using multiple sources of data” (Tellis, 1997, p.3), and is conducted through “a triangulated research strategy” (Tellis, 1997). Triangulation of multiple data sources confirms the validity process within the study. Defined as a bounded system, a case study is used to closely examine a topic being studied and explores how individuals utilize, comprehend, or manage the focus of the study by providing a “holistic description and analysis” of the experience (Merriam & Tisdell, 2016, p. 232).

Qualitative case studies provide an in-depth look into what factors contribute to the success or failure of a given strategy (Oslo, 1982; Merriam, 1998). Through multiple forms of data collection and rich description of the environment, I can see how and what influences the issue at hand— science teaching. In this case, the issue or focal point would be teacher perception of culture and pedagogical approaches in middle school science classrooms.

Understanding the ways individuals operate, adapt to their surroundings, and make sense of their surroundings through social structures is a benefit of conducting a qualitative research study (Merriam & Tisdale, 2016). Unlike quantitative studies, a qualitative study has the ability to examine (1) the ways people interpret their experiences, (2) construct their worlds, and (3) assign meaning to their experiences to understand how people make sense of their lives and experiences (Merriam & Tisdale, 2016). This study of 6<sup>th</sup>, 7<sup>th</sup>, and 8<sup>th</sup> grade science teachers

provided insight into teachers' cognitive processes of defining and understanding culture and its dimensions.

The following research questions guided the study:

- (1) How do middle school science teachers define culture?
- (2) How do teachers' definitions of culture manifest in science instruction in the middle school classroom?
- (3) What evidence of culturally relevant practices are observed in a sample of middle school teachers selected for potentially enacting culturally relevant pedagogical practices within science education?

Qualitative research requires a level of transparency between the researcher and the study participant(s), producing a "quality" of work that becomes insightful and meaningful. Providing a holistic view of the phenomenon being studied, rather than a snapshot, is the essence of qualitative inquiry (Flick, 2013; Merriam & Tisdell, 2016).

Within this study, the case is defined by current 6<sup>th</sup>, 7<sup>th</sup>, and 8<sup>th</sup> grade science teachers who are participants in a STEM partnership program in a southern state. Actively involved in learning how to engage African American students in science education, science modules were developed by neighboring institutions to address the stagnant growth among African American learners in science in an effort to attract African Americans to STEM professions as they transitioned into college.

## **Ethical Considerations**

Ethical considerations in research are critical regardless of the type of research design chosen to conduct a study. Ethical principles are noted within qualitative research to protect participants and the integrity of the study (Miller, Birch, Mauthner, & Jessop, 2012). The following four core principals are addressed in this study: a) Respect for Persons, b) Beneficence, c) Justice, and 4) Respect for Communities. Although my involvement as a graduate research assistant within this STEM- funded grant has provided access to the participants within this study, re-accessing participants for the use of this study and the use within the scope of the grant, are elements that require added measures to ensure the following four ethical principles are not violated. Due to this, inquiry surrounding these ethical principles, and use of data for this study, emerged as to what is acceptable and what is not acceptable when conducting qualitative research (Birch et al., 2012).

### **Principle One: Respect for Persons**

**Respect for persons.** Respecting the autonomy, decision-making, and dignity of participants is of utmost importance when working with human subjects in research (Bobeica, 2019; Miller et al., 2012). Adhering to this principle required that participants be informed of the nature of the study, potential risks by participating in the study, being of their own free will to consent to participating in the study, and made aware of their right to remove self from participating in this portion of the study.

### **Principle Two: Beneficence**

**Beneficence.** This principle addresses the minimization of risks and maximization of benefits toward research participants (Bobeica, 2019; Miller et al., 2012). Understanding that teachers are human too, chosen practices implemented by teachers were not reported as a means of evaluation or end-of-year review of participants as classroom teachers. I collected data for the

sole purpose of understanding how teachers use culture to enhance instruction in science. However, questioning about teaching practices have the ability elicit emotional feelings, and as a potential risk, this is addressed to participants as well. Based upon the aforementioned information, participants can decide if participating in the study outweighs the risks associated with the study.

The notion of maximizing benefits for participants included enhancing teaching practices in the classroom as the participant and I discuss classroom observations and lesson plan documents. However, other benefits included the presentation of findings at national conferences to highlight teaching practices in science and to further teacher understanding of how cultural dimensions are implemented within science education in a middle school setting.

### **Principle Three: Justice**

**Justice.** The purpose of this principle is to ensure participant selection for my study was just and ethical (Bobeica, 2019; Miller et al., 2012). Participant selection for this study included recent or past teacher involvement in an ongoing grant-funded program STEM partnership program. Under the scope of the grant and its purpose to the community and the students it serves, the Institutional Review Board (IRB) granted permission to conduct the initial study and all other subsequent studies that aim to enhance student engagement in science, student interest in science, and provide teacher support in the area of science education. Chosen based upon their active involvement in the grant-funded STEM partnership program, participants noted their verbal acknowledgement of using “real world connections” to engage students in science; making content applicable to students’ everyday lived experiences.

### **Principle Four: Respect for Communities**

**Respect for communities.** Respect for communities is to protect the values and interests of the community and protect the community from harm (Bobeica, 2019; Miller et al., 2012). To adhere to this ethical principle, information about teachers, the communities they live, and the communities they serve were not misrepresented in any way within the study. To ensure information about the community, school structure, and teacher information are true representations of each teacher, participants had the opportunity to review documents and correct information that may be perceived as misleading or taken out of context. From a relativist-constructivist paradigm there are multiple meanings can derive from any experience or interaction.

### **Trustworthiness**

Patton (2015) noted “trustworthiness of the data is tied directly to the trustworthiness of those who collect and analyze the data—and their demonstrated competence” (p. 706). In other words, the data collected is a true reflection of the information gathered and portrays the experiences and perspectives of the participants. For three years I worked with several teachers in this STEM partnership program to evaluate science modules. I traveled with teachers to professional development trainings and had the opportunity to co-teach science modules with teachers as well. Spending many hours in the classroom conducting observations, I was able to connect with the participants because of the time we spent together, but also due to our similar experiences as classroom teachers. Having a vested interest in the STEM partnership program, coupled with the close relationship I formed with each participant within the study, I made sure to take several measures to ensure trustworthiness in the study. Navigating my feelings and responsibility as a researcher addressed some ethical dilemmas.

Ethical dilemmas are noted as situations that “emerge with regard to the collection of data and in the dissemination of findings” (Merriam & Tisdell, 2016, p. 261). As a program evaluator for the STEM partnership program participants were a part of can be considered ethical dilemma that must be addressed. My relationship with the participants questions the validity of the data being collected (Lincoln, 1995). It became necessary to portray the data in my study from a lens that did not distort the data or its meaning; ensuring that all “voices [are] heard” (Merriam & Tisdell, 2016, p. 261). I took my concerns to my committee and was reminded that teachers are human too and their daily experiences in the classroom will yield different outcomes—possibly contrary to my own personal experiences as a teacher—making it unfair to judge an individual from a snap shot vantage point.

### **Participants**

Purposeful sampling was chosen to select the participants for this study (Patton, 1990). Purposeful sampling allows researchers to gain “different perspectives on the problem, process, or event” (Creswell, 2012, p. 75) via the lens of multiple individuals with distinct and informative perspectives. Teachers selected to participate in the current study due to their participation in a grant-funded program in which I assisted with the evaluation of science modules. Participants taught grades 6, 7, and 8 at a school in a rural area of a southeastern state. As a graduate research assistant for this grant, my previous interactions with the teacher participants provided me with access to this population.

A total of 13 teachers participated in part one of the study. Part one of my study included interviews and observations of several 6<sup>th</sup>, 7<sup>th</sup>, and 8<sup>th</sup> grade teachers at multiple schools located throughout a southeastern state. The initial study examined the pedagogical practices of 13 teachers participating in a STEM partnership program. During each interview science teachers

had the opportunity to share how they bridged student understanding in science. All 13 participants noted the use of “real world connections” to bridge students understanding of inquiry-based instruction and the 5Es, yet my observations did not always yield such results. Through further examination (i.e., interviews and observations), I asked teachers to provide instances of when they experienced success with their students using “real world connections” in science. The on-going dialogue between each participant and myself did yield information that knowledge obtained in science was done so through connections and student support; this information aligned with the culturally relevant framework described by Ladson-Billings (1992, 1995, 2014). From the explanations provided by each teacher and from their years of participation with the STEM partnership program, I chose three teachers who expressed at various times during the grant their use of “real-world connections” to teach science in their classrooms. The STEM partnership has been in existence with neighboring schools for a total of 7 years. Of the 13 original participants from study one, the three selected participants chosen for my study participated in the partnership program each year and have been active in implementing and/or teaching an array of science modules created by the STEM partnership program. The partnership program was designed to enhance student engagement in science for populations that have been underserved. I defined “active participant” as a person who taught, co-taught, or invited a speaker to teach a minimum of 7 science modules. Scholarship in science education suggests that students who seem themselves in the content/curriculum and make connections from a cultural lens experience success in the field of science (Atwater et al., 2013; Emdin, 2011; Mensah, 2013). For students to experience success would warrant that teachers not only understand this need in science education, but also recognize and acknowledge the cultural lens or filters used by students to understand science. Understanding culture became the basic

foundation to employing culturally relevant practices and avoid what is seen as a “cultural mismatch” in the classroom—particularly in content areas where African Americans persistently lag behind their peers (Gay, 2000; Howard, 2017; Siwatu & Poloydore, 2010; Stephens, Townsend, Markus, & Phillips, 2012). A skewed view of cultural dimensions can lead to the misconceptions and miscommunication between others (Johnson, 2010; Underwood & Mensah, 2018; Villegas, 1988).

Participants in this study ranged in age from 25 to 49 years. Each study participant held a teaching certificate in secondary education, a science endorsement with an elementary education teaching certificate (grades P through 6), or a teaching certificate in elementary education (grades P through 6). Table 1 presents pseudonyms and basic profiles of each teacher participant.

**Table 1**

<b>Teacher Participants</b>			
Teacher	Racial Identity	Years of Experience	Grade-Level Content Focus
Velma Nichols	White	20+	Grade 8/ Physical Science
Tammy Wilson	Black	15+	Grade 6/Earth and Space Science & 7 <sup>th</sup> Grade Life Science
Meredith Richards	Black	5+	Grade 8/Physical Science

### **Data Collection**

Three types of data were collected for this qualitative study, a) semi-structured interviews, b) classroom observations, and c) lesson plans. As cited in the literature (Merriam, 1998; Merriam & Grenier, 2019; Merriam & Tisdell, 2016), multiple forms of data are needed to provide an in-depth analysis of the case or cases being examined. Participant identities are protected by the use of pseudonyms provided in Table 1. Data collected for this study is securely



on a password-protected computer. Research findings may be shared at conferences and in publications; however, participants will not be identified in published documents or conference presentations.

Used to triangulate information as multiple sources, interviews, observations, and lesson plans showed the ways teachers' implemented culture as they defined in their interviews. These additional data sources enhance the credibility of the data collected and the overall quality of the study. As the data may have yielded different results (e.g., information provided publicly vs. information provided privately), it was important to compare/contrast the data from each of the three data sources to corroborate the statements given during the interviews.

## **Interviews**

Interview data were one of three data sources used in this study. Merriam and Tisdell (2016) have noted qualitative interviews to “[provide] cultural stories and examples of how beliefs, specifically about cultural issues, played out in their pedagogy” (p. 47). Conducting interviews helps to build “rapport with participants” (James & Busher, 2012; Merriam & Tisdell, 2016). In essence, in attempting to understand *why* teachers teach the way they do and employ particular strategies (e.g. real-world connections, hands-on learning), I sought to understand the ways teachers define specific educational or basic terms (e.g., culture), the ways their experiences have influenced their instruction, and their existing knowledge of pedagogy.

Interviews conducted determined the ways teachers defined and used culture in their science classes to support student learning. Sleeter (2011) noted that further study was needed to adequately assess teachers' practices and use of culturally centered practices (i.e., culturally relevant pedagogy and culturally responsive teaching) in their learning environments. In addition to the interviews in which participants provided responses, observations aided in the

identification of the types of teaching practices used to bridge student understanding in science education—integrating real-world issues, situations, and relatable connections throughout their science lessons. To guide the in-depth, semi-structured interviews, several categories of questions were created, including questions pertaining to participants’ backgrounds, participants’ teaching beliefs, the work environment, and science content and integration. Categories and questions are presented in Table 2.

The interview questions shown in Table 2 provided the open-ended framework needed to conduct the interviews. Dependent upon the participants’ responses, questions may follow the original questions, enabling unrestricted conversations with each teacher participant.

## Observations

**Table 2**

<b>Categories and Questions Guiding In-Depth Interviews</b>	
<b>Category</b>	<b>Guiding Interview Question(s)</b>
Participant background	<ol style="list-style-type: none"> <li>1. Tell me about yourself: your upbringing, where you attending school and where you’re from.</li> <li>2. Tell me about your learning experiences as a student.</li> </ol>
Teaching beliefs	<ol style="list-style-type: none"> <li>1. What do you believe is the role of the teacher in today’s classroom (teaching philosophy)?</li> <li>2. Describe a time when you were in a school where a teacher used "best practices" in the classroom?</li> </ol>
Work environment	<ol style="list-style-type: none"> <li>1. Describe the culture of your school? Describe the culture of your grade level team.</li> <li>2. How do you implement cultural components into your classroom?</li> <li>3. In your own words, how do you define culture?</li> <li>4. Provide an example when you were successful in implementing culturally relevant material into your science lesson(s).</li> <li>5. How often do you and your colleagues meet to discuss and plan for future science lessons? What topics are discussed to frame a lesson in science?</li> </ol>
Science content and integration	<ol style="list-style-type: none"> <li>1. What strategies do you use to make learning relevant in science?</li> </ol>

Classroom observations are the second form of data collection used in the current study. Used as a data source to highlight evidence of culturally relevant pedagogical practices, observations showed connections between home and school cultures, student interactions with one another, teacher interactions with students, and differentiation of instruction between class periods on various days during the week. Understanding the ways teachers use culture as a basis for student understanding in science yielded a focus on two components during classroom observations: (1) frequency of learning tasks and directives (e.g. methods used to enhance instruction) to support student learning, and (2) classroom interactions between the teachers and students (e.g. relationship building). Documenting these instances (i.e., learning tasks and classroom interactions) provided a deeper understanding of the ways cultural dimensions were contextualized in the science classroom to bridge student understanding. Each observation lasted for a full class session, and class sessions ranged from 55 to 90 minutes (dependent on the structure of the school day and class schedule). Observed a minimum of 4 class periods with a minimum of 5 hours of observation time, participants agreed for observations to take place in their science classes.

Each teacher was observed four times (for a half or full school day) over a four-week period or until saturation had occurred. Saturation is “reaching a point of redundancy...hearing the same responses or seeing the same behaviors in observations (Merriam & Tisdell, 2016, p. 101). Teachers were observed for a half a day or for a full day depending on teacher availability and schedule. Each class period observed counted as one observation. (See Table 3 for further description). Observations create an opportunity for a researcher to record various aspects of the learning environment, all of which can enhance our understanding of the phenomenon being examined. As part of the observation process during data collection, participants reviewed the

observation notes for verification and/or clarification purposes, which further validated the trustworthiness of the data.

---

**Table 3**

<b>Classroom Observation Hours</b>	
Teacher	Classroom Observation Hours
Velma Nichols	9 Observation Hours
Tammy Wilson	8 Observation Hours
Meredith Richards	5 Observations Hours

---

### **Lesson Plans**

Lesson plans were the third and final source of data collected for the current study. Document analysis of lesson plans explain the ways participants planned to incorporate cultural connections into their lessons and activities. Lesson plans contain possible questions that are used to initiate conversations at the opening of the lesson, to stimulate and direct conversation throughout the lesson, and even at the conclusion of a lesson.

### **Data Analysis**

Flick (2013) described data analysis as the “central step in qualitative research...forming the outcomes of the research” (p. 3). As a common and appropriate research technique to analyze data within a case study, the analysis becomes the “classification and interpretation of material to make statements about implicit and explicit dimensions and structures of meaning-making in the material and what is represented in it...also is applied to discover and describe issues in the field, routines [or] practices” (Flick, 2013, p. 5).

Constructed themes supported the analysis of data (Merriam & Tisdell, 2016). Themes derived from rich, thick descriptions of the environment, note-taking during the interviews, transcripts, documents, and the triangulation of data sources supports the nature of a case study

(Baxter & Jack, 2008; Flick, 2013, Merriam and Tisdell, 2016; Phillipi & Lauderdale, 2018; White & Marsh, 2006).

According to Merriam and Tisdell (2016), a coding system is initiated by reading the data, taking notes, and then rereading the data to reflect on the observations and prepare for subsequent observations and to construct the follow-up questions needed to clarify the data. Interviews and observations were compared to document recurrent words, actions, and activities, to find segments in the data to answer the research questions (Merriam & Tisdell, 2016). I transcribed interviews and constructed meaning from the data provided by each participant. Using descriptive coding, I hand coded each transcript from interviews and classroom observations. I color coded important key words and phrases from interviews, observations, and lesson plans. I constructed themes from the words and phrases coded within the data. Through an iterative process—a process that systematically checks data over and over as questions emerge and connections are made—in this study, measures how, and to what degree, teachers' definition of culture aligns with the CRP framework illustrated by Ladson-Billings (1992a). Over time, the iterative process examines just how effective the “real world connections” or the cultural connections are being made when addressed in the middle school science classroom. The iterative process noted by Harlow (2010) consists of “feedback loops” (Mayring, 2000), which refers to the repeated analysis of multiple data sources to find meaning within the data (Merriam & Tisdell, 2016). Findings from this process showed the methods to which teachers' understanding of culture informed their practices in the science classroom. Information from classroom observations and interviews were transcribed and coded, and a list of codes was created to organize the data and lead to the identification of themes. Lesson plans were reviewed, and the data was categorized into the three premises of CRP: 1) student learning and academic

success, 2) cultural competency, and 3) sociopolitical consciousness. A secure and password protected computer was designated to keep all data.

### **Credibility of the Study**

In qualitative research, three things establish trustworthiness of a study: (1) reliability, (2) validity, and (3) credibility. Reliability establishes the dependability of the research findings: Can the study yield similar findings if repeated by another researcher using the same process? Like many qualitative studies, it is essential to validate the credibility (internal validity) and transferability (external validity) of the data collected and analyzed. Therefore, credibility in a case study is to identify and address potential bias, ensure that participants' voices are adequately documented, and establish the benefits of the study to the participants (Patton, 2015). Understanding that the credibility of the study can be violated by predispositions and biases-- remaining attentive to the ways themes and patterns are detected within the data is important to the development of a study (Patton, 2015).

In qualitative research, the purpose of the study is to understand the realities of the population being served. Therefore, the notion of the study rooted in constructivism, meaning that thoughts, beliefs, and actions constantly and consistently change based on a number of variables, such as age and education (Merriam & Tisdell, 2016; Patton, 2015; Tracy, 2013). The study's reliability is rooted in the study's design, the data collections methods used, and the data analysis process, and the transferability of the study (Merriam & Tisdell, 2016).

### **Transferability**

Transferability of a study is dependent on the nature of the study. It is the notion that the finding from a study can be applied to other setting that are similar in context (Merriam & Tisdell, 2016). Case studies are not designed to generalize outcomes or control the narrative of a study. A

case study explores a concept or concepts and its authenticity within an environment. Within this study, transferability informs the reader of possible predictions that can be applied to a study with a similar focus. For the sake of this study, it is to explore teacher epistemology of culture to inform the establishment of “real-world connections” in middle school science classrooms.

### **Part 1 of the Study**

The current study emerged from a pilot study of middle-grade science teachers in a southeastern state. In this pilot study, teachers’ use and understanding of inquiry and the 5E’s (i.e., engage, explore, explain, elaborate, and evaluate) were examined to support inquiry-based instruction in the science classroom as noted as a program goal within the grant-funded program. Teachers were asked about module use, module difficulty, stakeholder interactions, and examples of the ways inquiry-based instruction and the 5E’s were used in these science modules and in daily middle-grade science lessons. Study data were collected to provide an in-depth look into teachers’ perceptions of culture and into the ways teachers utilized cultural knowledge to enhance science instruction.

Concluding this study, it was found that (1) a lack of knowledge about content, pedagogy, and student experiences can prevent “good intentions” from being fulfilled and (2) teachers felt that they would benefit from training opportunities, continuing education, exposure to various cultures, and reflection time being embedded in the school day. The data collected in the pilot study also highlighted the following: (1) applicability (i.e., How were connections being made between science concepts and the students living in a Southeastern state?) and (2) cultural congruence (i.e., understanding the importance of culture and socialization within communities and the way they impact science education).

The lack of cultural and content knowledge among the teacher participants did impact the ways these teachers taught the lessons required by the terms of the grant associated with the pilot study. Despite attempts, teachers failed to bridge the gap between home and school cultures in science education modules that referenced properties of nanoscience, nanotechnology, and nanoengineering. Research posits that there are many benefits to inquiry-based instruction being coupled with culturally relevant practices, such as the enhancement of student involvement, engagement, and science knowledge (Meyer & Crawford, 2011). A lack of communication and understanding between school leaders, curriculum developers, and teachers was a factor underlying the misalignment of theory and practice in science education. Although teachers were reportedly confident in their ability and desire to teach science modules, one-on-one interviews contradicted their original statements and revealed that they somewhat misunderstood the grant. It was discovered that as a result, some of the teachers participating in the grant program/pilot study opted not to implement the modules due to a lack of content knowledge, perceived relevance, or time constraints.

As the data showed, teachers may have been unclear about the meaning of “culture,” and it also appeared as if the teachers did not fully understand the totality of the program goals of the grant under which they were working. Many teachers were unable to articulate the ways inquiry-based instruction was used within each science module, and this lack of understanding was connected to a lack of communication from stakeholders to university professors, from university professors to teachers, and from teachers to students. Although participants struggled to articulate the nature of the grant and the ways culture was embedded in science, they were able to articulate the many ways they kept their students engaged using “real-world connections.”



The current study was developed from the findings of part one of the study, and the interviews conducted for the current inquiry offered insight into teachers' efforts to make science "relatable" and "engaging." While it may be natural for an outsider (like myself) to highlight the things that teachers are not doing well in the classroom, it too becomes necessary to acknowledge and elaborate on the things that teachers are doing well in their classrooms (Esposito & Swain, 2009; Hollins, 2011)

### **Summary**

Conducting qualitative research serves a distinct purpose in academia: It provides in-depth information from the sample under study. It reveals narratives and perceptions shaping the lives and experiences of others that cannot be supported using any other data collection approaches. Although CRP scholarship in K–12 settings has steadily gained traction, the literature on culture and science education in rural settings remains scant. Thus, in this study, the importance and impact of culture in science education in rural settings is emphasized; this is an area within education that should not be overlooked.

## **CHAPTER 4:**

### **FINDINGS**

The current study is an exploration of teachers' perceptions of culture and the cultural nuances used to enhance and support instruction in middle school science classrooms. Culturally relevant pedagogy (CRP) is noted as a "vehicle for learning" and a form of "good teaching," according to educational theorist Ladson-Billings (1995). When teachers embed content within cultural contexts to which students can relate, they improve student success rates and narrow the gaps in student achievement (Ladson-Billings, 2009; Milner, 2014). To some, the culturally relevant framework is a fairly new instructional practice in kindergarten through secondary, and even some post-secondary educational spaces (Howard & Rodriguez-Scheel, 2017), leaving many to be unfamiliar with CRP and associated terminology. However, this lack of familiarity does not mean that teachers are not enacting practices that are socially and culturally relevant to their students.

According to Ladson-Billings (2009), teachers who are consciously aware of the cultures that students belong to, engage in the following: (1) They uphold high student expectations to support student learning; (2) They highlight the similarities and differences that exist between people remaining competent and cognizant that differences do not equate to deficits; and (3) They provide opportunities for students to learn and become aware of the social, political, and economic structures that can impact their quality of life. Culturally conscious teachers are aware that their students are not "blank slates," but rather possess knowledge that can enhance and aid in the student learning experience.

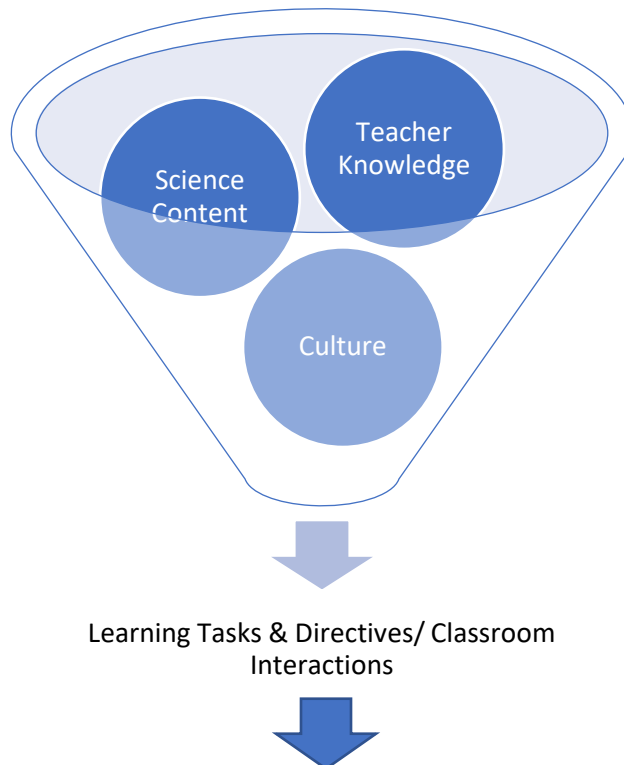
The following research questions guided the current study:

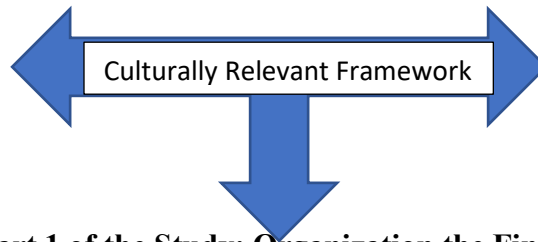
(1) How do middle school science teachers define culture?

(2) How do teachers' definitions of culture manifest in science instruction in the middle school classroom?

(3) What evidence of culturally relevant practices are observed in a sample of middle school teachers selected for potentially enacting culturally relevant pedagogical practices within science education?

Understanding the ways teachers use culture as a basis for student understanding in science did yield a focus on two components during classroom observations: (1) frequency of learning tasks and directives to support student learning, and (2) classroom interactions between the teachers and students. Evidence within each component that could support the three-part culturally relevant pedagogical (CRP) framework was also examined within the data collected. In addition, instructional practices were shared throughout the interviews as well as how lesson preparation supported their notions of “real-world connections” as method to add value to the middle school science curriculum.





**Diagram 1**

**Extending Part 1 of the Study: Organization the Findings**

As described in Chapter 2, the current study is an extension of a grant-funded program for middle-grade science teachers and their use and understanding of inquiry and the 5E's to support inquiry-based instruction in the science classroom. Data from part one of the study provided an in-depth look into teachers' perceptions of culture and the ways they used their knowledge of culture to enhance science instruction. Results of this study warranted further examination of teachers' practices, specifically those that involved "real-world connections." The current inquiry is an extension of that study, but one that is focused on teachers' understanding of culture to inform their pedagogical practices in the science classroom. This focus area is one of many objectives requiring additional research (as aligned with the grant). The data for this study were collected via interviews, observations, and lesson plan analysis.

The first section of this chapter will detail biographies of each teacher participant as well as descriptions of their classrooms. These detailed, rich-descriptions of each participant offers an intimate look into the teachers' personal and professional lives to provide a sense of their cultural identities, positionality in their classrooms, and their ascribed pedagogical practices as middle school science teachers. After the introductory biographies, the case study data collected for this study will be presented in more detailed discussions of the teacher participants, including their definitions of culture in the classroom. The themes that emerged from the data will be embedded in participant discussions; these will be referred to throughout the chapter as "teacher attributes." Evidence is provided for each theme to support the ideas, beliefs, and teaching strategies of the

three middle school science teachers that participated in this study. The description of each teacher's classroom in terms of attribute themes is then followed by a detailed description of the daily procedures of their classroom and the quality of interactions between the teacher, students, and others.

### **Participant Biographies**

Three female middle school science teachers located in rural settings in a southeastern state participated in this study. Each teacher taught a range of subjects within science, e.g., 6th-grade Earth and Space Science, 7th-grade Life Science, 8th-grade Physical Science, or a combination of the three. Although these teachers currently teach science in a middle school setting, their teaching expertise in grades K through 8, years of teaching experience, and educational background varied. The study participants have worked in various capacities and have held various job titles within education that include, but are not limited to, reading intervention specialist, kindergarten teacher, math teacher, social studies teacher, and language arts teacher.

As evidenced through interviews and classroom observations teachers brought an abundance of knowledge into the learning environment. Participants within the current study shared common practices and experiences to which supported their choice to pursue a career in teaching. Common traits were also categorized and analyzed to provide deeper insight into the teaching philosophy and practices of the teacher. In addition to their different approaches to learning and content delivery, each participant was selected for potentially enacting culturally relevant pedagogical (CRP) practices in their science classrooms. This perception was based on several years of observations of their classroom as part of the larger grant. Table 3 provides a

snapshot of each teacher participant’s grade level, school type, and teaching experience; pseudonyms are also shown in this table.

This multisite case study provides a multifaceted perspective and interpretation of what the role or roles a teacher may exhibit over the course of one’s professional career in the profession. While each teacher was unique, patterns emerged and the creation of themes across three classrooms were determined.

**Table 4**

**Teaching Demographics**

Teacher	Race	School Setting	Classroom Experience	Grade-Level and Experience
Velma Nichols	White	Rural, 98% Black	20+ years	Grade 8/ Elementary Grades
Tammy Wilson	Black	Rural, 97% Black	15+ years	Grade 6/English Language Arts
Meredith Richards	Black	Rural, 100% Black	5+ years	Grades 7 & 8/ Secondary Science Certification

**Participant 1: Velma Nichols**

Mrs. Velma Nichols almost missed the opportunity to become a teacher. Wanting to pursue a career in which she would earn more money, Mrs. Nichols declared a major in college that she believed would be noble and pleasing to her family—a career working with numbers. Her interaction with a family friend while she was still in college challenged her to follow her heart and dreams, not just the money. It was at that moment that she decided that teaching was her passion and the career that she would pursue.

Mrs. Nichols has had the pleasure of teaching at the same middle school for over 20 years. As the longest-standing faculty member, she has been able to foster relationships in her local community by teaching both the children and the grandchildren of her former students. With such a presence in the community, everyone knows her by name. Beginning her career in

early childhood education, Mrs. Nichols attributes her teaching style and approaches to learning to her years of training and on-the-job experience as an elementary school teacher. Although her love for children never faded, her love for teaching at the elementary level did fade over time.

When her love for teaching elementary-aged students started to wane, she recounted the conversation she had with the family friend during college—the “follow your heart, not the money” conversation—and decided to pursue her love of science and teach at the middle school level. She then earned a general science endorsement. Mrs. Nichols expressed that the role of the teacher “goes beyond the walls of the classroom and requires you to be attentive...listen carefully...take action when needed.” Mrs. Nichols understood, over time, that the best learning takes place when teachers guide and provide opportunities for students to take the lead. Not knowing when she will actually retire, Mrs. Nichols acknowledged that teaching 8th-grade Physical Science has all of her attention at the moment.

As I walked toward Mrs. Nichols’s classroom, I saw her at the door greeting and welcoming students with a smile as they entered the room. As I got closer, I overheard her saying, “Don’t forget to pick up your notebook...write down the opener, and let’s prepare for day.” As I walked in and took a seat in the back of the room near the science curriculum kits, I noticed a sea of organism-type things, science posters, and science projects within neat borders hanging from and on the walls. The classroom was bright and airy, and students’ desks were actually science lab workstations, which brought a different feel to the classroom. All of the other classrooms I observed in other schools, and within the same school, had normal desks and chairs, so this arrangement was different.

In the classroom, Mrs. Nichols’s desk was nestled in the corner near her wall projector and the stand where she took attendance. On the day of the observation, before the daily lesson

began, Mrs. Nichols asked, "Y'all remember Ms. Rashida from Auburn University? She's normally on the tablet observing us, but today she's here to get a look at what we do in the classroom. Now who in here is an Auburn fan?" Only one hand was raised. Mrs. Nichols and I laughed, and she replied, "Well that's alright; they like the other team." Mrs. Nichols reiterates what the students should record in their notebooks while she takes attendance. She completed attendance in approximately two minutes, checked on students who had previously been absent, and inquired about students absent on that day. After closing her computer and transitioning to what appeared to be the lesson opener, Mrs. Nichols said, "Now let's go over what we talked about yesterday." She clicked on Class Dojo and allowed it to scramble the students' names, and she chose the first volunteer to begin her review. Class Dojo is a communication application that gamifies the learning process via game-like features that allow learning activities such as logging/reporting student behavior, collecting quiz answers, tallying participation points, cataloging video uploads, tracking completed assignments, reporting student progress, and communicating with parents in real time. From this point, I began to focus on her connections to students and to science.

### **Participant 2: Tammy Wilson**

Having earned a master's degree in elementary education, Mrs. Wilson proudly represents her community by teaching in the same school district where she attended primary, middle, and high school. With over 15 years in the field, Mrs. Wilson has worn many hats aside from teaching 6th-grade science—robotics teacher, science fair coordinator, and tutor for English Language Arts, math, and science. Mrs. Wilson decided that she wanted to become a teacher during middle school as her teachers in Grades 5 and 7 "went beyond the call of duty" to ensure their students had enjoyable learning experiences: They might dress as certain characters to make



social studies more memorable or create songs and beats to teach mathematical equations and operations. Raised by a single mother and immediate family members, Mrs. Wilson knew that her teachers would always fill in the gaps if there were things that her relatives could not provide. While her desire to teach started during middle school, her desire to “give back” to her community would carry her into a teaching career, which she considers both rewarding and honorable.

Mrs. Wilson’s classroom was warm and colorful, and the drapes near her windows and the décor throughout the room were eye-catching and looked as if it was designed just for her classroom. Everything had its place in the room, including student backpacks, books, pencils, and other classroom supplies. As I entered the doorway, she greeted me with a smile, and we exchange pleasantries. As I took a seat in the same spot that I normally sat and just observed, I noticed that Mrs. Wilson had a different set of students, and they stared as if they were wondering who I was and what I was doing there. Student seating was set-up in groups or desks were lined around the perimeter of the classroom. Due to this setup, I sat in the front of the room at a table near Mrs. Wilson’s desk. The students did various things while waiting for class to start, for example, read books, worked on tablets, and made small talk. To signal the start of class, Mrs. Wilson clapped five times, and her students immediately clapped back. Mrs. Wilson got the students’ attention this way whenever she wanted her students to quiet down, wanted to start or end a lesson, or wanted to transition from one activity to the next. With a calm and soft, but stern tone, she started the lesson opener.

### **Participant 3: Meredith Richards**

Mrs. Richards has a degree in science education and, at the time of this study, was completing her master’s degree. With over 5 years in the field, she felt like she was “home”—

because she was. Mrs. Richards was once a student at the school where she is currently employed, and she is from the same town in which she currently resides. She loves science, loves her community, and loves her work. Mrs. Richards openly shares her feelings about her students, job, and reasons for becoming a teacher, stressing the importance of making a difference and showing them that there is life outside of their town. Working on several committees and projects and attending multiple science conferences and trainings annually, Mrs. Richards often brings fresh information and insight into her classroom. Mrs. Richards knew at a young age that she could benefit her community by becoming a teacher as she was taught that one of life's best rewards is giving back to others. Although Mrs. Richards loves her job, she still knows that to make a significant difference, you must position yourself to do so, which, for her, means working with curriculum and instruction at the district level. Mrs. Richards wants to promote change throughout the school district, not just for the students in her classroom.

Upon visiting Mrs. Richards's classroom, she greeted me the same way she greeted her students—with a smile and a hug. Rules and standards are posted around the room, and the desks are in groups of four, with a couple of desks strategically placed at the front and at the back of the classroom. The books in the room are stacked neatly on the shelf and labeled by grade level. As I sat at Mrs. Richards' desk, I noticed that the Smart Board was on and that the standard to be addressed that day and the opening activity were posted for the class to see. The walls were lined with crates filled with various science experiment materials, and details to set the stations for science experiments were posted near some of the crates.

As her students walked in, they all said "good morning" to their teacher and to me before taking their seats. Everyone sat quietly before the start of the lesson. Shortly after the last student entered the classroom, the bell rang, and Mrs. Richards enthusiastically said, "Guess what we're

going to see today?” Based on the posted video embedded in the PowerPoint presentation, it seemed to be related to the skeletal system and body functions. The students spoke to the people in their groups, and after 30 seconds, Mrs. Richards posed a question while a video of the x-ray simulation of a person drinking from a cup appeared. She paused the video 15 seconds into the simulation and asked the students if that had ever happened to them (the person in the video choked when drinking). Students raised their hand in agreement to note they experienced choking while drinking something. Students asked how this happened and Mrs. Richards explained how every person has two pipes in their throat; the trachea and esophagus. She explained that the trachea helps a person to breathe, while the esophagus transports food to your stomach once you have swallowed. If the flap, called the epiglottis, does not cover the larynx you can choke. The embedded video showed this happening.

### **Cross-Site Analysis**

Teachers chose careers in education inspired by their own experiences as students. Teachers took varying approaches to provide engaging learning environments characterized by colorful spaces with intentional layouts, reflective imagery—symbolizing science learning. Totalling more than 40 years over a 20-year span, teachers possessed an abundance of content knowledge in science that is observed as an asset in the learning environment. The desire to give back and emulate the practices of former teachers made the transition in the classroom effortless.

### **Themes & Teacher Attributes**

Four constructed themes came from the data: (1) Role of the teacher is believing in students, (2) Skills first, mastery second: Creating opportunities for students, (3) There is no “I” in Team: We all have a role to play, and (4) Lights. Camera. Action: Know your students. Each theme highlights how science teacher engaged learners through various pedagogical practices

and use of culture to enhance the learning environment. Table 5 provides a description of each theme and subsequent sections will unveil the correlation among teacher practices to themes constructed from the data.

**Table 5**

**Themes**

<u>Themes Identified</u>	<u>Definitions</u>
<p><u>Theme 1:</u> Role of the teacher is believing in students</p>	<p>Teachers focused on hope, high expectations, and the needs of the community to explain how the value placed upon the type of impact teachers and their teaching would and could have on their students and their development as young men and women in society.</p>
<p>Theme 2: Skills first. Mastery second: Creating opportunities for students</p>	<p>Each teacher set a foundation—introducing students to new vocabulary, note-taking, decoding passages, using inquiry-based instruction to support claims through research to prepare students to be future scientists and/or leaders in their community. By providing students with a base of knowledge, students can master concepts at their own pace, make connections, and ask questions until they discover a sense of clarity.</p>
<p>Theme 3: There is no “I” in team: We all have a role to play</p>	<p>Each teacher believes in collaboration with peers and students to make learning fun and relevant. Teachers also recognized their role and the relationships with students and other teachers as important tools in the classroom. Supporting students meant students had a say in their education and teachers worked with staff and students alike to instill a sense of pride in what they would accomplish in class.</p>
<p>Theme 4 Lights. Camera. Action: Know your students</p>	<p>Relevance often came from social media, technology, YouTube, movie clips, documentaries, commercials, music and simulations to introduce, reiterate, or culminate a science concept. Students are also able to create presentations (e.g., Prezi, PowerPoint, poster, video, iMovie) to showcase what they learned. This is also coupled with highlighting what was important to both the</p>

---

teacher and student, providing student support, and advocating for what was best for students by taking action.

---

## **Understanding Culture**

Encouraged to share how “real-world connections” in science supported student engagement in science, participants shared their understanding of culture and its connection to science education.

### **Teachers’ Understanding of Culture in the Classroom**

**Velma Nichols.** Velma Nichols, a pillar in her community, considers herself “an extension of the families in her classroom.” With over 20 years of teaching experience in her county, she has a solid understanding of her community and maintains this by establishing and cultivating relationships with her students and their parents, some of whom are her former students.

### **Defining Culture by Velma Nichols**

Mrs. Nichols uses community-based, real-world examples to connect science concepts for her students because she understands that cultural references validate the concepts she teaches. When asked to define culture during the interview, she stated:

Culture is made up of the customs upheld by different groups of people. It can be broad for example; my grandmother’s generation grew up in the Depression, so it was her culture to be a minimalist when it came to spending money. At the same time culture can be specific. We have a community of people [right here in town] who eat white clay mined from the sides of the [Artesian] River bank. Culture is found within races and gender. Culture affects how we see skin color, religious differences, poverty, and lifestyles, just to name a few.

With an understanding of what culture is and whom culture impacts, Mrs. Nichols expressed that she uses people, objects, buildings, businesses, plants, and factories to make sense

of the world outside of their small town. She stated, “I don’t go out of my way to say ‘hey, I’m using culture,’ I just know what makes these kids learn and what I can reference to get my lesson across to them.” Mrs. Nichols acknowledged that she may not always use the best examples, but her students assist her by posing questions themselves or providing examples to which the rest of the class can relate. Although she attempts to make everything she teaches relate back to the community in meaningful ways, this was not evidenced during every observation. However, Mrs. Nichols displayed an understanding of culture and highlighted the ways she is both similar to and different from her students. With a love for teaching science, Mrs. Nichols believes that as a teacher, she

is a facilitator where students are taking charge of their own learning through exploration... I help direct a lot of activities to their everyday lives...preparing these kids for high school and for college, possibly having a career in STEM.

**Tammy Wilson.** Tammy Wilson takes pride in her teaching abilities and her willingness to collaborate with others to develop science materials, prompts, activities, and field trips that resonate with her students. As a person who loves to learn, she creates spaces in her classroom that prompt her students to want the same. In a community where everyone knows everyone, staying connected and going the extra mile is not difficult for teachers at Stanton Elementary School; it is a part of their identities as teachers.

### **Defining Culture by Tammy Wilson**

Understanding the vast differences in people, Mrs. Wilson believes that all people should see the things that bind us together as opposed to those things that separate us. When asked about her thoughts on culture and how she would define it, Mrs. Wilson responded, “Ooooh, that’s a good one and that’s hard...(long pause)...ummmm, I think culture is different personalities, different backgrounds where people from all over can come together to learn common

objectives.” Stating that “different cultures do things differently and that we sometimes learn best by learning from others,” These sentiments were reflective of Mrs. Wilson’s teaching style. Finding cultural references valuable in science lead to fun and informative science lessons.

**Meredith Richards.** Meredith Richards perceives her role as an educator to be in the best interest of her students at all times. As a native of community she understands the community, the students, and the dynamics of the elementary, middle, and high schools. While her experiences as a young woman in El Dorado county do not mirror the experiences of her students, she can relate in ways that others coming from outside counties, school districts, and states may not be able to relate.

### **Defining Culture by Meredith Richards**

Mrs. Richards use common community and house-hold items to bring relevance to science. Culturally, she centers science within the Black/African American community and not trying to center the Black/African American community in science. When asked to define culture, Mrs. Richards explained culture as “pretty much like the environment in which these kids, not just learn, but how they live. Culture can be as far as music, religion, food...all different aspects of life and a person’s culture.” Her definition of culture mirrored what scholars would reference as *essentialism*. Sleeter (2011) discussed the ways teachers *essentialize* culture by focusing on food, fun, fashion, and fables to highlight to the diversity that exists among racial and ethnic groups. In doing this, a disservice is done to students who are unaware of the fact that culture embodies much more than glorified holidays, dance moves, and food choices. Her response to this question prompted me to inquire about her use of things like food and music to enhance the learning experience. She stated:

Ummm...again...going back to whenever we talk about food...ummmm, trying to get them to understand calorie intake and salt intake and things like that so that they

understand how that plays a major role on blood pressure and different types of medications that are prescribed that impact insulin use. So, a follow-up question is to ask, why is insulin important and how does that relate back to their food choices and food intake and things of that nature. There is a reason and cause for a lot of things that we do, and science helps to explain it...there's scientific evidence for everything we do.

Mrs. Richards's connection to food seemed to be personal—one rooted in the community—but also due to the misuse and abuse of food in the Black community and around the world in general. As Mrs. Richards's researched the level of access people of color in rural areas have to fresh produce compared to those living in other regions, she noticed that your "farmer's markets" or organic based food were not in reach to the community, not too many could afford the foods that were healthier. What she noticed was the vast number of fast-food restaurants in her community. It became a priority for Mrs. Richards to point out the differences to her students and allow to make decisions about what they decide to put in their bodies.

### **Cross-Case Analysis**

Participants acknowledged in very broad descriptions that culture and "real-world connections" are synonymous. Shaped by people, experiences, interactions, culture is acknowledged as a fluid concept, how culture will influence individuals is unpredictable, and has the ability to involve anything and everyone where a connection – formal or informal—is established. Participants noted that to understanding culture is to understand one's self, one's students, and the community. Although each participant provided similar descriptions of culture, the execution of the concept varied by teacher.

### **Themes: Teacher Pedagogical Practices**

As practitioners in education, teachers establish identities in their classrooms to create and deliver comprehensive lessons that are personal and unique to both the teacher and to his or her students. As part of establishing this identity, teachers can go to great lengths to not only emulate best practices, but to also promote the practices they believe are beneficial for all



students. From using hands-on teaching strategies to extending learning opportunities outside of school hours, some teachers use a variety of methods to meet their students' academic, social, and cultural needs.

As the researcher, working closely with each participant revealed to me that every teacher has a unique set of qualities that speak to her identity as a teacher and as an individual. These teachers have found ways to cultivate relationships, advocate for students' rights, and become role models in their classrooms, and these attributes were visible from 2015 (at the start of my involvement in the grant program) to the present. During both the interviews and the observations, I saw instructional practices vary from class to class. However, there were four areas, or themes, highlighted throughout the data collection process: (1) *Role of the teacher in believing in students*, (2) *Skills are first, mastery is second: Creating opportunities for students*; (3) *There is no "I" in team: We all have a role to play*; and (4) *Lights. Camera. Action: Know your Students*.

### **Theme One: The Role of the Teacher is Believing in Students**

Teachers within this study provided distinct ways of connecting with students in their science classrooms. However, among the three teachers, their philosophy of teaching was similar in regards to their role and significance as middle school classroom teachers. Participants held themselves to a high standard—a standard of accountability in the preparing the next cohort of skilled professionals in STEM. The belief to instill a sense of self worth in African American students focused on the ability to a) empower students, b) add value to the science curriculum, c) encourage students to set goals, and d) cultivate learning environments where students would have opportunities to experience some form of academic success.

Teachers noted their hope for their students as they transitioned through life, why learning should be limitless, the significant role teachers played in supporting student growth and development, and lastly, the importance of cultivating relationships with students.

**Believing in Students.** The belief of student ability and success is a disposition that teachers within this study formulate as part of their teaching philosophy. The notion of success a teacher desires for one's student is a manifestation of hard work, actionable mechanisms, and support a teacher believes is necessary to yield specific outcomes. Evidenced in this study, it is the belief that students are capable of learning due to knowledge acquisition varying from person-to-person. From the example of "hope," "expectation," and "relationship building," teachers adopted support mechanism they believed enhanced student learning and academic success, to which speaks to their decision to pursue a career in teaching.

**Teacher:**

...you gotta make sure they study, you gotta make sure you protect them, that you covet them and keep them from harm and from them being exposed to things they don't need to be exposed to..."

The general notion of believing in students and taking a vested interest in student's stem from their experiences as teachers and their interactions with teachers during their matriculation through elementary school, middle school, and high school. For teachers in this study, words of affirmation, the conversations about life, the importance of a quality education, purposeful decision making did reflect teachers' stance of the type of support students would require from them.

The role of the teacher became synonymous with each teacher's philosophy about teaching—"if not me, than who? Who will challenge them? Who will motivate them? Who ensure they explore all their options?" Living in a small, isolating, and rural provinces can limit

the type of opportunities and level of exposure students are provided. Outside of day-to-day interactions, teachers made it a priority to highlight opportunities and information regionally, nationally and globally.

**Teacher:**

“...my students really connect when we talk about the human body and start to talk about different diseases and things that are relevant to our culture...it’s a very high percentage of African American students in my school, so when we start to talk about diabetes, the sickle trait, these are just some of the things they can relate to...it’s their culture...the high blood pressure, body systems, and other things are genetic diseases that I need to find very innovative ways to teach them about how to live a healthier life.”

Beliefs about teaching and the role teachers adopted to support student learning became actionable efforts evident in and outside of the classroom environment. Efforts focusing on science applications in middle school-initiated dialogue to reflect students needs. Although all attempts to support students learning through instructional mechanisms (i.e., hope, expectations, and relationship building) did not always yield desired outcomes, teachers continued to support student learning and academic success by adhering to a core belief system that all students deserved the support and tools to achieve success in science.

**Theme Two:  
Skills First. Mastery Second: Creating Opportunities for Students**

**Creating opportunities.** Creating opportunities for students to succeed set the platform to measure student progress in science. Teachers cultivated science instructional practices to illuminate the process of knowledge acquisition for African American students and further support student acquisition of critical thinking skills. Gaining foundational knowledge in science coupled with cultural associations acted as a gateway for students to master science concepts, rather than act as a gate-keeper to hinder students progress. I found that ability to think outside the box supported teacher development looking beyond the instructional resources provided in

state issued textbooks to create learning opportunities that spoke to language differences (i.e., code-switching), family customs, community/school traditions, consciousness of self and others. Learning in many ways was customized to expound on culturally relevant instruction. Teachers used various characteristics of culture to act as the core tenet to teaching middle school science curriculum. Teachers encapsulated the element of care

**Teacher:**

“[We] bring to life things that [students] have never seen with their own eyes...we examine it and we talk about it.”

Teachers emphasized inquiry-based instruction as a format to create validating questions to promote thoughtful and engaging conversations. Using this approach, teachers examined cultural connections within the community to create a foundation in science-based concepts. Noting the science textbooks lacked sufficient information to support the learning of African American students, teachers utilized outside resources to bridge connections and establish a foundation in science from a cultural lens.

**Teacher:**

“ I like to learn different things...anything that will help my students...once I learn it, I got it, and I use it. I buy materials I need over the summer and practice with my lil man (her son) and I show him what I’m planning to do...we discuss it and then I come to do [the lesson] in my class.”

Teachers expressed the need to further their own education to meet the growing instructional demands in the classroom. Learning how to connect science from a cultural perspective was often confusing for teachers but using elements of culture acted as a learning tool to understand how science fit into the lived experiences of their students, and further supported student learning in science.

Core tenets within theme 2—creating student opportunities to learn basic foundational science concepts and cultural connections—illuminated teacher ability to step outside of traditional and standardized instructional practices to differentiate learning. Through the enactment of technological frameworks as Edmodo and Google classroom, teachers utilized online platforms that promoted a student-centered learning environment and increased student-teacher dialogue and collaboration. Teachers believed that to foster a learning environment in science warranted multiple pathways toward acquiring knowledge (i.e., vocabulary development, differentiated instruction, technology, student-centered and student-led classrooms); co-facilitating activities that students find meaningful, unrestrictive, and interactive. Creating opportunities applied to both teacher and student. Teachers cannot teach what they do not know.

**Theme Three:  
There is no “I” in Team: We All Have a Role to Play**

**There is no “I” in Team.** This phrase symbolizes teamwork and collaboration as vital components to teaching science from a cultural lens in a rural setting. Collaboration acted as the core component to enacting culturally congruent practices. Teachers understood they were the experts of the science curriculum, but understanding cultural dispositions was joint effort among teachers and students. Teachers believed in order to grow in areas which are unfamiliar, transparency of what is known is required. Teachers were open about their upbringing, what they have experienced and learned as teachers, but despite their years in the classroom, merging science into the lived and cultural experiences of the students is a difficult task to master. Being a team player requires that teachers know when let others lead. Teachers have noted the benefit of facilitating spaces where students feel comfortable taking the lead; leading discussion and/or posing pertinent questions.

**Teacher:**

."I facilitate...but knowing when to step back and let [students] lead and come up with a problem to solve on their own...see if they can solve it using the tools they [have] kids will learn more when they can solve a problem."

Becoming a team player and supporting students as they learn speaks to the role the teachers believes they must adhere to. It also speaks to the intention and added value of working together to achieve a goal. Teamwork adds value and holds individuals accountable for his/her actions. It presents opportunities for students and teachers to contribute to the overall learning process and share knowledge of topics to others.

**Teacher:**

"We need to remind them of who they are...how are they supposed to act...and that they have goals and can reach those goals...I have to have those high expectations of them...letting them know that I'm proud of them—being their cheerleader...All the things I was taught as a student teacher I learned to give those things to my students...my teachers were very hands-on...we had a chance to get out into the community and learn about life, our town, and each other. I left school with a love for science and knew that I would be a science teacher because I wanted to give my students what my teachers gave me—hope, an appreciation for life, and a love for science and the outdoors."

The core tenets of theme 3 illuminated the innerworkings of teamwork and collaboration. Learning from a constructivist lens lends an understanding that learning is heightened when people interact with one another, engage in conversation with another, or having the ability to make observations of others. Teachers believed that working as team, receiving feedback from a peer, and engaging in healthy conversation enhanced student learning.

**Theme Four:**

**Lights. Camera. Action: Know Your Students**

As the final theme constructed from this study, meeting students where they are culturally, socially, and academically requires the teacher to possess a bit of knowledge about the students being taught. Teachers understood that students learn differently and respond differently to various learning tasks to which yields approaches that are effective to meet the needs of the

learners. The elements of “care” and “concern” initiated relationships between students and teachers. Viewed as another pathway to success, teachers devoted time to develop relationships with students, parents, and within the community. Teachers believed it was important to collectively support student learning by involving parents in the learning process by informing parents of student academic progress, but to also to create opportunities to showcase student talents.

**Teacher.**

..”being able to explain, touch and feel an interact with things is more of a better learning experience than reading it from a book.”

**Teacher:**

“...everyone gets to participate...they get to measure, find things...the hands-on portion...it’s impressive because when you find out that something is working they all get involved...and when it’s not that lets me know that I need to switch it up.”

Relationship building became an essential skill used by teachers to create learning opportunities for students. Teachers used church references, health disparities, and popular movie scenes to build upon student relationships and customize instruction for students.

Teachers noted the better the relationship, the better the connection in the classroom.

**Teacher:**

“Making things or try to make things tangible... is making sure the curriculum in tangible as possible...being able to explain, touch and feel an interact with things is more of a better learning experience than reading it from a book.”

Teachers rarely placed stipulations on what students could do showcase their work. Learning how to navigate various applications, teachers created projects for students to highlight what they learned in the format of their choice. Whether students created presentations about photosynthesis, iMovies to describe the influence of the Supercontinent and Pangea, conducting

interviews to acquire information of individual consumption of drinking water or sugar-based drinks, co-producing music videos about atoms and organisms, creating graphic organizers on the effects of sport drinks on the body, or simply writing a research paper on the health disparities persistent in the African American community, teachers believed in providing options of how students decided to showcase their new knowledge and use this knowledge to inform others—this, providing an array of learning tasks and directives to support student learning.

### Frequency of Learning Tasks and Directives

The information below gives an overview of the directives and frequency of learning tasks observed in each classroom. The asterisk next to each name in each column indicated if the learning task was observed. A description of each task is provided, explaining how each task was viewed in each learning environment. The learning tasks link to the CRP framework in many ways. The frequency of learning task addressed how teachers engaged their students (e.g., opener), supported academic achievement (e.g. notetaking), used students’ culture (e.g. class discussions), and promoted critical consciousness (e.g., class discussions). Teachers used the learning tasks to create lead-ins and openers into lessons and often summarized the lesson with a connection within the community. During class discussions, teachers use community-based examples, the lived experiences of the students and herself to bridge learning gaps and enhance science connections. Table 6 provides a glimpse of how teachers use culturally relevant pedagogy in science. While Table 6 does not include a comprehensive list of all methods used by each teacher, it does provide a snapshot.

**Table 6**

**Learning Tasks: Frequency of Teacher Directives during Observations**

Learning Task	Frequency	Teacher	Description of Task
Opener (Activate & Interactions = AI)	<i>Daily</i>	Nichols* Wilson* Richards*	Begins the lesson by posing a question, showing an image, or playing a video to capture the attention of the class. Follows the opener with a series of questions



			for students to ponder (e.g., How does a hot air balloon stay in the sky? How are you able to swallow without choking? How small is small...centimeter...nanometer?).
Notetaking/ Notebooking	Daily (2-3 reminders of its importance)	Nichols* Wilson* Richards	Using an interactive notebook or notebook ringer, students recorded information (i.e. vocabulary) and key facts pertaining to the lesson. Notebooks are checked weekly for a grade and to keep students accountable.
Edmodo/Class Dojo	Daily	Nichols* Wilson* Richards*	Teachers use forum to post assignments for students to review and to keep students engaged in the lesson. (Class participation & accountability).
Assessment (pre-/post test)	Daily	Nichols* Wilson* Richards	Teachers provide pre- and post-assessments to track information learned throughout by the end of the lesson.(i.e., 3-4 questions).
Activity: Written (Handout)	Daily	Nichols* Wilson* Richards	In class worksheets are provided for students to highlight, underline, circle terms/phrases to gather pertinent information about the lesson topic. Handout is placed in notebook. Graded during weekly notebook check.
Activity: Interactive (Group Work + Collaboration = Hands-On Learning)	Daily	Nichols* Wilson* Richards*	Students work together to solve problems, discuss scenarios, build or inspect a product, or work in centers/lab to complete a given task.
Video	1	Nichols* Wilson* Richards*	Class videos are shown to highlight the importance of the lesson (e.g. National Geographic, Youtube clip, movie clip). Videos are followed by questions to check for understanding and probe and get students thinking.
PowerPoint Presentation	Daily	Nichols* Wilson* Richards*	Teachers present content in the form of a presentation for students to follow. Periodically, students create presentations at the end of a unit grade for a grade.
Class Discussion/ Community related example	Daily	Nichols* Wilson* Richards*	Students engage in conversation with teachers and peers to brainstorm topics. Using community-based examples to make connections. (Food choices (heavy carbs) can lead to bad diets and sickness (diabetes/high blood pressure), safe drinking water (bottled or tap?), best sports drink to hydrate the body and replenish electrolytes, and the effect of alcohol on our organs. Students have the opportunity to gain knowledge and give knowledge.
Closing (Review & Reflect = R&R)	Daily	Nichols* Wilson* Richards*	Recaps the lesson and students record what they have learned; takes a post-test that is graded for credit (all information is kept in notebook for review). Questions are posed to address misconceptions or misunderstandings.

**Science lesson plans.** Data from lesson plans were collected to support teacher use of culture in science. Teachers used lesson plans to outline step-by-step processes to help students

meet learning goals. Lesson plans are often personalized to meet learners' needs and address content standards. In the current study, lesson plans, the third data source, were used to examine the extent of "real-world" connections that were planned and anticipated to substantiate learning outcomes in the teachers' science courses.

Document analysis of lesson plan did not yielded results that aligned with the hours of planning supposedly used by teachers each week, however, the display of information was evident but in the delivery of each lesson. However, this was not seen within the submitted lesson plan. When asked to view lesson plans in which teachers incorporated culture, I was given lesson plans that were not developed by the teachers but were generated by a third party. Producing generalized lesson are not uncommon for teachers to submit, however, lesson plans are a guide to how lessons are delivered in the classroom. In addition, some of the plans were printed from online resources, were extracted from teacher resource books, or were not submitted by the end of the study. Although the lesson plans provided were not authentic to the cultures of the students being served, the generated lesson plans provided teachers with scripts, actions, ways to engage students in conversation, actual handouts to use, and ways to culminate the lessons for the students. Lesson plans did provide a general overview of concepts that related to national issues like alcoholism, obesity, and climate change. Considering the numbers of hours supposedly devoted to lesson planning each week, I made the assumption that a detailed description about lesson chunking and/or scaffolding to meet the social, academic, and cultural needs of students would be provided.

### **Cross-Site Analysis**

In this study I was able to unveil four constructed themes from data collected from three participants: Mrs. Nichols, Mrs. Wilson, and Mrs. Richards. Each participant having a similar

definition for culture, utilized dimensions of culture differently to teach science. However, each participant believed in the following: 1) teachers had a vital role in the success of their students, 2) students had to acquire certain skills (i.e., vocabulary, self-assurance) before learning could be advanced, 3) working together as a team can yield great results, and 4) to make learning engaging and fun requires an understanding of what students consider engaging and fun.

### **Theme 1: Role of the teacher is believing in students**

To believe in student is to believe that a student is capable of learning and is able to achieve a set goal. As a teacher, the notion of supporting a student requires that one believe that a child can, and will be successful. It may require additional resources, additional time, but the idea remains: the teacher will support students until they reach a specified goal. For participants within this study, hope, expectations, and reach one, teach one describes how each teacher found a unique way to support the learning of their students. Planting positive words of affirmation becomes the core element within this theme.

Participant Nichols would say, “don’t let anyone define what you can and cannot do—just keep working,” Wilson’s belief in students came in the form of, “you too can become the scientist that changes the world.” For Richards, she would say, “become the change you want to see.” It was knowing that students did not have to wait until they were adults to be great or the experience success in science, they could start now and cultivate their love for science, their community, and the world as 6<sup>th</sup>, 7<sup>th</sup>, and 8<sup>th</sup> grade students.

**Hope.** Hope was described by Mrs. Nichols as a means of providing options for her students—constantly informing her students could have a successful, both in and outside of their small town. It was creating an image—a vivid picture—of what exists beyond their town, but

encouraging her students to see science at the gateway to fulfilling one's dreams and being exposed to many opportunities.

**Expectations.** Setting expectations for Mrs. Wilson centered around explorations beyond her classroom. She allowed her students to conduct research to support a claim or clarify a concept. She believed that everyone was destined to succeed despite their academic progress. She believed in her students and she made sure they believed in themselves as well.

**Reach one, Teach one.** Using herself as an example, Mrs. Wilson spoke of her successes as a graduate of the same schools and a member of the same community. She reassured her students that she was successful because she had teachers who believed in her, encouraged her while she was in school, and exposed her to things that changed her life for the better. She too felt that the need to do for her students, what was done for her.

## **Theme 2: Skills 1<sup>st</sup>, Mastery 2<sup>nd</sup>: Creating opportunities for students**

The theme of prioritizing skills and following this with mastery was inherently evident in each classroom and from each teacher. Participants began their lessons with “the basics,” such as vocabulary (i.e., decoding), brainstorming activities (i.e., writing freely in notebooks and using graphic organizers), note-taking (e.g., looking for key words and phrases), and speaking and writing.

**Learning without boundaries.** Learning without boundaries describes how Mrs. Nichols used any and every resource available to create a base of knowledge for students. She challenged her students to know the basic elements of science in order to advance throughout the lesson. For instance, during her gallery walks (walking around to observe student behavior) to each group, Mrs. Nichols (Participant 1) would say something similar to, “If you can't tell me what you're talking about, then you don't know what you're talking about.” This reference was used to help

students understand that dialogue and comprehension go hand-in-hand. As students stumbled over information, she would offer examples such as:

You know how you're sitting at your grandmama's house on a warm summer day and she has the fan blowing? Have you ever wondered who created the fan, the motor, or what power source is allowing the fan to operate? In your station you have a smaller version of that motor system. Why don't we take it a part together and see what's inside.

As part of this lesson on electricity, waves, and information transfer, the students reviewed electrical components, and the students needed to be familiar with certain vocabulary words (e.g., capacitors, diodes, integrated circuits, resistors, solar cells) to conduct the associated lab experiment. The students were supposed to be able to recognize that power sources came in different shapes and sizes and served one purpose—to provide power.

**Care.** Care is devoting time and effort to see students gain the necessary skills to succeed and shine. It was not just about succeeding in Mrs. Wilson's class, but ensuring students would do well even if they were not in her presence. The amount of time Tammy Wilson (Participant 2) spent on vocabulary words in efforts to build students' background knowledge was interesting. To me, it seemed excessive and almost like a misuse of time when the students would spend an entire class period creating t-charts, looking up words and definitions, reading passages to understand terminology, writing sentences using the words, sharing meanings of words, and discussing the sentences they wrote. However, Mrs. Wilson knew her students and how they learned best. She explained that she introduced vocabulary this way due to the amount of information the students needed to learn and review throughout the week. She further noted: "If I create the time for them to learn the necessary vocabulary, it makes the activities I present throughout the week easier for them to grasp." With limited blocks of time with the students (i.e., 60 to 75 minutes) many ongoing in-school activities (e.g., club meetings), intercom interruptions, and study hall pullouts (students are excused from class to receive tutoring services), this heavy

focus on terminology is understandable once Mrs. Wilson was able to explain why she made vocabulary a focus in her class.

**Differentiation.** Differentiation is using a series of resources that are student driven to ensure each student has an opportunity to learn and master the content. Meredith Richards (Participant 3) always started a lesson with a scenario or storyline to introduce vocabulary. By embedding new terms into a storyline or scenario, she innovatively connected science to the real world. She would also show images that allowed students to make visual connections with the terminology. This student-friendly lesson format fostered conversations that helped the students correlate basic terms with technical/scientific terms, and this approach was effective because Mrs. Richards understood that every great story should have a great storyline.

The emergence of a theme related to the process of focusing on *skills first* and *mastery second* captures the importance of teachers helping their students build knowledge in science. Learning vocabulary boosts students' literacy skills (Harmon & Wood, 2018), and a lack of literacy skills is a barrier to reading comprehension in middle school classrooms, particularly in rural and urban settings (National Assessment of Educational Progress [NAEP], 2014). As the teachers engaged in a variety of approaches to teaching vocabulary and fostering literacy skills, it is evident that vocabulary is essential to comprehension. The teachers in this study showed that learning vocabulary does not have to be monotonous in nature or filled with mundane routines to be effective—learning vocabulary can be insightful if teachers discover ways to make their approach to learning vocabulary purposeful and engaging.

### **There is no “I” in team: We all have a role to play**

This theme speaks to the collaboration and time that teachers spent preparing their students to master grade-level goals (benchmarks) as well as teacher-set and student-led goals. It

requires time, effort, and patience for teachers to teach students from backgrounds (i.e., racial, ethnic, cultural) that are the same and different from their own. All the participants sought some type of support to teach their science classes (e.g., attended workshops and summer conferences, co-taught classes, preplanned group meetings). Teachers also welcomed ideas that the students gave them to create plans that were engaging.

Collective collaboration was evident in classrooms taught by Mrs. Nichols, Mrs. Wilson, and Mrs. Richards. Each teacher was an active participant in the STEM partnership program and utilized the resources provide by the program to gain insight into advanced science concepts and teaching strategies. Each teacher attended the conferences and professional development sessions offered by the STEM partnership. Collaboration took place inside the classroom with their students, but also outside of the classroom with their peers. Mrs. Wilson noted:

“I’ve had teachers call me...like the one teacher out there...you know the one in Elk Grove and ask about a lesson I’ve taught, and I’ve done the same if I was struggling to get a message across. We work really well together, and I’ve learned a lot by being in the group. I don’t know everything and sometimes people give ideas about things I’ve never even thought.”

Strengthening her knowledge in science and participating in the STEM partnership presented opportunities for Mrs. Wilson. She was asked to present modules at a conference. She noted:

“I was lucky to teach four of Terri and Shawn’s module [to my colleagues] at the conference. Once I learn it, I got it, and I use it. I buy the materials I need over the summer and practice with my [son] at the table and then I come do it in my classroom.”

For Mrs. Nichols she collaborated with her colleagues by noting:

“it’s like if I’m teaching a lesson about metric units, I will collaborate with the math teacher to see what he’s working on, so we help one another teach the same

information—students get double the help from the both of us. I’ve also collaborated with the English teacher to incorporate vocabulary into our lessons, so once again, students get a double dose of the information.”

As a suggestion from her principal, Mrs. Richards collaborates with the entire 8<sup>th</sup> grade level team and with the science teachers in her school, grades 3<sup>rd</sup>- 8<sup>th</sup>. She noted:

“as a team we do linear team planning where we work together to share what are students need to learn each and our goals to getting them there. We note who is behind grade level and we work to get them on grade level. I also work with the science teachers so we can review what they will need to know by the time they get to me. Honestly, by the time I see students, what I’m talking about should be a refresher for them, but it should definitely be a review for them by the time they reach high school. We are trying to make sure we do what we can do now to ensure they are successful when they leave us.

### **Lights. Camera. Action: Know your students**

This theme is related to the use of technology and computer-based applications in the classroom. The teachers in this study used several resources and social media outlets to aid in the delivery of science content. As differentiation looks different in every classroom, teachers have found ways to keep their students engaged using products that the students enjoy using and find useful. For the teachers within this study, they always provided options for their students to choose from and students were able to go at their own pace and ability. Mrs. Richards noted:

“we’re transitioning into technology so a lot of the engagement that my students are taking in is coming from a lot of technology like Edmodo or Google classrooms. Usually I use those lessons that I get and try to incorporate them on there. So we’ll have full discussions [about the lesson] online where they are able to see how others think in the room, as well as, keep track of their learning.”



Mrs. Richards noted this was good change for her class—presenting lessons in this format. She felt students needed an additional pathway to connect with her (i.e., absenteeism, IEPs, ILPs) and their peers.

Mrs. Wilson often used movement and movie clips to highlight science concepts. She noted:

“I know they like to dance and rap...its like so much a part of their culture, so lately I incorporate assignments that allow them free range to express themselves and what they’ve learned in class. They will work in teams and have some to record one them...they do the editing and make the changes by adding information and they have a week to put it together....then we make an iMovie. We make one big movie and watch it on Friday. It gets their attention because they want to do it, some even request to do it, and its graded...so it’s like they’re taking pride in their work because everyone will see it.”

Mrs. Wilson also noted the movie trailer for the animated picture Ice Age. Her students were learning about plate tectonics and Pangea. Although the students saw the movie several times, they never made the connection to what was happening. Mrs. Wilson used their knowledge about the film to help them make connections throughout the week-long lesson. She posed questions and students provides responses to support why the supercontinent split.

Mrs. Nichols used technology to get her students more active in her lessons. She noted:

“sometimes they would just sit there...it was like I was talking to myself...it was getting really frustrating because they would ask questions after class and then I would ask why they didn’t say it in class because it was a good question, I’m sure, everyone else was thinking about too. So I started using this program that randomly assigned groups and randomly called on students. With a bit a probing during the lesson to jar their memory about other things we’ve done and explanations of why this method was great for everyone—students started to come around. Now, they still huff and puff if they don’t get

to hang with their friends, but I remind that I didn't choose the group (laughs) and that we are here to learn from everyone.”

### **Addressing the Research Questions**

In Chapter 5 you will read how the research questions within this study align with the data collected from each participating teachers. You can expect to see similarities among the participants as they define culture, how culture manifests in their science classroom, and how much of the participants' practices aligned with the theoretical framework, culturally relevant pedagogy (CRP). CRP is noted as a form of “good teaching” and the use of students' culture is noted as “vehicle for learning” for minority populations—particularly African American youth (Ladson-Billings, 1995). This study will highlight how rural middle school science teachers approach instruction and in what ways does their practice align with the pedagogical and cultural framework known as CRP.

## **CHAPTER 5:**

### **DISCUSSION**

The purpose of the current study was to explore middle school science teachers' perceptions of culture, the way these perceptions inform their pedagogical practices in science education, and the cultural nuances these teachers use to enhance and support learning for Black students in rural settings. Several details about the teacher participants were uncovered to illuminate their individual teaching styles, such as the factors that led them to become teachers, their use of culture as a basis for learning, the manifestation of cultural underpinnings in the

science classroom, and evidence of the culturally relevant pedagogical framework, all of which were essential to the dissemination of science concepts.

Scholars have documented culturally relevant pedagogy (CRP) as a viable solution to narrowing the achievement gap. In science education, culturally relevant education brings value to a discipline that has, historically, been labeled as *culturally incongruent* to the needs of culturally diverse student populations. Interviewing and observing the teacher participants over the course of this study provided valuable insight into culturally relevant instruction in science as well as into the ways rural science teachers approached instruction through cultural referents.

The research questions guiding the current inquiry include the following:

- (1) How do middle school science teachers define culture?
- (2) How do teachers' definitions of culture manifest in science instruction in the middle school classroom?
- (3) What evidence of culturally relevant practices are observed in a sample of middle school teachers selected for potentially enacting culturally relevant pedagogical practices within science education?

### **Reconnecting with the Pilot Study: Connecting the “Real World” and the Classroom**

Embracing culture in science classrooms can be beneficial to students as educators attempt to engage them in meaningful learning experiences. The underrepresentation of Black professionals in science, technology, engineering, and mathematics (STEM) fields leads us to ponder the reasons that Black men and women do not enter these professions. Additionally, statistics (NAEP, 2009, 2013, 2017) show that students of color, particularly students who identify as Black or African American, trail behind their peers in science and across many other disciplines.

In the pilot study the instructional practices of middle school science teachers in a southeastern state were examined. Teachers were interviewed about the ways they enhance student learning in science. Participants, including the three teachers chosen for this study, noted “real-world” examples and connections were incorporated throughout their science lessons to make them relevant and engaging. However, some of the inconsistencies detected between these teachers’ words and their actions from part 1 of the study incited my interest in their definitions of culture and the correlation with “real-world connection,” and their related pedagogical practices. Although teachers were able to articulate how they bridged learning concepts, they had misconceptions about inquiry-based instruction and the 5Es (i.e., engage, explore, explain, elaborate, and evaluate) of instruction. Teachers understood inquiry-based instruction and 5Es to be synonymous with hands-on learning. Although elements of inquiry-based instruction and the 5Es allow for hands-on instruction to be present within the lesson, it also requires a level of critical thinking, on-going evaluations, and explorations to assess what students have learned.

Studies have shown that cultural nuances, sayings, and representations are socially constructed and are learned and transmitted as byproducts of human interaction in communities, organizations, and professions (Meyers & Crawford, 2011; Milner, 2014). Although some cultural characterizations are common among groups of people from homogeneous and heterogeneous racial/ethnic groups, the meaning of cultural acts can differ. The current study is an extension of pilot study to unveil the “real world” connections that teachers have linked with making cultural connections to enhance students’ knowledge and engagement in middle school science classrooms.

### **Approaches to Learning: Four Themes**

Four overarching themes emerged from the data as representations of the ways the teacher participants approached learning in their science classrooms: (1) *The role of the teacher is believing in students*; (2) *Skills are first. Mastery is second: Creating opportunities for students*; (3) *There is no “I” in team: We all have a role to play*; and (4) *Lights. Camera. Action: Know your students*. Table 7, originally presented in Chapter 4, provided details about each of these themes.

---

**Table 7**

**Themes**

---

<b>Themes Identified</b>	<b>Definitions</b>
<p><b>Theme 1:</b> Role of the teacher in believing in students</p>	<p>Whether the teacher focused on hope, high expectations, or the needs of the community, each participant thought deeply about the impact of their teaching on students.</p>
<p><b>Theme 2:</b> Skills first. Mastery second: Creating opportunities for students</p>	<p>Each teacher sets a foundation—introducing students to new vocabulary, note-taking, decoding passages, using inquiry-based instruction, and support claims through research as a way to prepare students to be future scientists and/or leaders in their community. By providing students with a base of knowledge, students can master concepts at their own pace, make connections, and ask questions until they find what they are looking for.</p>
<p><b>Theme 3:</b> There is no “I” in team: We all have a role to play</p>	<p>Each teacher believes in collaboration with peers and students to make learning fun and relevant. Teachers also recognized their important role and the relationships with students and other teachers as important tools.</p>
<p><b>Theme 4</b> Lights. Camera. Action: Know your students</p>	<p>Relevance often came from social media, technology, YouTube, movie clips, documentaries, commercials, music and simulations to introduce, reiterate, or culminate a science concept. Students are also able to create presentations (e.g., Prezi, PowerPoint, poster, video, iMovie) to showcase what they learned. This is also coupled with highlighting what was important to both the teacher and student, providing student support, and advocating for what was best for students by taking action.</p>

---

## **Embracing Culture Within the CRP Framework**

Embracing the CRP framework is embracing the idea that children thrive in environments where culture is used as bridge-builder in the classroom. Understanding the cultural nuances that impact social, political, and economic structures further supports student learning. Ladson-Billings (2009) noted, “the notion of cultural relevance moves beyond language to include other aspects of student and school culture...to maintain and transcend the negative effects of the dominant culture [and able to] identify with African or African American culture” (pp. 19–20).

Cultural relevance in science education has become a common area of concern among scholars in the field based on the dismal academic performance of minorities in science and the lack of representation of minorities—particularly of African Americans in STEM fields. Thus, actions performed in science classrooms are shifting due to teachers’ cultural attitudes and beliefs (Atwater, Freeman, Butler, & Draper-Morris, 2010).

## **Addressing the Research Questions**

### **Research Question 1**

The first research question that guided the current inquiry was, *how do middle school teachers define culture?* Understanding culture means understanding that the concept of culture is not bound by specific characteristics. Broadly defined in education as a fluid, complex construct (Atwater et al., 2013; Howard, 2018; Milner, 2014), *culture* is ultimately conceptualized as a system of beliefs, values, behaviors, and actions that are based on a series of socially constructed events within one’s environment and through the interactions one encounters and experiences with others. The participants’ understanding of culture was similar

and incorporated a range of associations to their culture, the students’ culture, the community, and society. Their definitions are presented in Table 8.

**Table 8**

**Teacher Participants’ Definitions of Culture**

Participant	Definition of Culture
Velma Nichols	“...Culture is made up of customs and beliefs upheld by different groups of people; it can be generational or specific to a region; it affects how we see skin color, religious differences, poverty, and lifestyles.”
Tammy Wilson	“...Culture is different personalities, different backgrounds where people from all of the can come together to learn common objectives.”
Meredith Richards	“...Culture is pretty much like the environment in which these kids, not just learn, but how they live. Culture can be as far as music, religion, food...all different aspects parts of a person’s culture.”

To understand these teachers’ perceptions of culture and the ways they used cultural connections in science, I asked them to tell me about their upbringing, their academic experiences, and their reasons for becoming teachers, specifically middle school science teachers. Social constructivism informs us that our environments and interactions can shape viewpoints of the world, so it was essential that I learn more about these individuals before asking them to define culture. As seen above in Table 11 participants had similar meanings of the term, seeing culture to include the way a person lives, thinks, and learns. Culture is all around us—it does not skip generations, and it is present in the daily actions of all racial/ethnic people groups. Cultural associations encompass a variety of things specific to people in groups, organizations, and professions.

**The value of culture in the science classroom.** Early in the interview process, participants were asked about the value of culture in their classrooms. Culture was noted as critical to teaching science because science is about making real world connections. Two of the three participants acknowledged that in middle and high school, their teachers used cultural

associations to connect concepts in science, math, and social studies. Mrs. Richards, in particular, appreciated the opportunities her teachers provided, such as going out into the community and being exposed to farms, agriculture, and different types of animals. She noted:

I was exposed to so much and my love for science started then. By the time I got to high school I was all into biology...fast forward the same teacher who exposed me to everything became my mentor when I started teaching.

One of Mrs. Wilson's teachers had a love for music and catchy tunes, which turned math procedures into memorable lyrics and beats. Mrs. Wilson noted, "He and another teacher made learning so fun that I wanted to be a teacher." Finally, Mrs. Nichols cited the love and support extended by a former principal and community leader to follow her dreams. "If it wasn't for that talk he had with me, I'd be doing something else. For him, a career was not about job security, it about following your passion." The participant narratives of their upbringing and experiences highlight teacher-to-student interactions and connections while reiterating the role of culture in student learning and success.

## **Research Question 2**

The second research question directing this inquiry was, "How do teacher definitions of culture manifest in science instruction in the middle school classroom?" Overall, participants defined culture as a combination of the things one finds engaging and enjoyable, the things that define character, the lessons one has learned, and a person's day-to-day actions/activities—in essence, your lifestyle. In other words, culture is an all-inclusive representation of anything learned or transmitted through interactions.

Defining culture was met with some confusion by some of the study participants. Responses such as "Ummm, that's a good question" or "I haven't really thought about it" caused some initial concern at the start of the study. Not knowing if it was use of the term "culture" or



the wording of the questions causing this confusion, I reworded the question by asking teachers to describe the connections used in the classroom to bridge students' understanding of science. At this point, teachers were able to provide an array of examples and activities that highlighted real world connections.

Mrs. Nichols discussed being practical and realistic, but with a touch of optimism. She referenced the ability to provide hands-on activities, like disassembling a fan to expose the motor and putting it back together. She stated, "You're an engineer and that is what they do...uncover a problem, figure out how to solve a problem, and then fix the problem." Mrs. Nichols loved to push her students to do more, and she did not tolerate her students "talking back" to her or what she would consider providing excuses. She preferred results to excuses and wanted students to make an honest effort despite the amount of time it took them to find the answers or solutions to a problem. Although Mrs. Nichols was stern, she cared about her students enough to make home visits and to be a part of an external STEM partnership program to expose her students to resources not available in their town. She offered examples for students to go to conduct additional research by traveling to the local riverbank to extend the lesson they currently studied or by taking the opportunity to interview a family member about their upbringing. Mrs. Nichols made great suggestions, but they were just suggestions. She noted:

Mainly I tried to relate all these activities to what they know about...home situations, from their parents bringing them up and what limited knowledge that they have of anything outside of this little world in Artesian. Ya know, if it had something to do with Hollywood, I would relate it. If it had something to do with rap or football...ya know or a nail salon that had to do with different chemicals...fumes...the impact on your lungs and body over time...getting their hair colored and chemical reactions...cancer has been linked to those things now, so I just try to think of things they understand.

Although Mrs. Nichols expressed her intention to provide examples that students can reference, not all of her lessons were explicit to the point where she could scaffold information.

The following questions could have prompted students' responses: 1) Why are color treatments to African American hair and to the body harmful, or 2) Why are harsh chemicals used to straighten African American hair linked to cancer? However, mentioning a problem and the potential dangers when using culturally relevant practices is not enough; teachers must be willing to think deeply about a problem to understand the root of the situation and encourage students to find solutions or safer alternatives to a problem.

Mrs. Wilson allows visitors into her classes to speak about their work as scientists, and she allows university professors and college students to teach science topics and conduct experiments in her class. She does not support being the only person teaching the students. Being part of a collaborative team effort, she expressed that she enjoys when parents visit the classroom for "show and tell" of STEM-related objects, read books, and conduct experiments; she never denies a parent the opportunity to get involved as she believes this improves morale in the class while shows students that they can learn something useful from just about anyone. As she noted, "My teachers went the extra mile and stepped in to help when my parents couldn't, so I'm trying to do the same for my students."

Mrs. Richards takes food, fun, fashion, and folklore to another dimension in her science classes. As a biology teacher, exploring body systems—managing what goes in and what comes out of your body—is just as fascinating as it is important. As food is present during times of mourning and celebration in various cultures, Mrs. Richards illuminated the joys of food and the pitfalls to which people succumb when they abuse it. As humans can be creatures of habit, not all habits/traditions/customs are conducive to a long life. This mindset about food and consumption enables Mrs. Richards to explore a variety of things, for example, juice and alcohol. A lesson covering the harmful effects of alcohol on the body allowed students to compare healthy organs

with alcohol-damaged organs while also covering brain function in both a sober and an intoxicated person. Mrs. Richards expressed: “It’s one thing to sit there and talk about cells and the body...being able to explain, touch, feel, and interact with things is more of a better learning experience than reading it from a book.” Each teacher noted the importance of making connections but doing so in a way that serves a purpose. Gives students something to think about should be the aim of every lesson and is what Milner (2014) describes as “purposeful teaching” (p.11).

### **Research Question 3**

What evidence of culturally relevant practices are observed in a sample of teachers selected for high potential for enacting culturally relevant pedagogy (CRP)?

**Academic achievement.** Students perform best when their teachers cheer them on in the classroom by motivating, encouraging, and empowering them to believe in their own ability to succeed. Saying that you believe in the success of all children means nothing if your actions do not support this. Teacher participants expressed variations of “tough love,” encouragement, and classroom support to help their students identify and capitalize their potential. Platforms such as Edmodo and Class Dojo are great applications that allow teachers to track students’ work and participation points as well as recap lessons for students in need of extra assistance. Culturally relevant teachers understand that every student does not learn the same way or by doing the same things. Providing differentiation, scaffolding information, and creating student-paced activities produces a work environment that is inclusive of everyone’s needs.

Mrs. Wilson used pretests and graphic organizers to assess students’ prior knowledge before the start of lesson. She then used this pretest to guide students through the lessons, ensuring that they can answer and support pertinent questions. Mrs. Nichols walked around the

room during her lessons to check for understanding and also to redirect students who were off-task. Mrs. Richards has an “open-door policy” so that students can ask as many questions as needed to understand a concept. She also began lessons with examples and provided more examples when she checked for understanding throughout the lesson. While each approach was different, the objective remained the same—support students throughout the learning process.

**Cultural competence.** Culturally competent teachers celebrate variations of thought in the learning environment. This variation allows teachers to use social interactions to cultivate relationships with students, “[demonstrating] a connectedness with all of their students and encourages the same connectedness between student” (Ladson-Billings, 2009, p. 28). For instance, Mrs. Nichols knew how to make connections between the content and the community, but not all lessons could be related to the cultural differences between students and teachers. The student population at the school of study was 99% Black/African American, and many of the references used were about the Black community. Sometimes, references were made under the assumption that all the students experienced the same dilemmas due to race, gender, or both. However, not all Black girls get hair relaxers, so some of them would not understand the long-term consequences of using these straightening chemicals just as not all Black girls are aware of the effects of the toxic fumes associated with being in a nail salon. The intended use of such claims is much lower or even nonexistent if students are not familiar with these association.

In addition to using real world connections, I sought more information from teachers by asking, “What is missing from education?” Mrs. Nichols stated, “Well, the problem is they are coming from broken homes where momma is raising them, grandmamma is raising them, or they are raising themselves.” In some instances, this may be true for Black children, but the implication that all of her students or all Black children come from broken homes would imply

something different. If these children did not come from broken homes, would they still struggle in school? Response like this one may possibly be a reflection of the teachers' perception of her students. From deficit thinking patterns to promoting a savior-type mentality, studies (Aronson, 2017; Ford, Harris, Tyson & Frazier, 2001; Garcia & Guerra, 2004; Valencia, 1997) have shown that teachers who promote teaching practices that perpetuate deficit thinking or a savior-type mentality does more harm than good.

In another instance, Mrs. Nichols discussed the importance of hydrating your body during recreational sports. She posed several questions to activate her students' prior knowledge, and the students documented the benefits of recreational sports and ways to stay hydrated in addition to listing the consequences engaging in extreme measures during recreational activity (e.g., death, dehydration, fatigue, body cramps). This lesson required that the students analyze sports drinks and their advertisements, and Mrs. Nichols discussed brands profiting from people who simply believed that branded products work better than others. The students conducted an experiment to see if their preferred brands would beat the competition or the proposed winner. Mrs. Nichols caught the interests of her students discussing a topic to which students could relate, could share experiences as athletes that they knew, she also introduced the power of influence in shifting people's views. The students were intrigued by this and excited to share this information with others.

There were moments throughout these examples that could have been more explicit and relevant. However, there were also cases where one of the participants, Mrs. Nichols captivated the attention of all of her students and their dialogue and interactions overpowered the lesson. Momentum differed from class to class, diminishing in the later classes as the students got very little time to converse. I noticed a shift in Mrs. Nichols's tone and accessibility during one

observation, and I asked, “How did you think the lesson went?” She responded, “Well it was great in the beginning, but you know, it just went downhill after lunch.”

Mrs. Richards integrated cultural components in her science classes to help her students weigh the pros and cons of life and think deeply about their choices. Her genuine relationships with her students opened the door for conversations that challenged them to think about the ways their actions today will impact their lives tomorrow. Her conversations were always grounded in her students’ cultural experiences, and she connected conversations through scenarios presented in class. Everything she presented to her students was calculated and relevant.

Mrs. Wilson, like Mrs. Nichols, delivered lessons, had activities, and built strong relationships with students, but some of the lessons did not extend beyond the materials that were packaged with the lesson. Culturally relevant teaching is a vehicle for learning only when teachers “involve in-depth knowledge of both the student and the subject matter” (Ladson-Billings, 2009, p. 136). Both Mrs. Wilson and Mrs. Nichols understood their content areas, but they often missed opportunities to explore and bridge real world connections into science.

**Sociopolitical consciousness.** Making connections between social, political, and economic structures is what Ladson-Billings (2009) considers connecting information to community, national, and global identities. Being conscious of the many ways race, ethnicity, and culture contribute to the way people view and adapt to the world is pertinent to the cause of challenging the status quo to “extend students’ thinking and abilities” (Ladson-Billings, 2009, p. 135). During the interviews, connections were made between content and the communities in which they students live, and teacher participants made many attempts to incorporate community and global connections into every lesson. However, Ladson-Billings gives attention to the level of empowerment, self-awareness, consciousness, activism, and students as change agents within

the community as an important element of the CRP framework that is often absent in its entirety when examining this premise in the classroom.

Sociopolitical consciousness for Mrs. Nichols was all about connecting their small town to the outside world. The outside world could be a larger city in the same state, but with different demographics and where the people's needs and the resources available them were different. During an observation, Mrs. Nichols taught a lesson on electricity, waves, and energy transfer, and she introduced the natural resources present in the city of Artesian. She described hydroelectricity as a method in which the city of Artesian uses to get their electricity. Students decoded the term and then understood that hydro refers to water and that electricity is produced by water. A young man asked, "Is it like the windmills I've learned about that make electricity?" Mrs. Nicholas clarified by saying, "Wind turbines in California uses the wind to generate electricity by turning the blades that connector to a generator... you're thinking of a similar concept and that's good...good job! Did everyone hear what Jackson said?"

She continued the discussion of hydroelectricity and illustrated the use of a handheld fan to illustrate. She said:

Raise your hand if you live in Rancho Cordova, Redding, Sacramento, Yuba, or Vallejo (More than half of the class raised their hands.) For the rest of you, do you know where the GW Bridge is located (heads nod) ...when you cross over the GW Bridge, what do you see on your right? (Student 1: trees?; Student 2: Water?; Student 3: Nothing?) ...that water is kept in a dam and that is where our electricity comes from.

Conversations started as the students appeared to be intrigued by the idea that electricity used in their homes is created from water. Mrs. Nichols pointed out a comment made earlier about windmills/wind turbines:

Water goes through a similar process that Jackson said earlier...its goes through a turbine and create electricity. And you know what...we have so much of it that we are able to sell it and make some money. So now you know...places like Artesian exist all over the world where natural resources are used to make electricity.

Mrs. Richards successfully incorporated community, national, and global issues in her science lessons, for instance, she shared with me during an interview that she had taught a lesson on obesity, cancer, diabetes, and high blood pressure: “I show them what they have in common—food. As a biology teacher my main objective is to teach them about the body and how it works.” As she discussed the connection between food consumption and disease, she highlighted that people all over the world suffer from food addictions and associated ailments—this is not a matter of race, ethnicity, gender, or location. She considered it her responsibility to educate her students and make science valuable and relevant for them. This lesson provided opportunities to discuss health disparities and unhealthy eating habits around the world, but particularly in Black communities.

Mrs. Wilson conducted a lab on water purification, and she expressed that when living in a small rural town, everyone, at some time, will experience water problems. She began this lesson by asking, “Do you know what’s in your water?” The students replied, “there’s nothing in our water,” and others chimed in and said, “I think I learned that they put something in the water for our teeth.” Mrs. Wilson shared, “Well, I’m not going to tell you the answers now, but I promise we will get to it.” Students documented their thoughts in their binders about water safety, and they were going to test water and select the one safest to drink. Water from the school water from the fountain, the restroom, several bottling companies, and a nearby creek was used, and students tested the water’s pH and got the results back in minutes. While waiting for the results, Mrs. Wilson talked to students about the Flint, Michigan, water crisis, informing her students that after several years, Flint residents were still without clean water. She referenced countries without clean water due to their financial resources. This discussion led students to question the reasons why clean water was not available to everyone. For teachers, sociopolitical



consciousness was evident in some, but not all of the lessons. Teaching from a cultural lens is often difficult to enact when the cultural understanding is absent from the lesson. To successfully implement the CRP in science requires a level of commitment that equally gives reference to student success and academic learning, cultural competence and student integrity, and sociopolitical consciousness and community activism.

### **Discussion**

Empirical studies examining teacher use and understanding of culturally relevant education have consistently shown teachers—both pre-service and in-service—facing a range of challenges when they enter the classroom. However, studies have also revealed that teachers can also experience successes implementing such practices in their classroom as well. The purpose of this study was to expand research in the area of culturally relevant science by investigating 1) how 3 middle school science teachers understood the meaning of culture, 2) how that meaning informed their pedagogical practices in science, and 3) how these practices aligned with the culturally relevant pedagogical framework.

Scholars in science education have steadily argued that current practices are no longer enough to support student learning of the African American child and that more needs to be done to teach African American students in science (Gay, 1975; Ladson-Billings, 1995; Jordan-Irvine, 1990; Howard, 2003; Young, 2010) From this stem of research, culturally relevant pedagogy has been noted as a viable solution to combat this gap in achievement and support student learning (Bryan, 2017; Boutte & Hill, 2006; Cocohran-Smith, 1995; Ladson-Bilings, 2014). Teaching from a culturally relevant lens empowers students in the classroom, highlights and supports their cultural stance in the world, and also encourages students to challenge the status

quo by using their knowledge and position in life to make a difference (Codrington, 2014; Emdin, 2010; Ladson-Billings, 2000). Although the use of the CRP teaching framework has been suggested as a great tool for African American youth and other minority groups, it serves a purpose for *all* students to be empowered, to take pride in who they are and where they are from, and assess how to make the world an equitable place to live (Gay, 2014). Even with the abundance of research supporting culturally relevant education and teacher perception of culturally relevant pedagogy to address the achievement gaps among African American and their nonminority counterparts, a scant amount of research examines teacher understanding of culture to support the development of culturally relevant teachers.

Findings from this study contribute to the body of culturally relevant science education research suggesting that teachers know—in a variety of ways—how to connect with their students and how to support students academically (Ladson-Billings, 1995); however, teachers with “good intentions” can unknowingly falter in making “real-world” connections (Milner & Laughter, 2015) between students’ lives and science (Osborne, Simon & Collins, 2003). Ladson-Billings (1995) noted that teachers can struggle to connect with students and that was evident at times within this study.

Data collected from 3 middle school science teachers to understand how they perceive culture guided this study. Findings noted teachers possessed an understanding of culture, but not necessarily how to always promote culture or “real world” connections in science. In this study, Mrs. Nichols, Mrs. Wilson, and Mrs. Richards entered the classroom with their own approaches to learning from a distinct cultural lens, each lens influenced by their upbringing, interactions, and classroom experiences. These 3 participants understood that their students fared a better chance retaining information and remaining engaged if science were hands-on and connected

to “real-world” scenarios, and students’ day-to-day interactions. Teachers enacted practices that worked for them and their students and noted it was a joint and collaborative process at times. Although their individual approaches to teaching science were similar, each teacher managed to use tenets of CRP sparingly or consistently throughout their lessons. Teachers who use culturally centered practices are said to use “culture and life experiences of students to structure learning that is conducive to their needs” (Wallace & Brand, 2012, p. 341). As science teachers that would mean situating science content within the classroom to support student learning (Atwater et al. 2013).

Mrs. Nichols used the local dams to discuss hydroelectricity, the increase of jobs in the community, and how their town capitalized on this resource by selling electricity to neighboring towns (e.g. sociopolitical consciousness). Mrs. Wilson used local STEM professionals from nearby universities to highlight the importance of the field, what science means to the community, and what it is like to be an African American in STEM (e.g, cultural competence). Mrs. Richards addressed obesity and diabetes in the African American community and why people of color were suffering from such diseases at an alarming rate (e.g. sociopolitical consciousness). Findings revealed that some day-to-day instruction and student teacher interactions yielded a teacher-led approach (e.g. lectures, handouts, with little dialogue), while some day-to-day instruction yielded more of a student led approach (e.g. culturally relevant and inquiry-based instruction). When teachers understand the underpinnings of culture—students’ culture, teacher culture, and the culture within society—it will serve as a basis for supporting teachers as they become culturally relevant (Borrero et al., 2018). It becomes difficult to ask teachers to adhere to concepts they do not fully understand. Teachers need time and opportunities to reflect on their practices and collaborate with others (Gay & Kirland,

2003). The data collected offered associations to the CRP framework, but not all lessons taught by teachers used tenets of CRP to teach science.

The participants within this study had similar understandings of what culture entailed and how they utilized elements to enhance science instruction for their students varied. As they discussed the need to enhance instruction, they also discussed real world connections being the cultural element to enhance that process. Teachers believed creating such connections in science added value to the lesson and supported students' overall learning experiences (Meyer & Crawford, 2015). Although the goal of the current study was not to examine rural science teachers' understanding of CRP or the integration of science concepts into the framework, the study does provide insight into the task's science teachers did in rural settings that aligned or did not align with the CRP framework. A major component of the CRP framework—sociopolitical consciousness—was overlooked in its entirety by participants. Participants presented concerns within the African American community, however, actionable steps did not promote student activism, but rather information students of issues they could revisit at a later time.

### **Limitations**

Limitations to a study are not apologies provided to excuse one's behaviors, but rather characteristics within a study that can influence the interpretation of the data collected. Utilizing a case study method is one limitation to this study. Case studies are not designed to generalize the outcomes from a study. Case studies are conducted to provide information about a given concept. Although a small sample size provided the data for this study, the limitation present itself from the lens of the who participated in the study. Using a combination of male and female participants may have producing variations to the outcome. A third limitation to this study is the personal relationships between the participants and the researcher. Working with participants

from which I had a professional relationship made it difficult, at times, to remain focused on observing and not a “fixer.” Although personal connections can skew one’s perception within a study, the presence of a close relationship can benefit the study. The fourth limitation within the study included unforeseen events that impacted time and interactions in the classrooms. These events ranged from cancellations due to field trips, trainings, award ceremonies, testing, break/holidays, shortened periods, inconsistent with class periods, early dismissals, and weather advisory. It was also difficult to reschedule observations sometimes, which impacted observation time. This is evident when examining the difference in observation times between participants. The final limitation in this study is the omission of culturally relevant pedagogy (CRP) as the focus of the study to the participants within this study. Framing research questions and interview questions around the CRP framework, may have resulted in different outcomes.

### **Implications for Future Research**

In this study, I examined the teaching practices of science educators in rural settings. Although many studies have examined CRP across the disciplines and in urban settings, I examined the ways teachers’ defined culture and the ways this understanding shaped their teaching practices. Teachers worked in an external STEM partnership program to gain access to resources for their students. They also stated that they collaborated with colleagues on topics that would benefit their students. Teachers were honest in expressing that they could not do this work alone without the help of others and the resources they have acquired over the years. The humanizing aspect of teaching is recognizing that everyone, including teachers, have room to grow in the world of teaching and learning. However, the inclusion of race and cultural associations never presented itself in the STEM partnership program, during professional development, or in conversation as a means to bridge student understanding.

Future studies can observe training methods and the exposure to culturally relevant lessons for middle school science teachers, involve post-lesson interviews with students to gather their thoughts on culturally centered and non-culturally centered lessons, and if the acquisition of knowledge was heightened throughout the academic year due to the development of culturally relevant science material. Raised in rural, and often isolating areas, it would be informative to better understand student views of themselves (i.e., identity), their town, and the opportunities in science. Surveys after each class lesson will allow the researcher to process the knowledge that students gained from the message. A comprehensive approach to understanding culture can aid in the design of lessons that meet students' social, cultural, and academic needs while also providing opportunities for teachers to teach culture while considering student feedback. It would be beneficial to understand students' definitions and perceptions of culture.

In addition to including students in future research, examining how race impacts teaching, learning, and the individual's perception of culture from the perspective of the teacher and student in rural settings would benefit research surrounding science education. Race and culture overlap in a way that it is difficult to discuss culturally relevancy in science without exploring the impact of race in science. Race is as important to a persons' identity as it their cultural connections within society. Examining effective instruction for African Americans will require explorations of student identity as well. Lastly, a comparison study of rural and urban science teachers using the same research questions would allow scholars in the field to gain a better understanding to the best methods to teach children in these settings, but also to support teachers as they work toward teaching science lessons that are culturally relevant.

### **My Personal Journey**

Before beginning this study, I had many assumptions and expectations regarding classroom observations. I expected the participants to be *perfect*, the students to be engaged, and everything to run smoothly. The irony is that my journey into the profession was full of mistakes, so the expectation of perfection was unrealistic! As a former elementary and middle school teacher, my perspectives about teaching and learning were deeply rooted in my own successes and failures as a teacher. I realized early in my career that I had to navigate spaces that were unfamiliar to me, and although this process was scary and frustrating, I began to question whether or not I could be the teacher my students needed me to be. It became evident that my pre-service teacher training did not prepare me for students in urban learning environments.

At times, I felt defeated because everything that should have worked did not. I came to a professional and personal crossroads shortly after I began my first teaching assignment as a second grade teacher. Two weeks after feeling like I failed myself and my students, I had to decide if I was going to find ways to connect with my students and the community while remaining true to myself or if I was going to quit. I spent 11 years in the classroom, and my journey was unique.

Students need amazing teachers who push them, motivate them, and care about their success just as they need someone to tell them the truth about the world, and challenge them to explore it and make positive changes. If a teacher or aspiring teacher has little to no desire to understand the relevance of culture and operate within this space, then teaching may be the wrong profession for an individual. Even with all of my struggles as a first-year teacher back in 2004, I chose to teach because I truly wanted to make a difference. Fast forward to the current year (2019), and I am still making a difference by attempting to cultivate learning environments

in which cultural relevance is embraced and where all students can thrive. Although it took me many years to reach this point in my career, I have succeeded in many ways.

### **Personal Tension**

As a former teacher, my passion for helping children succeed led me into the field of teaching. I have a first-hand understanding of the struggles associated with teaching, and I also know that it takes more time to plan a lesson than it takes to teach that lesson. As a graduate research assistant, I was charged with the task to evaluate science lessons, provide lesson feedback and report my findings to the university's program evaluation team. Throughout the course of the study, I became overly critical of the actions of the participants, which became a distraction. Some of the negative practices I observed began to overshadow the goal of the program and the research in which I was engaged, affecting me in ways that raised ethical concerns as I continued to observe teachers in their element. Soon after my research began, I had to reflect on my feelings and ask myself why these things bothered me. Although my own teaching experience had strengthened my awareness of the impact of ineffective teaching on student success, this was not applicable to the goals of the current study—to capture practices that embedded culture as a means to bridge learning in science.

Throughout my observation of the participants, I noticed that teachers elevated their voices to reprimand students for their behavior. Also, students' noncompliance to classroom rules resulted in students being removed from the learning environment. As a visitor, I had to suppress my role and perspective as a program evaluator and focus solely on my role as researcher. The "human" aspects of being a teacher, which I was reminded of during this study, reminded me that I was not conducting this study to judge anyone's teaching practices, but to examine the ways teachers' understanding of culture transcended in their classrooms, through



their pedagogical practices and the impact their approach to teaching science influenced student learning.

My role as the researcher was to understand the practices that were evident in the classroom and expound on them through follow-up questioning, not to collaborate or to actively improve student experiences. Although external factors contributed to the tension I felt earlier in the study, I acknowledged that my past experiences as an educator and interactions with others in the field became problematic, and at times, I struggled not to draw conclusions or make judgments. As a former teacher I was taught very specific ways to be effective with my students. My training over the years allowed me to observe, critique, and assist classroom teachers as needed. Due to the many hats that I wore as a teacher and grade-level chair, I am accustomed to helping, evaluating, and often times correcting, teachers when I assist them in their classrooms. Within this study I remained cognizant that I was not an evaluator or coach, but an observer.

### **Summary**

Implementing approaches that address the needs of students, of a school, and of the community is a purposeful and intentional act. Decisions like this should consider the ramifications associated with a students' success and/or failure when examining the impact of culture, race, and culturally centered practices in educational settings. Teaching practices within this study supported student empowerment, motivation, hope, and community to engage the learner in science. Culturally relevant pedagogy suggests successful instructional practices of African American students uplift and challenge children to believe in themselves (Ladson-Billings, 2009) while also remaining cognizant of systemic structures that can deny or hinder their progress (Milner, 2014). However, the quest remains the same: African American students

must be provided with opportunities to discover, uncover, and learn how science concepts are relevant in their lives; establishing a sound foundation of who they are as African Americans, understand race as a social construct, not a sign of authority or superiority, and lastly, the notion of giving back and supporting their communities in some form. To change the narrative of African Americans in science and how African American perform in science, is to the change the delivery of instructional practices that are designed to support the learning of African American students.

My study examined teacher understanding of culture and use of cultural references (i.e., traditions, rituals, language, music, everyday life experiences) to impart knowledge and enhance science understanding for marginalized and often disenfranchised populations. The increased demand of competent professionals in science (Byars-Winston, 2013; Stiles, 2016), the damning student achievement rates in science of African American students (NAEP, 2015; NCES, 2017), the increase of diversity in K-12 settings (Anastasiou & Keller, 2014; Au et al., 2010), the overwhelming dismissive actions in teacher education programs (Darling-Hammond, 2006; Trent et al., 2008), standardized instruction taught by an overwhelming representation of White, middle class female teachers (NCES, 2015), and the lack of culturally diverse science curriculum that exclude the impact race and culture instead of highlighting its impact (Emdin. 2011; Underwood & Mensah, 2018) lead to conducting this case study analysis. Sleeter (2012) noted the need for more empirical and practical research for teachers to implement culturally relevant educational practices in their classrooms. Scholars have highlighted the importance and positive impact of culturally centered approaches on the academic achievement for African American learners (Aronson & Laughter, 2016; Atwater et al, 2013; Agajong & Emdin, 2015); Esposito & Swain, 2008; Gay,2013; Howard, 2017; Ladson-Billings, 2014; Mensah, 2011; Milner, 2012;

Morrison et al., 2008). Examining cultural contexts to overcome educational inequities will bridge gaps and build partnerships within the community. Although the need is warranted and justified, teachers encounter difficulty understanding and implementing the theory into their courses of study. Teachers should be supported as they become aware and learn about terminology that can shape their understanding of a concept such as culture. Thus, to adopt culturally relevant practices that are driven by culture, an understanding of the concept must be met first to effectively teach under this framework. As practitioners and researchers, we must remain cognizant that failure to recognize the ways that culture and experience construct students' knowledge across disciplines can impede a student's learning (Ginsberg & Wlodkowski, 2007).

## References

- Adams, T.R., & Glass, T.S. (2018). Urban teacher educator perception of culturally relevant pedagogy: A qualitative inquiry. *Journal of Urban Learning, Teaching and Research, 14(1)*, 7-17.
- Adjapong, E.S., & Emdin, C. (2015). Rethinking Pedagogy in urban spaces: Implementing hip-hop pedagogy in the urban science classroom. *Journal of Urban Learning, Teaching, and Research, 11(1)*, 66-77.
- Albury, A. (1992). Social orientations, learning conditions, and learning outcomes among low-income Black and White grade school children. Unpublished doctoral dissertation, Howard University, Washington, DC.
- Allen, B. A., & Boykin, A. W. (1992). African-American children and the educational process: Alleviating cultural discontinuity through perspective pedagogy. *School Psychology Review, 21(4)*, 586-598.
- Anastasiou, D., & Keller, C. E. (2014). Cross-national differences in special education coverage: An empirical analysis. *Council for Exceptional Children, 80(3)*, 353-367.
- Anderson, J.D. (1988). *The education of Blacks in the south, 1860-1935*. Chapel Hill, NC: University of North Carolina Press.
- Anderson, R. D. (2002). Reforming science teaching. What research says about inquiry? *Journal of Research in Science Teaching, 13*, 1-12.
- Andrzejewski, C.E., Bagget, H.C., & Askia, R.E. (2018). Exploring the tension between preservice teachers' personal ideologies about and professional responsibilities for LGBTQ students. In Strunk, K.K. (Ed). *Queering education in the Deep South*, 15-29. Charlotte, NC: Information Age.

- Annamma, S.A., Connor, D., & Ferri, B. (2013). Dis/ability critical race studies (DisCrit): Theorizing at the intersections of race and dis/ability. *Race Ethnicity and Education*, 16(1), pp. 1-31.
- Aronson, B. & Laughter, J. (2016). The theory and practice of culturally relevant education: A synthesis of research across content areas. *Review of Educational Research*, 86(1), pp. 163-206.
- Artiles, A., Kozleski, E.B., Trent, S., Osher, D., & Ortiz, A. (2010). Justifying and explaining disproportionality, 1968-2008: A critique of underlying views of culture. *Exceptional Children*.
- Artiles, A. J., & Trent, S. C. (1994). Overrepresentation of minority students in special education: A continuing debate. *The Journal of Special Education*, 27(4), 410-437.
- Ash, A., & Wiggan, G. (2018). Race, multiculturalisms and the role of science in teaching diversity: Towards a critical post-modern science pedagogy. *Multicultural Education Review*, 10(2), 94-120.
- Atwater, M., Freeman, T., Butler, M., & Draper-Morris, J. (2010). A case study of science teacher candidates' understandings and actions related to the culturally responsive teaching of 'other' students. *International Journal of Environmental & Science Education*, 5(3), 287-318.
- Atwater, M. M., Lance, J., Woodard, U., & Hillsman-Johnson, N. (2013). Race and ethnicity: Powerful cultural forecasters of science learning and performance. *Journal Theory into Practice*, 52(1), 6-13.
- Au, K. (2007). Culturally responsive instruction: Application to multiethnic classrooms. *Pedagogies: An International Journal*, 2(1), 1-18.

- Au, K., & Jordan, C. (1981). Teaching reading to Hawaiian children: Finding a culturally appropriate solution. In H. Trueba, G. Guthrie, & K. Au (Eds.), *Culture and the bilingual classroom: Studies in classroom ethnography*. 139-152. Rowley, MA: Newbury House.
- Au, K. H., & Kawakami, A. J. (1991). Culture and ownership: Schooling of minority students. *Childhood Education*, 67(5), 280-284.
- Aud, S., Fox, M., & Kewal-Ramani, A. (2010). *Status and trends in the education of racial and ethnic groups*. National Center for Education Statistics.
- Baker, B.D., Farrie, D., & Sciarra, D.G. (2016). *Minding the gap: 20 years of progress and retrenchment in school funding and achievement gaps*. Princeton, NJ: Educational Testing Service.
- Baker-Doyle., & Petchauer, E. (2015). Rumor has it: Investigating teacher licensure exam advice networks. *Teacher Education Quarterly*, 3-32.
- Banks, J.A. (1977). Pluralism and educational concepts: A clarification. *Peabody Journal of Education*, 54(2), 73-78.
- Banks, J.A. (1988). *Multiethnic Education: Theory and Practice*. (2<sup>nd</sup> ed). Boston: Allyn and Bacon.
- Banks, J.A. (2016). *Cultural diversity and education: Foundations, curriculum, and teaching*. (6<sup>th</sup> Eds). New York: Routledge.
- Barron, B., & Darling-Hammond, L. (2008). *Teaching for Meaningful Learning: A Review of Research on Inquiry-Based and Cooperative Learning*. Book Excerpt. George Lucan Educational Foundation.
- Bartolome, L.I. (1994). Beyond the method fetish: Toward a humanizing pedagogy. *Harvard Educational Review*, 64 (2), 173-194.

- Barton-Vasquez, K.A. (2018). A case study of significant disproportional discipline of African American students in special education: Inquiry in a suburban school district. ProQuest Dissertations, 10745060.
- Barton, P.E., & Coley, R.J. (2010). *The Black-White achievement gap: When progress stopped*. Policy information report. Princeton, NJ: Educational Testing Service.
- Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *The Qualitative Report*, 13(4), 544-559.
- Bennett, M.M. (2008). Understanding the students we teach: Poverty in the classroom. *The Clearing House*, 81(6),251-256.
- Berchini, C. (2015). Why are all the teachers White? *Education Week*. Retrieved from <http://www.edweek.org/tm/articles/2015/04/28/why-are-all-the-teachers-white.html>.
- Bergm B.L., & Lune, H. (2012). *Qualitative Research Method for the Social Sciences*. (8<sup>th</sup> ed). United Kingdom: Pearson.
- Bergeron, B. (2008). Enacting a culturally responsive curriculum in a novice teacher's classroom: Encountering disequilibrium. *Urban Education*, 43(1), 4-28.
- Bledsoe, K. & Donaldson, S. (2015). Culturally responsive theory-driven evaluation. *Continuing the Journey to Reposition Culture and Cultural Context in Evaluation Theory and Practice*, 3-27. Information Age Publishing.
- Boddy, N., Watson, K., & Aubusson, P. (2003). A trial of the five Es" A referent model for constructivist teaching and learning. *Research in Science Education*, 33, 27-42.
- Bondy, E., Ross, D. D., Gallingane, C., & Hambacher, E. (2007). Creating environments of success and resilience culturally responsive classroom management and more. *Urban Education*, 42(1), 326-348.

- Bonilla-Silva, E. (2006). *Racism without racist: Color-blind racism and the persistence of racial inequality in the United States*. New York: Rowan & Littlefield.
- Borrero, N.E., Flores, E., & de la Cruz G. (2016). Developing and enacting culturally relevant pedagogy: Voices of new teachers of color. *Equity & Excellence in Education, 49(1)*, 27-40.
- Borrero, N.E., Ziauddin, A., & Ahn, A. (2018). Teaching for change: New Teachers' experiences with and visions for culturally relevant pedagogy. *Critical Questions in Education, 9(1)*, pp. 22-39.
- Botcheva, L., Shih, J., & Huffman, L. (2009). Emphasizing cultural competence in evaluation: A process-oriented approach. *American Journal of Evaluation, v30(2)*, pp. 176-178.
- Boutte, G. S., & Hill, E. L. (2006). African American communities: Implications for culturally relevant teaching. *Journal of The New Educator, 2(4)*, pp. 311-329.
- Boutte, G., Kelly-Jackson, C., & Lee Johnson, G. (2010). Culturally relevant teaching in science classrooms: Addressing academic achievement, cultural competence, and critical consciousness. *International Journal of Multicultural Education, 12(2)*, pp. 1-20.
- Bristol, T. (2014). Black men of the classroom: An exploration of how the organizational conditions, characteristics, and dynamics in schools affect Black male teacher's pathway into the profession, experiences, and retention. Unpublished Dissertation. New York: Columbia University.
- Bristol, T (2015). Teaching boys: Towards a theory of gender-relevant pedagogy. *Gender and Education, 27(1)*, 53-68.
- Brown, A. (2009a). Brother's gonna work it out: Understanding the pedagogic performance of



- African American males teachers working with African American male students. *Urban Review*, 41(1), 416-435.
- Brown, A. (2009b). On human kinds and role models: A critical discussion about the African American male teacher. *Journal of American Educational Studies Association*, 48(3), 296-315.
- Brown, D.F. (2004). Urban teachers' professed classroom management strategies: Reflections of culturally responsive teaching. *Urban Education*, 39, 266-289.
- Brown, M. R. (2007). Educating all students: Creating culturally responsive teachers, classrooms, and schools. *Intervention in School and Clinic*, 43(1), 57-62.
- Brown, B. A., Boda, P., Lemmi, C., & Monroe, X. (2019). Moving culturally relevant pedagogy from theory to practice: Exploring teachers' application of culturally relevant education in science and mathematics. *Urban Education*, 54(6), 775-803.
- Brown, J. C., & Crippen, K.J. (2016). The growing awareness inventory: Building capacity for culturally responsive science and mathematics with a structured observation protocol. *School Science and Mathematics*, 116(3), 127-138.
- Brown-Jeffy, S., & Cooper, J.E. (2011). Toward a conceptual framework of culturally relevant pedagogy: An overview of the conceptual and theoretical literature. *Teacher Education Quarterly*, 38, 65-84.
- Bryan, N. (2016). Towards a multidimensional framework: Exploring the constructed identities and pedagogical styles of Black male kindergarten teachers in the South. Unpublished Dissertation. University of South Carolina.
- Bryan, N., & Williams, T.M. (2017). We need more than just male bodies in classrooms:

- Recruiting and retaining culturally relevant Black male teachers in early childhood education. *Journal of Early Childhood Teacher Education*, 38(3), 209-222.
- Byars-Winston, A. (2013). Connecting the disconnects: Considerations for advancing racial/ethnic and gender diversity in STEM. *Career Planning and Adult Development Journal*, 29(1), 53-63.
- Byars-Winston, A. (2014). Toward a framework for multicultural STEM-focused career interventions. *The Career Development Quarterly*, 62(1), 340-357.
- Bybee, R.W. (2014). The BSCS 5E instructional model: Personal reflections and contemporary implications. *Science and Children*, 51(8), 10-13.
- Carlone, H.B., & Johnson, A. (2007). Understanding the science experiences of successful women of color: Science identity as an analytic lens. *Journal of Research in Science Teaching*, 44(8), 1187-1218.
- Cazden, C., & Leggett, E. (1976). Culturally responsive education: A discussion of LAU remedies, II. Prepared for the U.S. Department of Health, Education, and Welfare. National Institute of Education.
- Chartock, R. K. (2010). *Strategies and lesson for culturally responsive teaching: A primer for K-12 teachers*. Boston: Allyn & Bacon Publishing.
- Cherng, H. & Halpin, P. (2016). The importance of minority teachers: Student perceptions of minority versus white teachers. *Educational Researcher*, 45(7), 407-420.
- Chokr, N. N. (2006). A fundamental misconception of “culture”: Philosophical and political implications. In Re-ethnizing the minds: Cultural revivals in contemporary thought. Amstream, (2006). New York: Rodopi.
- Cholewa, B., Goodman, R., West-Olatunji, C., & Amatea, E. (2014). A Qualitative Examination

- of the Impact of Culturally Responsive Educational Practices on the Psychological Well-Being of Students of Color. *Urban Review*, 46(4), 574-596.
- Cobb, J.S. (2017). Inequality frames: How teachers inhabit color-blind ideology. *Sociology of Education*, 90(4), 315-332.
- Cochran-Smith, M. (1995). Color blindness and basket making are not the answers: Confront the dilemmas of race, culture, and language diversity in teacher education. *American Educational Research Journal*, 32(3), 493-522.
- Cochran-Smith, M. (2004). *Walking the road: Race, diversity and social justice in teacher education*. New York: Teachers College Press.
- Codrington, J. (2014). Sharpening the lens of culturally responsive science teaching: A call for liberatory education for oppressed student groups. *Cultural Studies of Science Education*, 9, 1015-1024.
- Considine, J.R., Mihalick, J.E., Mogi-Hen, Y.R., Penick-Parks, M.W., Van Auken, P.M. (2014). “Who am I to bring diversity into the classroom?” Learning communities wrestle with creating inclusive college classroom. *Journal of the Scholarship of Teaching and Learning*, 14(4), 18-30.
- Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches*. Thousand Oaks, California. Sage Publications.
- Creswell, J.W., & Poth, C.N. (2018). *Qualitative Inquiry and Research Design: Choosing Among Five Approaches* (4<sup>th</sup> ed), Thousand Oaks, CA: Sage Publications.
- Curran, F. C., & Kellogg, A. T. (2016). Understanding science achievement gap by race/ethnicity and gender in kindergarten and first grade. *Educational Researcher*, 45(5), 273-282.

- D'Andrade, R. G., and C. Strauss, eds. 1992. *Human motives and cultural models*. New York: Cambridge University Press.
- Dallaris, C., "Extending theories of culturally responsive pedagogy: An ethnographic examination of Catholic schooling in a immigrant community in Chicago" (2008). Dissertation, Retrieved on November 1, 2016 from [https://deepblue.lib.umich.edu/bitstream/handle/2027.42/61636/dallavis\\_1.pdf?sequence=1&isAllowed=y](https://deepblue.lib.umich.edu/bitstream/handle/2027.42/61636/dallavis_1.pdf?sequence=1&isAllowed=y).
- Dantas-Whitney, M., & Ulveland, R.D. (2016). Problematizing assumptions, examining dilemmas, and exploring promising possibilities in culturally relevant pedagogy. *Journal of Democracy & Education*, 24(1), 1-4.
- Darling-Hammond, L. (2000). How teacher education matter. *Journal of Teacher Education*, 51(3), 166-173.
- Darling-Hammond, L. (2004). From "Separate but Equal" to "No Child Left Behind": the collision of new stands and old inequalities. In D. Meir & G. Wood (Eds.), *Many Children Left Behind: How the No Child Left Behind Act is damaging our children and our schools*, 3-32. Boston, MA: Beacon.
- Darling-Hammond, L. (2006). Constructing 21<sup>st</sup> century teacher education. *Journal of Education for Teaching*, 57(3), 300-314.
- Debnam, K. J., Pas, E. T., Bottiani, J., Cash, A. H., & Bradshaw, C. P. (2015). An Examination of the Association Between Observed and Self-Reported Culturally Proficient Teaching Practices. *Psychology In The Schools*, 52(6), 533-548.
- Delgado-Gaitan, C. (2006). *Building culturally responsive classrooms: A guide for K-6 teachers*. Thousand Oaks, CA: Corwin Press.
- Delpti, L. (2005). The politics of curricular change: Race, hegemony, and power in education.

- New York: Peter Lang Publishing.
- Delpit, L. (2006). *Other people's children: Cultural conflict in the classroom* (2<sup>nd</sup> edition). New York, New York. New Press.
- Delpit, L. (2012). "Multiplication is for White people": Raising expectations for other people's children. New York: The New Press.
- Demiski, J. (2012). This time it's personal. *T.H.E Journal*, 39(1), 32-26.
- Denzin, N.K., & Lincoln, Y.S. (2018). *The Sage Handbook of Qualitative Research*. (5<sup>th</sup> ed). Los Angeles, CA: Sage.
- Dewey, J. (1933). *How we think*. Chicago: Henry Regnery.
- Dover, A.G. (2013). Getting 'up to code': Preparing for and confronting challenges when teaching for social justice in standards-based classrooms. *Action in Teacher Education*, 35(2), 89-102.
- Dover, A.G. (2013). Teaching for social justice: From conceptual frameworks to classroom practices. *Multicultural Perspectives*, 15(1), 3-11.
- Drissen, G. (2015). Teacher ethnicity, student ethnicity, and student outcomes. *Intercultural Education*, 26, 179-191.
- DuBois, W.E.B. (1995). *The souls of black folk*. New York: Signet Classics Publishing.
- DuBois, W.E.B. (1986). Race Intelligence, The Crisis. In Huggins, N. (ed). *W.E.B DuBois: Writings*. New York: The Library of America (1920).
- Durden, T. (2008). Do your homework! Investigating the role of culturally relevant pedagogy in comprehensive school reform models serving diverse student populations. *Urban Review*, 40, 403-419.

- Easton-Brooks, D. (2015). Bridging the gap and diversifying teaching education. *The Race Controversy in American Education*, 2(1), 259-280.
- Edwards, C. Exploring students' and teachers' perceptions of the cultural responsiveness in three programs for African American students. Ed.D. dissertation, New York University (Publication No. AAT 3404537).
- Eglash, R., Gilbert, J. E., Taylor, V., & Geier, S. R. (2013). Culturally Responsive Computing in Urban, After-School Contexts: Two Approaches. *Urban Education*, 48(5), 629-656.
- Emdin, C. (2010). Affiliation and alienation: Hip-hop, rap, and urban science education. *Journal of Curriculum Studies*, 42(1), 1-25.
- Emdin, C. (2011). Droppin' science and dropping science: African American males and urban science education. *Journal of African American Males in Education*, 2(1), 66-79.
- Erickson, F., & Mohatt, G. (1982). Cultural organization and participation structures in two classroom of Indian students. In G. Spindler (Ed.) *Doing the ethnography of schooling*, 131-174. New York: Holt, Rinehart, & Winston.
- Esposito, J. & Swain, A.N. (2009). Pathways to social justice: Urban teachers' uses of culturally relevant pedagogy as a conduit for teaching for social justice. *Perspectives on Urban Education*.
- Flick, U. (2013). *The SAGE Handbook of Qualitative Data Analysis*. Germany: SAGE.
- Florio-Ruane, S., & Williams, L.G. (2008). Uncovering paths to teaching: Teacher identity and the cultural arts of memory. *Teacher Education Quarterly*, 35(3), 7-22.
- Ford, D. Y. (2004). Intelligence testing and cultural diversity: Concerns, cautions, and considerations. *The National Research Center on the Gifted and Talented*. University of Connecticut.

- Frierson, H.T., Hood, S., & Hughes, G. (2002). Strategies that address culturally responsive evaluation. Arlington, VA: National Science Foundation.
- Garvin-Hudson, B., & Jackson, T. O. (2018). A case for culturally relevant science education in the summer for African American youth. *International Journal of Qualitative Studies in Education*, 31(8), 708-725.
- Gay, G. (1975). Cultural differences important in the education of Black children. *Momentum*, 2-5.
- Gay, G. (1988). Designing relevant curricula for diverse learners. *Education and Urban Society*, 2(4), 327-340.
- Gay, G. (1994). Coming of age ethnically: Teaching young adolescents of color. *Theory into Practice*, 33(3), 149-155.
- Gay, G. (2000). *Culturally responsive teaching: Theory, research, and practice*. New York: Teachers College Press.
- Gay, G. (2010). *Culturally responsive teaching*. Second edition. New York, New York: Teachers College Press.
- Gay, G. (2013). Teaching to and through cultural diversity. *Curriculum Inquiry*, 43, 48-70.
- Gay, G., & Kirkland, K. (2003). Developing cultural critical consciousness and self-reflection in preservice teacher evaluation. *Theory into Practice*, 42(3), 181-187.
- Ginsberg, M. (2011). *Transformative professional learning: A system to enhance teacher and student motivation*. Corwin Press.
- Glickman, C., Gordon, S., Ross-Gordon, J. (2014). *Supervision and instructional leadership: A developmental approach*. New Jersey. Pearson Education, Inc.
- Glimps, B.J., & Ford, N. (2010). *White power and privilege: Barriers to culturally responsive*

- teaching. *International Journal of Educational Policies*, 4(1), 39-52.
- Goldenberg, B. M. (2014). White teachers in urban classrooms: Embracing non-White students' cultural capital for better teaching and learning. *Urban Education*, 49(1), 111-144.
- Goldston, J.M., Dantzler, J., Day, J., & Webb, B. (2013). A psychometric Approach to the development of a 5E lesson plan scoring instrument for inquiry-based instruction. *Journal of Science Teacher Education*, 3(1), 527-551.
- Griffin, L., Watson, D., & Liggett, T. (2016). "I didn't see it as a cultural thing:" Supervisors of student teachers define and describe culturally responsive supervision. *Journal of Democracy and Education*, 24(1), 1-13.
- Grinnell, R.M. & Unrau, Y.A. (2005). *Social Work Research and Evaluation: Quantitative and Qualitative Approaches*. Oxford University Press.
- Guba, E.G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. In Denzin, N.K. & Lincoln, Y.S. (Eds), *Handbook of Qualitative Research*, 105-117. Thousand Oaks, CA, US: Sage Publications.
- Guerrero, C., Shahnazarian, A., & Brown, M.F. (2017), Queer(y)ing culture through professional learning communities: A reimagining of culturally relevant and responsive pedagogy. *PennGSE Perspectives of Urban Education*, 1-12.
- Guskey, T.R. (2002). Professional development and teacher change. *Teachers and Teaching: Theory and Practice*, 8(1), 381-391.
- Guskey & M. Huberman (Eds.). Professional development in education: New paradigms and practices, pp. 92-113. New York: Teachers College Press.
- Gutstein, E. (2007). Connecting community, critical, and classical Knowledge in teaching mathematics for social justice. *The Montana Mathematics Enthusiast*, 109-118.



- Hall, M. (2014). Strategies for culturally responsive data collection and analysis. Online submission. Retrieved on November 10, 2016 from [https://nau.edu/uploadedFiles/Administrative/Folder\\_Templates/Strategies%20for%20Culturally%20Responsive%20Data%20Collection%20Analysis%20-%20Melvin%20Hall.pdf](https://nau.edu/uploadedFiles/Administrative/Folder_Templates/Strategies%20for%20Culturally%20Responsive%20Data%20Collection%20Analysis%20-%20Melvin%20Hall.pdf).
- Hall, M., & Hood, D. W. (2005). Persuasive language, responsive design: A framework for interculturally responsive evaluation. *The role of culture and cultural context*, pp. 39-58.
- Harlow, E. (2010). *Encyclopedia of Case Study Research*. Thousand Oaks, CA: SAGE.
- Hastie, P. A., Martin, E., & Buchanan, A. M. (2006). Stepping out of the norm: An examination of praxis for a culturally-relevant pedagogy for African American children. *Journal of Curriculum Studies*, 38(3), 293-306.
- Hayes, C., & Juarez, B. (2012). There is no culturally responsive teaching spoken here: A critical race perspective. *Democracy and Education*, 20(1), 1-11.
- Hayes, C., Juarez, B., & Escoffery-Runnels, V. (2014). We were there too: Learning from Black male teachers in Mississippi about successful teaching of Black students. *Democracy & Education*, 22(1), 1-11.
- Henfield, M.S., & Washington, A.R. (2012). "I want to do the right thing but what is it?" White teachers' experiences with African American students. *The Journal of Negro Education*, 81(2), 148-161.
- Henriksen, E.K., Jensen, F., & Sjaastad, J. (2014). The role of out-of-school experiences and targeted recruitment efforts in Norwegian science and technology students' educational choice. *International Journal of Science Education*, 5(3), 203-222.
- Hernandez, C.M., Morales, A.R., & Shroyer, M.G. (2013). The development of a model

- culturally responsive science and mathematics teaching. *Cultural Studies of Science Education*. 8(1), 803-820.
- Hermessi, T. (2017). Teacher perception of cultural difference in L2 materials: Is filtering culture the right approach?. *The Electronic Journal for English as a Second Language*, 21(2), 1-19.
- Hill, Antonia L., "Culturally Responsive Teaching: An Investigation of Effective Practices for African American Learners" (2012). Dissertations. Paper 353. Retrieved on November 1, 2016 from [http://ecommons.luc.edu/luc\\_diss/353](http://ecommons.luc.edu/luc_diss/353).
- Hilliard, A. G. (1991). Do we have the will to educate all children? *Educational Leadership*, 49(1), 31-36.
- Hilliard, A.G. (2000). Excellence in education versus high-stakes standardized testing. *Journal of Teacher Education*, 51(4), 293-304.
- Hollins, E. R. (2011). Teacher preparation for quality teaching. *Journal of Teacher Education*, 62(4), 395-407.
- Hood, S. (2004). A journey to understand the role of culture in program evaluation: Snapshots and personal reflections of one African American evaluator. *New Directions for Evaluation*, 102, 21-26.
- Hood, S., Hopson, R., & Frierson (2015). This is where we stand. The role of culture and culture context: A mandate of inclusion, the discovery of truth and understanding in evaluative theory and practice. 1-5. Greenwich, GT: Information Age.
- Howard, G.R. (2006). We can't teach what we don't know. White teachers, multicultural schools. (2<sup>nd</sup> ed.). New York: Teachers College Press.
- Howard, T. (2003). Culturally relevant pedagogy: Ingredients for critical teacher reflection.

- Theory into Practice*, 42(3), 195-202.
- Howard, T.C. (2002). Hearing footsteps in the dark: African American students' descriptions of effective teachers. *Journal of Education for Students Placed At-Risk*, 7(4), 425-444.
- Howard, T.C. (2003). Powerful pedagogy for African American students: Conceptions of culturally relevant pedagogy. *Journal of Urban Education*, 36(2), 179-202.
- Howard, T. C. (2010). Why race and culture matter in schools: Closing the achievement gap in America's classrooms. New York: Teachers College Press.
- Howard, T.C., & Reynolds, R. (2008). Examining parent involvement in reversing the underachievement of African American students in middle-class schools. *Educational Foundations*, 79-98.
- Howard, T. C., & Rodriguez-Minkoff, A.C. (2017). Culturally relevant pedagogy 20 years later: Progress or pontificating? What have we learned, and where do we go?, *Teachers College Record*, 119, 1-32.
- Hussar, W.J., & Bailey, T.M. (2018). Projections of Education Statistics to 2026. (45<sup>th</sup> ed). National Center for Education Statistics. U.S. Department of Education.
- Irvine, J.J. (1989). Beyond role models: An examination of cultural influences on the pedagogical perspective of Black teachers. *Peabody Journal of Education*, 66(4), 51-63.
- Irvine, J.J. (2009). Relevant: Beyond the basics, *Teaching Tolerance Journal*, 36, 1-4.
- Irvine, J. J., & Armento, B. J. (2001). *Culturally responsive teaching: Lesson planning for elementary and middle grades*. New York: McGraw-Hill.
- Irvine, J. J., & York, D.E. (1995). Learning styles and culturally diverse students: A literature review. In J.A. Banks & C.A.M. Banks (Eds). *Handbook of research on multicultural education*, 484-497. New York: Macmillan.

- Jackson, T. O., & Boutte, G.S. (2018). Exploring culturally relevant/responsive pedagogy as praxis in teacher education. *The New Educator, 14(2)*, 87-90.
- Johnson, C. C. (2010). The road to culturally relevant science: Exploring how teachers navigate change in pedagogy. *Journal of Research in Science Teaching, 48(2)*, 170-198.
- Jordan, C. (1985). Translating culture: From ethnographic information to educational program. *Anthropology and Education Quarterly, 16*, 105-123.
- Kholi, R. (2012). Racial pedagogy of the oppressed: Critical interracial dialogue for the teachers of color. *Equity & Excellence in Education, 45(1)*, 181-196.
- Knight, S.L. & Wiseman, D.L. (2005). Professional development for teachers of diverse students: A summary of the research, *Journal of Education for Students Placed at Risk, 10(4)*, 387-405.
- Knobloch, N.A., & Ball, A.L. (2006). Analyzing the contextual, motivated, and conceptual characteristics of teaching faculty in regard to the user of learner centered approaches to teaching. Paper presented at the American Education Research Association, San Francisco, CA.
- Korkmaz, H., Thomas, J.A., Tatar, N., & Altunay, S. (2017). Students' out-of-school experiences, job priorities, and perceptions toward themselves as a scientist: A cross-cultural study. *International Journal of Curriculum and Instruction, 9(1)*, 63-80.
- Kozleski, E. B. (2010). Culturally responsive teaching matters!. U.S. Department of Education online submission. *The Equity Alliance*, 1-8.
- Kozleski, E. B., & Suitly, M. B. (2016). The complexities of inclusive education: How cultural histories shape the ways teachers respond to multiple forms of diversity. *Capacity Building Network, 2*, 1-16.

- Kumashiro, K. (2012). *Bad teacher: How blaming teachers distorts the bigger picture*. New York: Teachers College Press.
- Kunjufu, J. (2013). *Changing school climates for Black boys*. Saulk Village, IL: African American Images.
- Ladson-Billings, G. (1992). Liberatory consequences of literacy: A case of culturally relevant instruction for African American students. *The Journal of Negro Education, 61(3)*, 378-391.
- Ladson-Billings, G. (1994). *The dreamkeepers: Successful teachers of African American children*. San Francisco: Jossey-Bass.
- Ladson-Billings, G. (1995a). But that's just good teaching! The case for culturally relevant pedagogy. *Theory Into Practice, 34(3)*, 159-165.
- Ladson-Billings, G. (1995b). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal, 32*, 465-491.
- Ladson-Billings, G. (2000). Fighting for our lives: Preparing teachers to teach African American students. *Journal of Teacher Education, 51(3)*, 206-214.
- Ladson-Billings, G. (2004). It's not the culture of poverty, it's the poverty of culture: The problem with teacher education. *Anthropology and Education Quarterly, 37(2)*, 104-109.
- Ladson-Billings, G. (2009). *The dreamkeepers: Successful teachers of African American children*. (2<sup>nd</sup> ed). San Francisco, CA: Jossey-Bass.
- Ladson-Billings, G. (2014). Culturally relevant pedagogy 2.0.: a.k.a the remix. *Harvard Educational Review, 84(1)*, 74-84.
- Lakin, J., & Shannon, D.M (2015). The role of treatment acceptability, effectiveness, and

- understanding in treatment fidelity: Predicting implementation variation in a middle school science program. *Studies in Educational Evaluation*, 47(1), 28-37.
- Lakin, J., & Wallace, C.S. (2015). Assessing dimensions of inquiry and practice by middle school science teachers engaged in a professional development program. *Journal of Science Teacher Education*, 26(2), 139-162.
- Landsman, J., & Lewis, C. (2011). A call to action and self-reflection for White teachers in diverse classrooms. In J. Landsman & C. Lewis (Eds.), *White teachers, diverse classrooms: Creating inclusive schools, building on students' diversity, and providing true educational equality* (2nd ed.) (1-10). Sterling, VA: Stylus Publishing.
- Lambert, N., & McCombs, B. (1998). *How students learn: Reforming schools through learner-centered education*. Washington D.C.: American Psychological Association.
- Larkin, D. B., Maloney, T., & Perry-Ryder, G. M. (2016). Reasoning about race and pedagogy in two preservice science teachers: A critical race theory analysis. *Journal of Cognition and Instruction*, 34(4), 285-322.
- Latham, A. S. (1999). *The teacher-student mismatch: What the research says about diversity*. Retrieved December 4, 2007 from <http://www.nea.org/teachexperience/divk040506.html>.
- Laughter, J.C., & Adams, A.D. (2012). Culturally relevant science teaching in middle school. *Urban Education*, 47(6), 1106-1134.
- Lea, V., & Sims, E. (2008). *Undoing Whiteness in the classroom: Critical educational teaching approached for social justice activism*. New York: Peter Lang.
- Lee, O. (2005). Science education and student diversity: Synthesis and research agenda. *Journal of Education for Students Placed At Risk*, 10(4), 431-440.

- Lee, O., & Buxton, C. (2008). Science curriculum and student diversity: A framework for equitable learning opportunities. *The Elementary School Journal*, 109(2), 123-137.
- Lee, O., Buxton, C., Lewis, S., & LeRoy, K. (2005). Science inquiry and student diversity: Enhanced abilities and continuing difficulties after an instructional intervention. *Journal of Research in Science Teaching*, 43(7), 607-636.
- Lee, O., & Luykx, A. (2007). Science education and student diversity: Race/ethnicity, language, culture, and socioeconomic status. In *Handbook of Research on Science Education*, (Ed). Abell, S., & Lederman, N. 171-197. Mahwah, NJ: Lawrence Erlbaum Associates Publishers.
- Leonard, J., Napp, C., & Adeleke, S. (2009). The complexities of culturally relevant pedagogy: A case study of two secondary mathematics teachers and their ESOL students. *The High School Journal*, 93(1), 3-22.
- Levers, M. D. (2013). Philosophical paradigms, grounded theory, and perspectives on emergence. *SAGE Open*, 1-6.
- Li, J., Klahr, D., & Siler, S. (2006). What lies beneath the science achievement gap: The challenges of aligning science instruction with standards and tests. *Science Education*, 15(1), 1-12.
- Liggett, T. (2104). The mapping of a framework: Critical race theory and TESOL. *The Urban Review*, 46(1), 112-124.
- Lipman, P. (1995). Bringing out the best in them: The contribution of culturally relevant teachers to education reform. *Theory into Practice*, 34(3), 202-208.
- Lofland, J., & Lofland, L.H. (1995). *Analyzing Social Settings: A Guide to Qualitative Observation and Analysis*. Wadsworth.

- Lucas, T., & Villegas, A.M. (2013). Preparing linguistically responsive teachers: Laying the foundation in preservice teacher education. *Journal of Theory into Practice, 52*(2), 98-109.
- Mable, G. E. (2000). Race, culture, and intelligence: An interview with Asa G. Hillard III. *The Education Forum, 64*(3), 243-251.
- Magen-Nagar, N., & Shachar, H. (2017). Quality of teaching and dropout risk: A multi-level analysis. *Journal of Education of Students Placed At-Risk, 22*(1), 9-24.
- Mansour, N. (2013). Modelling the sociocultural contexts of science education: The teachers' perspective. *Research Science Education, 43*(1), 347-369.
- Martell, C.C. (2018). Teaching race in U.S History: Examining culturally relevant pedagogy in a multicultural urban high school. *Journal of Education, 198*(1), 63-77.
- Mayring, P. (2000). Qualitative content analysis. *Forum Qualitative Social Research, 1*(2), Art 20.
- McCollough, C., & Ramirez, O. (2012). Cultivating culture: Preparing future teachers for diversity through family science learning event. *School Science and Mathematics, 112*(7), 443-451.
- McLaughlin, J. (2013). Crack in the pavement': Pedagogy as political and moral practice for educating culturally competent professionals. *The International Education Journal: Comparative Perspectives, 12*(1), 249-265.
- McKinley, J. (2010). Raising Black student's achievement through culturally responsive teaching. Virginia: Association of Supervision and Curriculum Development.
- Mensah, F. M. (2011). A case for culturally relevant teaching in science education and lessons learned for teacher education. *The Journal of Negro Education, 80*(3), 296-309.



- Mensah, F. M. (2013). Theoretically and practically speaking, what is needed in diversity and equity in science teaching and learning?. *Theory into Practice*, 52(1), 66-72.
- Merriam, S. (2009). *Qualitative research: A guide to design and implementation*. San Francisco, CA: Jossey-Bass.
- Merriam, S.B., & Grenier, R.S. (2019). *Qualitative Research in Practice: Examples for Discussion and Analysis*. (2<sup>nd</sup> ed). San Francisco, CA: Jossey-Bass.
- Merriam, S.B., & Tisdell, E.J. (2018). *Qualitative Research: A Guide to Design and Implementation*. (4<sup>th</sup> ed). San Francisco, CA: Jossey-Bass.
- Metta, J. (2016). It's not about race. Those People. Retrieved from <https://thsppl.com/its-not-about-race-fb140bac8f1#.hp25viwt3>.
- Meyer, X., & Crawford, B.A. (2011). Teaching science as a cultural way of knowing: Merging authentic inquiry, nature of science, and multicultural strategies. *Cultural Studies of Science Education*, 6(1), 524-547.
- Miller, T., Birch, M., Mauthner, M., & Jessop, J. (2012). *Ethics in Qualitative Research*. (2<sup>nd</sup> ed). Thousand Oaks, CA: SAGE.
- Milner, H. R. (2003). Teacher reflection and race in cultural contexts: History, meanings, and methods in teaching. *Theory into Practice*, 42(3), 173-180.
- Milner, H. R. (2006). The promise of Black teachers' success with Black students. *The Journal of Educational Foundations*, 20(3/4), 89.
- Milner, H.R. (2007). Race, culture, and researcher positionality: Working through dangers seen, unseen, and unforeseen. *Educational Researcher*, 36(7), 388-400.
- Milner, H. R. (2010). Start where you are, but don't stay there: Understanding diversity and

- opportunity gaps and teaching today's classroom. Cambridge, MA. Harvard Educational Press.
- Milner, H. R. (2011). Culturally relevant pedagogy in a diverse urban classroom. *Urban Rev*, 43(1), 66-89.
- Milner, H. R. (2014). Culturally relevant, purpose-driven learning and teaching in a middle school social studies classroom. *Multicultural Education*, 21(2), 9-17.
- Milner, H. R. (2015). Getting real about race. *Teaching Tolerance*, 29-31.
- Milner, H. R. (2018). More than a math and science teacher: Bringing students' interests into the classroom enriches learning. *Educational Leadership*, 89-90.
- Minner, D.D, Levy, A. J., & Century, J. (2009). Inquiry-based science instruction—what is it and does it matter? Results from a research synthesis years 1984 to 2002. *Journal of Research in Science Teaching*, 47(4), 474-496.
- Mohatt, G., & Erickson, F. (1981). Cultural differences in teaching styles in an Odawa school: A sociolinguistic approach. In Trueba, H., Guthrie, G., & Au, K. (eds). *Culture and the bilingual classroom: Studies in classroom ethnography*, Rowley, MA: Newbury House.
- Moll, L.C., Amanti, C., Neff, D., & Gonzalez, N. (1992). Funds of knowledge for teaching: Using a qualitative approach to connect homes and school. *Theory into Practice*, 31(1), 132-141.
- Monzo, L.D., & Rueda, R. (2003). Shaping education through diverse funds of knowledge: A look at one Latina paraeducator's lived experiences, beliefs, and teaching practice. *Anthropology & Education Quarterly*, 34(1), 72-95.
- Morales-Doyle, D. (2017). Justice-centered science pedagogy: A catalyst for academic achievement and social transformation. *Science Education*, 101, 1034-1060

- Morrison, K. A., Robbins, H.H., & Rose, D.G. (2008). Operationalizing culturally relevant pedagogy: A synthesis of classroom-based research. *Equity and Excellence in Education, 41(1)*, 433–435.
- Murphy, T.P., & Mancini-Samuels, G.J. (2012). Graduating STEM competent and confident teachers: The creation of a STEM certificate for elementary education majors. *Journal of College Science Teaching, 42(2)*, 18-23.
- Nam, Y., Roehrig, G., Kern, A., & Reynolds, B. (2013). Perceptions and practices of culturally relevant science teaching in American Indian classrooms. *International Journal of Science and Mathematics Education 11 (1)*, 143-167.
- Nasir, N. S., & Hand, V. M. (2006). Exploring sociocultural perspectives on race, culture, and learning. *Review of Educational Research, 76(4)*, 449-475.
- Nelson, J. A., Bustamante, R. M., & Onwuegbuzie, A. J. (2008). The school-wise cultural competence observation checklist for school counselors. *ASCA, 11(4)*, 207-217.
- Nichols, W.D., Rupley, W.H., & Webb-Johnson, G. (2000). Teacher's role in providing culturally responsive literacy instruction. *Reading Horizons, 41*, 1-18.
- Nieto, S. (2000). *Affirming diversity: The sociopolitical context of multicultural education* (3rd ed.). New York: Longman.
- Nieto, S. (1999). *The light in their eyes: Creating multicultural learning communities*. New York: Teachers College Press.
- Nieto, S. (2017). Re-imagining multicultural education: New visions, new possibilities. *Multicultural Education Review, 9(1)*, 1-10.
- Ngo, B. (2010). *Unresolved identities: Discourse, ambivalence, and urban immigrant students*. New York. SUNY Press.

- Odom, A. L., & Bell, C. V. (2017). Developing PK-12 preservice teachers' skills for understanding data-driven instruction through inquiry learning. *Journal of Statistics Education, 25(1)*, 29-37.
- Olneck, M. R. (1995). "Immigrants and Education." In *Handbook of Research on Multicultural Education*, edited by J. A. Banks and C. A. M. Banks. New York: Macmillan.
- Oran, G. (2009). Culturally relevant pedagogy: Preparing teachers for culturally relevant pedagogy. Retrieved from <http://www.education.com/reference/article/culturally-relevant-pedagogy/>.
- Pai, Y., Adler, S.A., Shadiow, L.K. (2006). *Cultural Foundations of Education*. (4<sup>th</sup> Eds) New Jersey: Pearson
- Palardy, G., & Rumberger, R. (2008). Teacher effectiveness in first grade: The importance of background qualifications, attitudes, and instructional practices for student learning. *Educational Evaluation and Policy Analysis, 30(2)*, 111-140.
- Parhar, N. & Sensoy, O. (2011). Culturally relevant pedagogy redux: Canadian teachers' conceptions of their work and its challenges. *Canadian Journal of Education, (34)2*, 189-218.
- Paris, D. (2012). Culturally sustaining pedagogy: A needed change in stance, terminology, and practice. *Educational Researcher, 41 (1)*, 93-97.
- Parsons, E. C. 2005. From caring as a relation to culturally relevant caring: A white teacher's bridge to black students. *Equity & Excellence in Education., 38 (1)*, 25-34.
- Patton, D. C. (2011). Evaluating the Culturally Relevant and Responsive Education Professional Development Program at the Elementary School Level in the Los Angeles Unified School District. *Learning Disabilities -- A Contemporary Journal, 9(1)*, 71-107.

- Patton, M.Q. (2015). *Qualitative Research & Evaluation Methods*. (4<sup>th</sup> ed). SAGE.
- Pelayo, I, Mateo, X, Mendoza, D.E., Ragusa, G. & Rueda, R. (2012) “A Culturally Responsive Coaching Model for Culturally Responsive Teaching Practices: An Early Childhood Case Study. Presented: American Education Research Association, Vancouver, British Columbia, Canada.
- Phillipi, J., & Lauderdale, J. (2018). A guide to field notes for qualitative research: Context and conversation. *Qualitative Health Research*, 28(3), 381-388.
- Phuntsog, N. (Summer, 1999). The magic of culturally responsive pedagogy: In search of the genie's lamp in multicultural education. *Teacher Education Quarterly*, 26(3), 97–111.
- Polydore, C. L., & Siwatu, K. O. (2011). Resolving a cultural conflict in the classroom: An exploration of preservice teachers’ perceptions of effective interventions. *Journal of Negro Education*, 79(4), 458-472.
- Potts, A., & Schlichting, K.A. (2011). Developing professional forums that support thoughtful discussion, reflection, and social action: One faculty’s commitment to social justice and culturally responsive practice. *International Journal of Teaching and Learning in Higher Education*, 23(1), 11-19.
- Povenmire-Kirk, T.C., Bethune, L.K., & Alverson, C.Y., & Kahn, L.G. (2015). A journey, not a destination: Developing cultural competence in secondary transition. *Teaching Exceptional Children*, 47(6), 319-328.
- Quinn, D. M., & Cooc, N. (2015). Science achievement gaps by gender and race/ethnicity in elementary and middle school: Trends and predictors. *Educational Reacher*, 44(6), 336-346.

- Quintana, S. M. (2007). Racial and ethnic identity: Development perspectives and research. *Journal of Counseling Psychology, 54*(3), 259-270.
- Quintana, S.M., & Mahgoub, L. (2016). Ethnic and racial disparities in education: Psychology's role in understanding and reducing disparities. *Journal of Theory into Practice, 55*(2), 94-103.
- Reynolds-Keefer, L. (2008). "Why isn't my teaching good enough?" The journey of urban charter school educators seeking certification. *Journal of Ethnographic Research, 2*(2), 138-144.
- Russell, T. & Korthagen, A.J. (1995). Teachers who teach teachers: Reflections on teacher education.
- Sadler, P.M., & Sonnert, G. (2016). Understanding misconceptions: Teaching and learning in middle school physical science. *American Educator, 26*-32.
- Sampson, D., & Garrison-Wade, D. F. (2011). Cultural vibrancy: Exploring the preferences of African American children toward culturally relevant and non-culturally relevant lessons. *Urban Rev, 43*(1), 279-309.
- Schmeichel, J. (2012). Good teaching? An examination of culturally relevant pedagogy as an equity practice. *Journal of Curriculum Studies, 44*(2).
- Schmidt, P.R. (2003, February). Culturally relevant pedagogy: A study of successful inservice. Paper presented at the annual meeting of the National Reading Conference, Scottsdale, AZ.
- Semrud-Clikeman, M. (2016). Research in brain function: The importance of matching instruction to a child's maturity level. American Psychological Association online submission. Retrieved on from <http://www.apa.org/education/k12/brain-function.aspx>.

- Sheets, R. H. (2005). *Diversity pedagogy: Examining the role of the culture in the teaching-learning process*. Boston: Pearson/Allyn & Beacon.
- Skiba, R.J., Chung, C., Trachok, M., Baker, T. I., Sheya, A., & Hughes, R.L. (2014). Parsing disciplinary disproportionality: Contributions of infraction, student, and school characteristics to out-of-school suspension and expulsion. *American Educational Research Journal*, *51*(4), 640-670.
- Sleeter, C. (2001). *Designing culturally relevant pedagogy*. E-book text section, p.1.
- Sleeter, C. (2011). An agenda to strength culturally responsive pedagogy. *English Teaching: Practice and Critique*, *10*(2), 7-23.
- Sleeter, C. (2012). Confronting the marginalization of the culturally responsive pedagogy. *Urban Education*, *43*(2), 562-584.
- Sleeter, C., & Grant, C. A. (1988). *Making choices for multicultural education*. Columbus, OH: Merrill Publishing Company.
- Sleeter, C., & Carmona, J.F. (2016). *Un-standardized curriculum: Multicultural teaching in the standards-based classroom*. New York, NY: Teachers College Press.
- Smith, A. (2014). You cannot teach what you do not know: You cannot lead where you have not been. *Teaching for a culturally diverse and racially just world*, 88-108.
- Smylie, M.A. (1995). Teacher learning in the work place: Implications for school reform. In T.R.
- Solorzano, D., & Yosso, T. (2001). From racial stereotyping and deficit discourse toward a critical race theory in teacher education. *Multicultural Education*, *9*(1), 2-8.
- Souto-Manning, M. (2013). *Multicultural teaching in the early childhood classroom*. New York: Teacher College Press.
- Spindler, G., & Spindler, L. (1994). *Pathways to cultural awareness: Cultural therapy with*

- teachers and students. Corwin Press.
- Staats, C. (2015). Understanding implicit bias: What educators should know. *American Educator*, 29-43.
- Stairs, A., Donnel, K., Dunn, A. (2012). Using culturally responsive pedagogy to improve teaching and learning. *Urban teaching in America: Theory, research, and practice in K-12 Classrooms*. Sage Publications.
- Sterling, D.R., & Frazier, W.M. (2011). Setting up uncertified teachers to succeed. *Kappan*, 40-45.
- Stephens, N.M., & Townsend, S.S.M. (2015). The norms that drive behavior: Implications for cultural mismatch theory. *Journal of Cross-Cultural Psychology*, 46(10), 1304-1306.
- Stephens, N.M., Townsend, S.S.M., Markus, H.R., & Phillips, L.T. (2012). A cultural mismatch: Independent cultural norms produces greater increase in cortisol and more negative emotions among first-generation college students. *Journal of Experimental Social Psychology*, 48(6), 1389-1393.
- Stiles, J. (2016). Partnership building as a broadening-participation strategy: Helping researcher and developers bridge the gaps in STEM education. *Cadre Brief*, 1-9.
- Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*, Newbury Park, CA: Sage Publications, Inc.
- Suitts, S. (2010). A new diverse majority: Students of color in the South's public schools. *Southern Education Foundation*.
- Tate, W. (2001). Science educational as a civil right: Urban schools and opportunity-to-learn considerations. *Journal of Research in Science Teaching*, 38(9), 1015-1028.
- Tellis, W.M. (1997). Introduction to Case Study. *The Qualitative Report*, (3(2)), 1-14.



- Trees, K. (2013). Effectively teaching diverse student groups: A reflection on teaching learning strategies. *Australian Journal of Adult Learning, 53*(2), 234-252.
- Trent, S.C., Kea, C.D., & Oh, K. (2008). Preparing preservice educators for cultural diversity: How far have we come? *Exceptional children, 74*(3), 328-350.
- Trochim, W.M.K. (2005). *Research Methods: The Concise Knowledge Base*. Atomic Dog Pub.
- Ulanir, E. (2012). An epistemological glance at the constructivist approach constructivist learning in Dewey, Piaget, and Montessori. *International Journal of Instruction, 5*(2), 195-212.
- Underwood, J. B., & Mensah, F. M. (2018). An investigation of science teacher educators' perceptions of culturally relevant pedagogy. *Journal of Science Teacher Education, 29*(1), 46-64.
- U.S. Department of Education, National Center for Education Statistics, Common Core Data. (2013). *State nonfiscal survey of public elementary and secondary education, 2013-2014*, Washington, DC: Author.
- Villegas, A.M. (1988). School failure and cultural mismatch: Another view. *The Urban Review, 20*(4), 253-265.
- Villegas, A.M., & Lucas, T. (2002). Preparing culturally responsive teachers: Rethinking the curriculum. *Journal of Teacher Education, 53*, 20-32.
- Vincent, S. K., & Kirby, A.T. (2015). Words speak louder an action?: A mixed-methods case study. *Journal of Agricultural Education, 56*(1), 32-42.
- Vygotsky, L. (1934/1978). *Mind in society: The development of higher psychological process*. Cambridge, MA: Harvard University Press.
- Wallace, T., & Brand, R. (2012). Using critical race theory to analyze science teachers culturally

- responsive practices. *Cultural Studies of Science Education*, 7(1), 341-374.
- Ware, F. (2006). Warm demander pedagogy: Culturally responsive teaching that supports a culture of achievement for African American students. *Urban Education*, 41, 427-456.
- White, M.D., & Marsh, E.E. (2006). Content analysis: A flexible methodology. *Library Trends*, 55(1), 22-45.
- White, S., & Reid, J. (2008). Placing teachers? Sustaining rural schooling through place-consciousness in teacher education. *Journal of Research in Rural Education*, 23(7), 1-11.
- Wimberley, R. C., & Morris, L. V. (1997). *The Southern Black Belt: A National Perspective*. TVA Rural Studies.
- Wise, T. (2008). *White like me: Reflections on race from a privileged son* (2<sup>nd</sup> ed). Berkeley, CA: Soft Skull Press.
- Wlodkowski, R.J., & Ginsberg, M.B. (1995) Diversity and motivation: Culturally responsive teaching. San Francisco: Jossey-Bass.
- Wlodkowski, R.J., & Ginsberg, M.B. (1995). A framework for culturally responsive teaching: Strengthening student engagement. *Journal of Educational Leadership*, 53(1), 17-21.
- Woodson, C.G. (2018). *The mis-education of the negro*.
- Wright, C., Standen, P., & Patel, T. (2010). *Black youth matters: Transitions from school to success*. New York, NY: Routledge.
- Wynter-Hoyte, K., Braden, E. G., Rodriguez, S., & Thornton, N. (2019). Disrupting the status quo: Exploring culturally relevant and sustaining pedagogies for young diverse learners. *Race, Ethnicity and Education*, 22(3), 428-447.
- Yosso. T.J. (2005). Whose culture has capital? A critical race theory discussion of community cultural wealth. *Race, Ethnicity, and Education*, 8(1), 69-91.

- Yarnell, L.M., & Bohrnstedt, G.W. (2018). Student-teacher racial match and its association with black student achievement: An exploration using multilevel structural equation modeling. *American Educational Research Journal*, 55(2), 287-324.
- Young, A.A. (2010). New life for an old concept. Frame analysis and the reinvigoration of studies in culture and poverty, *The ANNALS of the American Academy of Political and Social Science*, 629(1), 53-74.
- Yurkewecz, T. (2013). Observational Tools to Inform Instruction for Culturally and Linguistically Diverse Learners. *The Language and Literacy Spectrum*. 24 (1).
- Zeichner, K. (2003). Teacher research as professional development for P–12 educators in the U.S. *Educational Action Research*, 11(2), 301-325.
- Zemelman, S., Daniels, H., & Hyde, A. (2012). Best practice: *Bringing standards to life in America's classroom*. Portsmouth, NH: Heinemann.