

**FROM BLACK AND WHITE TO TECHNICOLOR: AN AUTOETHNOGRAPHIC  
STUDY ON A BIRACIAL TEACHER'S JOURNEY TO RESIST  
WHITENESS IN SCIENCE EDUCATION**

by

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## **DEDICATION**

*To my husband, thank you for your unconditional love and support. To my daughter, I once thought it was impossible to write a thesis. I hope this proves that impossible things are possible with the right people in your corner. I love you both very much. xoxo*

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The purpose of this autoethnographic study is to explore how a biracial science teacher resists whiteness in science education. This autoethnographic exploration delves into the intricate web of identity, informed by the intersection of Critical Race Theory (CRT), Critical Whiteness Studies (CWS), and Cultural Efficacy. In a world marked by increasing diversity and complexity, understanding the dynamics of race, whiteness, and cultural efficacy has never been more critical. This research offers a nuanced self-narrative that uncovers the multi-layered dimensions of identity, privilege, and agency within the context of the United States. Through the self-narrative lens of autoethnography, the study provides an intimate journey of self-discovery, acknowledging the researcher's own experiences, biases, and evolving awareness in relation to race and identity. This research aims to inspire critical dialogue, self-reflection, and collective action, inviting readers to consider their own role in dismantling racial inequities and fostering social change.

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## **CHAPTER ONE: RATIONALE**

### **Introduction**

This chapter outlines the rationale for a study on the need to examine how teachers learn how to embrace multiculturalism and critical theories based on race in the classroom while resisting the dominant ethos of whiteness in science education. As student populations continue to increase in the degree of diversity amongst students in the classroom, most educators remain White identifying individuals. In the 2017–18 school year, 79.3 percent of public-school teachers were White and non-Hispanic (Spiegelman, 2020). The same study found that the race/ethnicity of the student and teacher populations in the classroom failed to match by a significant margin. The study showed that in schools where a majority of students identify as non-White, the teacher population remains predominately White apart from schools where most students identify as Native Hawaiian/Pacific Islander. This means that schools with most of their students being students of color are less likely to have educators with the same cultural and ethnic background as the students themselves despite consistent changes in the demographics of student populations moving toward more culturally diverse bodies.

The National Center for Educational Statistics also performed a study during the 2017-2018 school year examining the number of educators who had received preservice coursework focused on meeting the needs of increasingly diverse student populations (Merlin 2021). The study reviewed preservice coursework in three fundamental areas for meeting the needs of a diverse student population including: diverse economic background, special needs and limited-English Proficiency or English language learners. Until recently the highest percentage of coursework preparation for educators was devoted primarily to serving students with special needs. Studies for the 2016-2018 school years demonstrate a shift in preservice training to



encourage a higher percentage of training oriented around serving students from diverse economic backgrounds.

While the increased emphasis on training educators to teach diverse student populations is a step in the right direction, we also need to look at how those educators are implementing their curriculum in the classroom. Additionally, it is not enough to only focus on new educators entering the classroom for the first time without circling back to how current educators are approaching the classroom with diverse populations. There is a critical need for current educators to be taught multicultural education concepts and content curriculum together while bringing awareness of the impact their own identity and positionality has on their students. Literature shows that “more multicultural education in teacher candidate education positively affects teachers’ attitudes and sense of efficacy toward helping culturally and linguistically diverse students” (Bodur, 2012, p. 50). Moreover, it is not enough for educators to learn about multicultural education and progressive theories of race and power structures if they fail to use these tools in the classroom either because of a lack of knowledge and/or support using them in the classroom. This study will examine how a science teacher learned how to turn research into classroom practices that ultimately transformed her teaching.

### **Problem Statement**

This study explores how whiteness exists in science education and how I as a science teacher reshaped my own teaching framework into practices that define and embrace a more progressive and multicultural view of science education. Currently, there is a critical need to unpack how whiteness lives in science education and hides unchecked under the guise of colorblind racial attitudes. To combat the complacent acceptance of whiteness in the science classroom we need to not only teach the pedagogy behind multicultural science education but

also the tools necessary to examine identity, positionality, power, privilege, and implicit bias as tools of self-reflection for teachers.

While training can provide educators with a base of knowledge, abstract theories will often remain abstract without concrete instructional practice. An autoethnographic approach will be used to analyze lived experiences and observations from the classroom to discuss how a shift in paradigm occurs and leads to increased agency when using a multicultural education approach. Using a conceptual framework based on Critical Race Theory (Solorzano, 1998), Critical Whiteness Studies (Nayak, 2007), and Culturally Efficacy (Flores and Gist, 2018). I will explore my development of cultural efficacy through narratives and reflections where I applied key literature topics to my experiences as a science teacher. Below is the main research question for this study.

**In what ways can a biracial science teacher learn to resist whiteness in science education?**

Mirroring national census trends, school populations are shifting to become more diverse but statistics on teacher diversity fail to show the same growth. Due to these diverging demographic models, current teachers lack knowledge of how to teach to a diverse population of students. Among public school educators, 74 percent of those who began teaching between 2016-2018 took courses on serving students from diverse economic backgrounds. Conversely, only 40 percent of public-school educators who started in classrooms before 1981 had similar training focused on economic background diversity. (Merlin, 2021). As the makeup of our classrooms continue to shift to more diverse populations it is essential for teachers to embrace multicultural science education to celebrate diversity while creating a more inclusive society. (Nieto & Bode, 2018).

## **Statement of Purpose**

This study explores how as a biracial science teacher I struggled to incorporate multicultural education into my classroom. I will explore my own notions of identity, positionality, and privilege by sharing insight into what research and experiences led to a change in my thinking and transformed my teaching. Given the personal nature of this research an autoethnographic approach was used to provide details about my success and failures in incorporating multicultural principles into science education. I will share experiences of how increased exposure to literature and critical theory forced me to renegotiate my own identity, my attempts to include multicultural education with science content, and my ultimate transformation into a science multicultural teacher.

## **Operational Definitions**

**Colorblind or Colorblind Ideology-** Choi (2008) explains, colorblind ideology can be seen in five distinct ways; the apprenticeship model, nationalistic ideology, the deficit perspective, meritocratic ideology, and postmodernist-neoliberal rhetoric. Racism can hide in colorblind ideology as people adopt the notion of colorblindness and are unwilling or unable to see the difference in institutional racism versus individual racism thus continuing the cycle of racial inequality. Consequently, colorblindness enables White people to be complicit in perpetuating racism without any acknowledgment or responsibility (Bonilla-Silva, 2014). We must hold future and current educators accountable by teaching them how to identify these types of unknown biases in the classroom so that they can address them. Educators can no longer afford to ignore their discomfort in talking about difficult subjects.

**Culturally Efficacious-** Cultural efficacy is confidence in your ability to instruct students from diverse populations especially when they are different from your own (Flores et al., 2015). The

term is used to describe a teacher who not only knows how to incorporate social justice, multicultural education, and culturally relevant pedagogy, but is also empowered to use it in their school and classroom.

**Culturally Efficacious Evolution Model-** The Culturally Efficacious Evolution Model (Flores & Gist, 2018) is used as an instrument to guide and assess preservice teacher's practice in the classroom. It contains four dimensions which will be explored in a later section.

**Multicultural Education-** My goals for a Multicultural education are based on Nieto & Bode (2018) "1. Tackling inequality and promoting equal education. 2. Raising achievement for all students. 3. Provide opportunity to become productive members of society" (p.8). However, I also think in specifics and some of my examples of Multicultural Education come from Sheth (2019) such as connecting to student's experiences, teaching the benefits of learning science, representing scientists of color and having the students see themselves as capable of doing science.

**Racism** - The use of racism will refer to Tatum's (1997) definition as "a system of advantage" rather than an issue of personal prejudice or stereotypes.

**Whiteness-** "Whiteness refers to the structural arrangements and ideologies of racial dominance within the United States. Racial power and inequities are at the core of whiteness, but all forms of power and inequity create and perpetuate whiteness" (Castagno, 2013, p. 101). Whiteness can be manifested as colorblind discourse, positioning whiteness as natural and normal, framing differences to being about nonwhites and not of whites themselves, affirmative action assumptions, etc. (Matias & Mackey, 2016). Normality of whiteness results in Whites not believing that they are actively investing, supporting, or participating in White supremacy or racism, which keeps oppression intact (Le & Matias, 2019). Whiteness is not to be confused with

the White race category but rather the privilege and power of cultural constructs that support Whites including financial resources, educational opportunities, health care and property rights. (Matias & Boucher, 2023; Nayak, 2007).

**Whiteness in Science Education-** Whiteness in science education can reveal itself in foundational practices of teachers in the classroom (Sheth, 2019), teacher education (Matias & Mackey, 2016), the teacher's knowledge of pedagogy, instructional practices, and preparedness to address cultural diversity (Le & Matias, 2019; Yerrick & Johnson, 2011).

## **Topic Rationale**

### **Self-Discovery & Positionality**

What is the purpose of middle school science? Science is a way to explain how the natural world works. On the record I teach middle school science, but I consider myself an interdisciplinary teacher because I also teach reading, mathematics, accountability, humanities, social studies, and art. Even though my job is “science teacher,” the reality is I must teach so that my students can take and pass a state mandated test while also trying to embed my class with the things all adults should take away need from science. I do not necessarily expect my students to become scientists and in truth do not even push for it. Rather, all adults need a fundamental science education to become better people and see the link between what we learn in class and what is happening in the world around them. Middle school science is a wonderful opportunity to introduce students to all the different branches of science so that they can find a type of science that they enjoy and can learn from. During the school year, I teach science subjects such as ecology, chemistry, physics, biology, environmental science, astronomy, and geology, hoping each student will find a type of science that interests them. The truth is it is becoming harder and harder to predict what specific science knowledge my students will need in the future based on

the ever-changing world where technological breakthroughs allow us to see further into the galaxy or deeper into the ocean. However, if I can teach them how to think like a scientist, how to ask questions, and how to know the rules that govern the natural world and acknowledge the exceptions to those rules this provides the students with basic building blocks that can extend from simple science facts towards a foundation of critical thinking and understanding of the world that surrounds them.

Why am I a science teacher? As a student my two favorite subjects were science and math. The answers I was searching for in those classes were always clear cut. Unlike my English and Philosophy classes where I was lost in the symbolism of a cloud, in science there are distinct types of clouds based on height and appearance. I like the directness of identifying a cloud not trying to subjectively interpret what that cloud represents. I gravitated towards teaching these subjects because they were ones I enjoyed and valued, and innovation comes from a wide background of knowledge with a solid foundation of science and mathematics. I also see that the current high paying fields of study are most often STEM subjects. According to a 2017 study done by the U.S. Bureau of Statistics, there are roughly 8.6 million STEM jobs in life science, mathematics, computer science, physical science, and engineering. The national average wage for these STEM occupations is double the national average wage for non-STEM occupations (\$87,570 versus \$45,700) (Fayer et al., 2017). Subjects in STEM are important for children to learn about because those fields of study make more money. While economic achievement is not the only measuring stick for success, I wanted to help create a future for my students because I saw the importance of STEM subjects with the ever-improving technology and innovation of our modern society. The STEM area is a driving force of innovation and economic growth in the US

and globally as STEM individuals produce new products and innovative solutions (Smith & Willison, 2021).

Another reason I am a science teacher is because I love working with students. I find such joy in teaching and getting to know the students in my class. My nickname in the classroom is Ms. Oz and students will run into me outside of school and share memories of our time together. They often remember our time making glow in the dark stickers, the Wizard of Oz decorations, the Mean Girl Quotes, or the year where every project was based on Taylor Swift. Being a teacher has also made me a better mother. I mother about one hundred and seventy kids a year so by the time I had my daughter they had broken me into the art of mothering. Conversely, I also think being a mother has made me more caring toward my students. I had a young daughter when I entered graduate school and as I grew in motherhood and my profession, I started developing better relationships with my students. We also survived a pandemic together. The students I had for the 2019-2020 and 2020-2021 school years will have a special bond with me because of how close I became working on Zoom with them and in small groups as they slowly trickled back into the classroom. I earned the affectionate nickname Mrs. Mom for that group. I build relationships with my students but not at the expense of also teaching them. My test scores are some of the top scores in the district and I am proud of what I accomplished in the classroom.

As I continue to grow as a teacher and gain experience, I often ask how can I be the voice for other biracial science educators? As a biracial individual of white skin people often make assumptions about me based on my name. When you read my name on the title page, and I wrote about being biracial you might have assumed one of the races was Hispanic but that last name comes from my father-in-law whose family came from Mexico. I am half White and half

Korean, but I did not always acknowledge my Korean heritage for most of my life because I felt White. This self-identification was furthered as I passed for White, and the only visible trace of my Korean lineage is a slight genetic slant in my eyes which most people cannot identify unless they are aware of it.

My mom is Korean, and my dad is White. They met while my dad was stationed in Seoul as an MP with the Army. They had a short courtship, moved to the United States, and married. My mother adapted to my father's "American" way of life. My brother and I grew up speaking English and eating hamburgers, not bulgogi. We used forks not chopsticks. We celebrated Thanksgiving and Christmas, not Chuseok and Seollal. My mom never cooked Korean food and she did not have Korean friends, so her culture was a mystery to me. My mother's decision to assimilate when she moved is part of the reason I identified and could pass for White. According to Berry et al., (1989) there are four types of acculturations; assimilation, integration, separation, and marginalization. My mother's behavior is indicative of the assimilation option where she diminished her Korean cultural identity to adopt the dominant American identity and raise her children in that dominant identity.

I am going to share stories to show how I have wrestled with my racial identity over time. The first story is about a time in high school where I realized I wasn't seen as White by my teachers.

*The year was 1996, I was in World History class and my teacher was explaining our first debate. I loved to argue and had no problem with public speaking so I was excited to be assigned a topic. As the topics were being introduced I started eyeing my friends trying to determine who wanted to work together when the teacher called my name and Alex Yang, the Chinese boy in class. We were chosen to be partners on the Pro Immigration debate. I resented the fact that I was chosen to debate a pro-immigration stance because my mother immigrated here. That was her story not mine. I was White. I grew up in a small town where there was one Asian Family who ran the Chinese food restaurant and my mom.*



Due to my biracial identity I assume the teacher wanted to capitalize on the fact that my mother had immigrated to this country or that I was half Asian. I never saw myself as Asian but in a classroom of White and Hispanic students my Korean identity stood out to that teacher. To my white friends I am Asian to my Asian friends I am White. For instance, here is a story from my freshman year in college

*I went to college in the fall of 1998 and had 9 roommates. My mom uses the word Oriental to describe herself and other Asian people. This became a word that I would use to describe my mother's heritage. You can imagine my shock when I used the word Oriental in front of my Chinese roommate. She cringed and said to me "Oriental is a rug not a person." I didn't fit the Korean mold. I didn't speak the language, eat the food or know the culture.*

My roommate thought of me as just another White girl. I have spent most of my life checking the box for White so I really couldn't argue with her. I constructed my identity around being a White American. I moved to New York City in 2001. I was immersed in a cultural melting pot and made friends with a group of people from Long Island. Every new introduction led to the question, where are you from? My first response was California until I began to realize they meant Why do you have slanted eyes? Why are you White but not White? My response was generally, my mother is Korean so my eye shape comes from her and my dad is White so I have a lot of features from his side of the family. In truth I looked nothing like either of my parents but the majority of my features are from my father so I passed for White. I adopted a colorblind stance to withdraw myself from conversations about race. I toed the line of being biracial and not seeing race as an issue. My positionality as a white individual underscores the necessity of acknowledging privilege, embracing awareness, and actively participating in efforts to dismantle systems of inequality.

In graduate school I had a transformational experience that led to many changes in my teaching. One of the things I learned about was the history of education for minorities in our

country and reflect on how that might have impacted my mother as she came to this country. A lot of the work I did in graduate school forced me to look at parts of my identity and explore identity development and positionality. I also learned about power, privilege, and implicit bias of classroom teachers and how I could use these as tools of self-reflection. The biggest change was my learning shifted from content knowledge to pedagogy styles where I learned about social justice, culturally relevant and culturally responsive pedagogy. The biggest struggle was figuring out how to change my classroom practices and the way I teach science to embrace multicultural science education. All my previous beliefs about how to teach science and the importance of teaching science have changed and this autoethnography is a chapter of that journey to self-discovery.

### **Professional Rationale**

My next professional goal is to teach future educators. My road to research has been a series of road closures and lane changes but I have persevered on my journey. I enjoy teaching middle school students and will continue to do that as I pursue my path of educating teachers. Every year in the class is an opportunity to collect data on how to model effective teaching practices. Every year as I complete my teacher evaluation I reflect on my teaching. I am always praised for my ability to build relationships and I realized that was a direct reflection of how much I have grown from my education during graduate school. I used to consider myself a science teacher and thought my only job was to teach them the content. I didn't realize the much bigger role I played in my student's lives and how I needed to build better relationships. I also am currently working on building my cultural efficacy. I work with colleagues who don't believe in privilege, they seem to think that if they acknowledge their privilege that it diminishes their hard work and achievement.

My first attempt at writing this thesis was denied by my school district without any feedback. I originally wanted to address the gaps of knowledge on culturally relevant teaching between educators currently in the field with educators that were entering the field after attending a university that focused on equity and social justice. I created a four-week digital learning module course to bridge the gaps of knowledge so that teachers could understand how to reach a population of diverse students. I wanted to incorporate some of the most meaningful things in my graduate school program that were able to shift my paradigm in teaching and have made me a better teacher by addressing topics of privilege, funds of knowledge, power dynamics in a classroom. I will never know why my school district passed on the opportunity to teach and collect data but it was also around the time that school districts were getting slammed with parents who were outraged at Critical Race Theory.

My second attempt was going to be about the growth of my clinical teacher. We attended the same university so it was the perfect opportunity to mentor her and share our experiences. As I started writing and researching I realized that I was still developing my cultural efficacy along with what I thought about the role of science and multicultural education. So, I went back to the drawing board and redesigned my current thesis around the previous barriers. The desire to write an autoethnography arose from my desire to not need district approval on my research, not rely on other teachers to fill out a survey or training and be able to testify to what parts of my education and experience led to a transformation in my teaching.

Writing a thesis has been a long-term goal for me. I was slowed down by a change in school districts, a global pandemic, working full time and fulfilling my familial roles of mother, wife, daughter and friend. I have given up more times than I can count but yet I persisted. An unknown drive to document my journey kept persisting in the back of my mind. It was probably

the voice of my professors who assured me that my journey mattered. I am not a verbose writer by nature, so writing has been a challenge. I could have graduated three years ago with my Master's degree but something in me needed to write this thesis. I sat in my graduate school classes and as I read the research a change started. It was an awakening to who I wanted to become as a teacher. If I stopped my journey to becoming a transformational teacher at the end of my graduate school classes I would have never reached this part of my self-awareness. I have struggled to identify why I couldn't apply the research to my content subject of science. In doing the research for my thesis a second rebirth happened. I saw reflections of myself in the research I found answers to my question with concrete examples that my brain could understand and I look back and I want to help others on a similar pathway. The goal was never to just get the diploma, the goal was to learn and become a better version of myself as a teacher, a Mrs. Oz 2.0. I hope that as I write about my struggles and awakening it will provide teacher educators insight into how to challenge other teachers like myself and lead them on the road to becoming a transformational teacher.

### **Summary of Key Topic Literature**

My conceptual framework for this study is based on three principles: Critical Race Theory, Critical Whiteness Studies and cultural efficacy.

**Critical Race Theory (CRT)** - I will use Critical Race Theory as part of my conceptual framework to examine institutional racism in our educational system, specifically in the subject of science education. Critical Race Theory can be used as a tool to examine the inequalities that students of color experience in their school environment. According to Solórzano 1997, there are five themes to Critical Race Theory in Education; the centrality and intersectionality of race and

racism, the challenge to dominant ideology, the commitment to social justice, the centrality of experimental knowledge and the interdisciplinary perspective.

I will use each of these themes as a lens to identify and dissect their appearance in education to show the implementation of Critical Race Theory in science education. In the theme of centrality and intersectionality of race and racism, race is described as a social construct and racism is used to divide White students from students of color to create unfair school or classroom environments created by a teacher's positionality and conscious or unconscious bias. In the challenge to the dominant ideology theme, teachers hide behind colorblind ideology to justify their racist classroom practices. In the commitment to social justice theme the hope that with knowledge and change we can engage in equitable social justice practices for all students regardless of color, gender, sexual orientation, pronouns or class. In the centrality of experimental knowledge theme, I will add to this body of knowledge with my own autoethnographic experience to contribute to the conversation as a biracial teacher. Autoethnography, as a methodology of storytelling, lends itself to this theme as a way to analyze and understand my lived experiences. In the interdisciplinary perspective theme, I will show how racism is so firmly embedded in school curriculum that teachers may have a hard time acknowledging its presence. We must look at racism's historical inception into education and how it lives in the educational system historically and currently to gain perspective on its application and removal.

Critical Race Theory becomes an important intellectual and social tool for deconstruction, reconstruction, and construction: deconstruction of oppressive structures and discourses, reconstruction of human agency, and construction of equitable and socially just relations of power (Ladson Billings, 1998). I will use it to show how students of color are

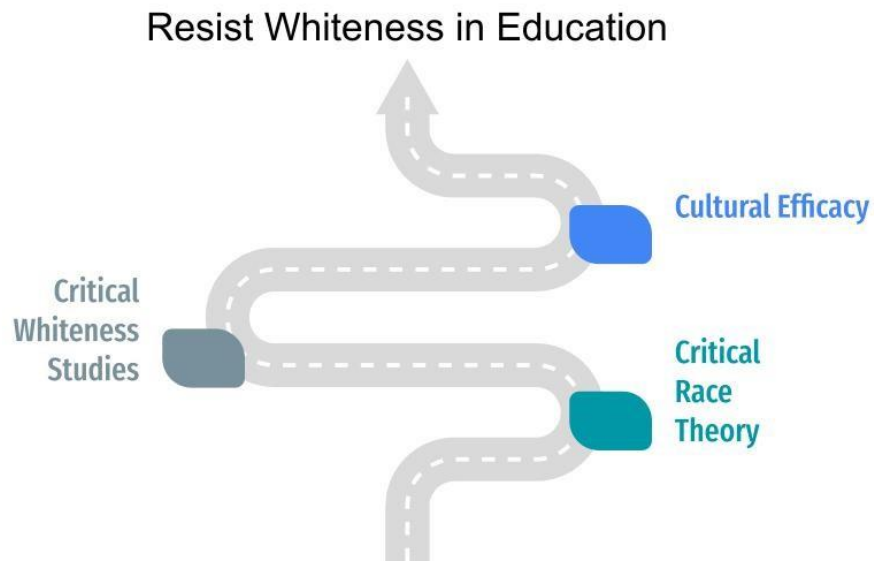
marginalized by their teachers and how teacher education can bring awareness to the teacher's identity and through self-reflection teachers can be empowered to change their practice.

**Critical Whiteness Studies**-Critical Whiteness Studies looks at the privileges of whiteness and how it allows racism to hide behind other terms such as colorblind or racial ignorance.

According to Nayak 2007, there are three beliefs in Critical Whiteness Studies. 1. Whiteness is a modern invention; it has changed over time and place. 2. Whiteness is a social norm and has become chained to an index of unspoken privileges. 3. The bonds of whiteness can yet be broken/deconstructed for the betterment of humanity. As I use Critical Race Theory to look at inequalities in education, I will in conjunction use Critical Whiteness Studies to understand White teacher's understanding of White privilege. Using the first belief I will look at the changes over time to what whiteness means. The study of whiteness has changed over time from how people of color suffer whiteness to how white people understand their privileges (Matias & Boucher, 2023). I will use this current idea of whiteness as privilege to acknowledge privileges that for the most part go unknown by teachers who feel guilt or colorblind. Using the second belief I will show how the education system and most teachers are unaware of unspoken privilege and code their language as a way to not acknowledge the difficulties of talking about power and privilege with students. Critical whiteness studies can be used to deconstruct the material, physical, emotional and political power of whiteness (Matias & Mackey, 2015). Using the last belief, I will show the work of other multicultural teachers who opened my eyes and shifted my beliefs to transform my teaching. Research on what methods aid in the deconstruction of whiteness have been seen when teaching innovative lessons, using inquiry and reflection to allow teachers to acknowledge privilege and work to dismantle it in their classrooms (Matias & Mackey, 2016).

**Culturally Efficacious Evolution Model (CEEM):** The Culturally Efficacious Evolution Model (Flores et al., 2018) was developed as a tool for teacher educators to use that could show the growth and development of teacher candidates as they gain cultural efficacy. It was developed to be used as a way to measure the growth and development of clinical teachers but I think it also has value to practicing teachers. The goal of the CEEM is to develop teachers who are knowledgeable, professional, and community-based culturally efficacious agents of change. The model has four dimensions, cultural consciousness, cultural competence, cultural proficiency and cultural and critical responsiveness to move through as you gain the last dimension of cultural efficacy. One dimension is cultural consciousness where teachers self-reflect about their identity, positionality and privilege in the classroom and how that affects their students. Another dimension is cultural competence where teachers gain knowledge of their students and develop relationships with their students. Teachers can identify funds of knowledge (Gonzalez et al., 2005) and use this to develop their culturally relevant (Ladson Billings, 1994) and culturally responsive teaching (Gay, 2000). Another dimension is cultural proficiency, where teachers use what they know about their students to create lessons that make cultural connections to students and their environment. It is also about our classroom practices that serve to “affirm student ethnic/cultural and academic identities” (Flores et al., 2018). The last dimension is cultural and critical responsiveness, as the teacher gains greater efficacy in their practice, they begin enacting transformative and critical practices. (Flores et al., 2018). The model is shown as a circle because a teacher will cycle through the dimension many times in their career and there is not one correct way to move through the dimensions.

## Conceptual Framework



**Figure 1**

### *Conceptual Framework for Resisting Whiteness in Science Education*

The conceptual framework that I developed above illustrates how I viewed my graduate school experience as a journey. I had a lot of stops and roadblocks on this journey but these were the main research ideas that I continued to return to and thus began to shape my teaching practices. The two-way road shows that while the destination is clear there might be a lot of back and forth between the topics which represents the continued learning of each topic as I grew in my teaching practice. There is also an interconnectedness between each of these topics and how they helped me become a teacher who can identify whiteness in curriculum materials and look for culturally relevant ways to instruct students.

### **Brief Review of Methods**

This autoethnographic study shared insight into my struggles of accepting how to incorporate research into practice. Autoethnography can be used to analyze and interpret lived experiences that connect to insights on self-identity, communication practices, values, and larger



social, cultural, and political issues (Poulos, 2021). I will also use recommendations and guidelines from the Bullough & Pinnegar (2001) study that outlines parts of autobiographical forms of self-study research that involves examining clear purpose, systematic data collection, rigorous data analysis, reflexivity, and contributions to the field of research. This study will be focused on my experience as a Korean and White female science teacher in identifying and trying to resist whiteness in science education. I will try to identify the shift in my paradigm that changed me as a teacher in the hopes that they can inspire change in others who are struggling with similar issues in teaching science.

### **Scope and Significance**

#### **Assumptions and Limitations**

This research relies on assuming my memories are accurate and fair. I assume that if my students or colleagues read this autoethnography they would agree with my interpretation of events and see that I represented them ethically. It is almost impossible to know how one's autoethnographic work will be received, and/or how, if people recognize themselves in the narratives, they will feel and, in turn, respond to us (Edwards, 2021). I hope that through my storytelling I can capture my readers' attention and in some way my audience will recognize themselves at a similar crossroads. As I show how I was affected by this experience it will keep the conversation moving forward on how we educate and train science teachers. This research is limited by what I can remember. It is a case study of one and while it may not have a large reach in terms of audience and global implications it may just be enough to help a few teachers find their way or help navigate the development of new teacher preparation programs

## **Significance**

This study is an inside look at a single person's experience in finding a pathway to teach multicultural science education where no clear path previously existed. I want to help build a pathway for other science teachers who find themselves in a comparable situation. I hope that others will benefit from my journey and, as I add to the history, may they learn from my mistakes and not make the same ones I did as a young professional. The model I am using was designed to be used for a teacher preparation program at a large university in the Southwest region of the United States of America but my usage of it will highlight its usefulness to current educators. I hope to contribute to the way we educate new and current science teachers to teach a diverse population of students. Contribution to literature on this subject matter is important to me because I want to teach future science educators.

## **Chapter Summary**

This chapter served as the rationale for an autoethnographic study of how whiteness permeates through science education and masks itself as colorblind to protect the status quo. This study examines how the use of the Culturally Efficacious Model (Flores & Gist, 2018) was used to develop cultural efficacy after a graduate school student attended a social justice and transformative college of education program. This chapter outlined the conceptual framework to be used in the analysis of cultural efficacy used and gained by a currently practicing teacher.

Chapter two uses literature to further discuss the state of science education and how science teachers can identify and resist whiteness in science education. Chapter 3 outlines the methodology involved in planning this study.

## **CHAPTER TWO: REVIEW OF LITERATURE**

Chapter One introduced the need for this autoethnographic study about how a biracial teacher learns to resist whiteness in science education, as well as the framework based on combining Critical Race Theory (CRT), Critical Whiteness Studies (CWS) and cultural efficacy. It also included operational definitions that will be used throughout this study. In addition, it provided the personal and professional rationale for this autoethnography to explain how I entered this idea of exploring how my knowledge was constructed and ultimately transformed by my graduate studies and thesis writing. I hope to use this body of knowledge to guide me as I move to the next part of my journey as a teacher educator.

In this chapter, I will provide analysis on current literature that shows the incorporation of Critical Race Theory and Critical Whiteness Studies into science teacher training programs. Critical Race Theory is a multifaceted and evolving framework that has garnered significant attention in the realm of education in recent years. Originating in the legal field, CRT has been adapted and applied to various disciplines, including education, where it offers a powerful lens through which to examine issues of race, equity, and social justice. The emergence of Critical Whiteness Studies within the educational context represents a crucial and evolving dimension of academic inquiry. CWS offers a lens through which to interrogate the power dynamics, racial hierarchies, and social structures that have, for generations, perpetuated systems of privilege and oppression in educational institutions. I will explore how Whiteness is protected in the science curriculum and how Critical Whiteness Studies can be used as a framework that examines how whiteness as a social construct perpetuates racial inequality and dominance in the field of education. CWS can inform and transform the preparation of science teachers. Last, I will discuss the ways to resist whiteness in education by using science multicultural studies and the

Culturally Efficacious Evolution Model. These approaches aim to provide diversity, inclusivity, and cultural sensitivity in science education.

### **State of Science Education**

The current state of science education provides insight into the trends, challenges, and innovations in this field. It is essential to understand the status of science education to improve teaching methods, curriculum development, and overall student performance. There is a growing emphasis on making science education more inclusive and equitable. Researchers and educators are working to reduce disparities in access to quality science education and promote diversity in STEM (Science, Technology, Engineering, and Mathematics) fields by teaching Critical Race Theory in teacher preparation programs. As the racial divide between teachers and students increases there is a need to analyze how to train and prepare White science teachers to educate in schools where the majority of students are not White. The science curriculum taught in class is developed from a historical shaping of curriculum determined by whose race matters. In science the White Eurocentric curriculum seems to echo that White Science matters most (Au et al., 2016). Science had been used in the past to assert White dominance over Black people by declaring Black people intellectually inferior Jefferson (1794) and Hoffman (1896). As we reconstruct science curriculum for all we need to look at practices that address cultural competence and inclusivity ensuring that preservice teachers can create a welcoming classroom environment.

### **Cultural Competence and Inclusivity**

Effective teacher training should address issues of cultural competence and inclusivity, ensuring that teachers can create a diverse and welcoming classroom environment. As schools are becoming increasingly diverse with students from various cultures, ethnicities and

socioeconomic backgrounds, teachers need to be better equipped at understanding, respecting, and responding to the unique needs of their students. Cultural competence is the ability to attend responsively to students' needs within the context of a range of social identity factors such as race, religion, ethnicity, language, culture, and ability in cross-cultural settings (Bustamente et al., 2016). Pre-service teacher training that intentionally includes a culturally responsive curriculum can increase teacher efficacy. Moore et al. (2021), found that teachers were confident in their own ability to teach culturally diverse learners when the program was intentionally focused, but a larger study was needed to gauge the readiness of the entire teacher workforce. Also, the scale questionnaire used did not ask the participants to justify their answers and should be noted that most teachers will say they are not racist but cannot identify racism in the curriculum. Cultural competence and inclusivity training can help teachers recognize and address disparities in education. Teachers who are aware of cultural differences and the potential biases that can arise are better positioned to provide an equitable education for all students, regardless of their backgrounds (Gay, 2010). Building trust and positive relationships with students is crucial for effective teaching and learning. Cultural competence helps teachers establish trust and rapport with students by respecting their cultural identities, backgrounds, and experiences (Ladson-Billings, 1995). By promoting cultural competence and inclusivity, teacher education programs can help future educators become more aware of their own biases and prejudices. This awareness can lead to a reduction in stereotypes and discrimination, fostering a more inclusive educational environment while challenging the inequalities present (Nieto & Bode, 2018). Incorporating cultural competence and inclusivity into teacher education programs is essential for preparing educators who can effectively serve all students and promote a more equitable and

just educational system. It is an investment in both the quality of education and the well-being of the students and communities they serve.

### **Application of CRT to Science Teacher Training**

Applying CRT to science teacher training allows for an examination of how racial dynamics and inequities manifest in the preparation and professional development of science teachers. We can also look at how CRT helps teachers understand how science education can perpetuate or challenge racial disparities. One form of contemporary racism is deficit thinking (Ladson-Billings, 1995; Yosso, 2005). Yosso (2005) emphasizes that culturally relevant pedagogy should recognize and incorporate these various forms of cultural capital to promote more equitable and inclusive educational practices. In her research, she identifies six key cultural capital forms: aspirational, familial, linguistic, navigational, resistance, and social capital, each of which contributes to the success and empowerment of students from culturally diverse backgrounds. Ladson-Billings (1995) argues that traditional education often overlooks the cultural backgrounds and experiences of students, resulting in disengagement and underachievement, particularly among minority students. She proposes that Culturally Relevant Pedagogy involves three key components: academic success, cultural competence, and critical consciousness. CRT literature highlights the role of implicit biases that influence their interactions with students of different racial backgrounds. Implicit biases refer to unconscious attitudes or stereotypes that influence an individual's understanding, actions, and decisions. Stereotypes are cognitive frameworks or mental shortcuts that categorize individuals or groups based on certain characteristics. “Approximately 25 percent of preservice teachers endorsed stereotypical beliefs about poor and minority students and expressed discomfort with student diversity” (Kumar & Hamer, 2013, p. 162). The literature explores the impact of implicit bias on

student-teacher interactions, student evaluations, and disciplinary actions in educational settings. Implicit bias can contribute to the achievement gap and unequal educational outcomes. Warikoo et al. (2016) presents findings that indicate that racial bias can influence educators' perceptions and expectations of students. This bias can result in disparities in teacher evaluations, discipline, and classroom dynamics. Implicit bias training for teachers is designed to help educators recognize and address their own unconscious biases and stereotypes, particularly those related to race, gender, ethnicity, and other social categories. Teachers need to engage in self-reflection to identify their own biases and stereotypes. They may complete self-assessment exercises to become aware of their implicit biases because it is a crucial step in addressing bias.

### **Protecting Whiteness in Science Education**

CWS is an interdisciplinary framework that explores how white supremacy operates and is reproduced in various social institutions, including education. It examines how whiteness is positioned as the norm, and how this positioning leads to the marginalization of non-white identities. The majority of shareholders in creating science education protect the interests of the dominant group and fail to recognize how whiteness manifests in science education. Nayak (2007) said that Whiteness is a social norm and has become chained to an index of unspoken privileges. These unspoken privileges can be identified from McIntosh (2001) article where she developed a series of twenty-six questions that highlighted her white privilege based on her skin color. “Over the last 20 years, the study of whiteness has shifted from understanding how people of color suffer whiteness to how whites understand their favor and privilege under it” Matias, & Boucher (2023). There is a failure to identify whiteness in science because most people do not know what to look for.

## **Interrogating Assumptions and Privilege**

Science teacher training informed by CWS encourages the interrogation of assumptions, privileges, and biases related to whiteness. This included examining how notions of objectivity, meritocracy, and colorblindness can reinforce white supremacy in science education. The earliest training that science teachers have is indoctrinated in them when they are students learning science. Their teacher's bias and positionality on what science is and who can do science can have an outcome of beliefs in their own success. Mensah & Jackson (2018) case study of preservice teachers in an elementary methods class participant had to overcome past experiences of feeling excluded from science because science was viewed as White property. The professors had to challenge the traditional image of the White male scientist to break the illusion that science is traditionally a White Eurocentric subject that exudes students of color. McCausland's (2022) autoethnography showed two stories from a white science lab teacher who showed signs of their exertions of whiteness in a college lab class by excluding people of color by not allowing them in the "space of science" due to its White Property. Both studies applied a Critical Whiteness Studies lens to analyze the behavior of the White teachers to determine what Nayak (2007) deemed as properties of critical whiteness studies that whiteness is a social norm that grants unspoken privileges like the preservice teachers believing that science was not meant for them or the lab students whose opinions and version of doing science were not deemed correct nor scientific.

Research from professors is particularly illuminating in what lessons are beneficial to shifting paradigms or confusing students. A case study done by Matias & Mackey (2016), looked at successes and failures of their students to identify racism and whiteness. The students' reflections on classroom assignments allows us to see the student's perspective and struggle to



identify privilege using a critical whiteness pedagogy. The student quotes were used to show success and failures in student learning. The case study was particularly helpful in identifying how students may struggle with racism and be colorblind to their own racist tendencies. Dunac & Demir (2017) also supports the notion of conversations about whiteness and privilege with preservice teachers and stresses the need for not only teaching Critical Race Theory and Culturally Relevant Pedagogy but also supporting the students with a methods class so that teacher may explore what practical application of the research look like.

There is a lot of support for including explorations of privilege in teacher education programs (Dunac & Demir,2017; Le & Mathias,2019; Mathias et al.,2014; Mathias &Mackey, 2016; Sleeter, 2001). Some of the ways that have shown to help white students identify their privilege is through a privilege walk. Using questions formulated from McIntosh (2001) *Unpacking the Invisible Backpack*, Siliman & Kearns (2020) found that students thought “intentionally about the experience of their privilege activities as a place of possibility and productive vulnerability.” Others created hand-on experiences to show inequalities in building structures using marshmallows (Matias & Mackey, 2016) or JENGA blocks (Pickering, 2023). The participants were told that they were given the same supplies to be successful but during the activities groups were given advantages over others to show how privileges affect equality.

Some classes will do a version of a privilege walk like Siliman & Kearns (2020) to “uncover how our different identities give us access and prevent our access to certain spaces, resources and energies” (p 48). Privilege walks are often criticized for making White people feel guilty but there are ways to do it and have the students remain anonymous by completing a digital version without identifying the students by name. Zarate & Mendoza (2020) chose class

reading and discussion with class pen pals about application of privilege to their life and was found to be most insightful for the students of color.

Choi (2008) research on colorblind ideologies argues that colorblind ideologies perpetuate racial disparities, as they tend to overlook systemic racism and inequalities. The work emphasizes that educators and institutions must unlearn these ideologies and instead adopt a more critical and inclusive approach to education. This involves recognizing and addressing the impact of race and racism on students' experiences and outcomes.

Gordon (2005) highlights how colorblindness, which involves ignoring or downplaying racial differences, can unintentionally perpetuate racial disparities and injustices in education. The author suggests that teacher education programs should be more proactive in addressing race and providing the necessary knowledge and skills to confront racial issues in the classroom. This includes acknowledging the significance of race, fostering cultural competence, and encouraging teachers to actively engage with diversity and social justice. A study by Peters et al. (2016) collected data on student teachers and found they “were more color-blind at the conclusion of student teaching, particularly regarding awareness of institutional discrimination and blatant racial issues.” Through interviews with six teachers Rudnick (2019) found that preservice teachers had feelings of uncertainty, discomfort and fear that prevented them from having class discussions about race. Another common response was to avoid or shut down conversations about race when feelings of guilt or judgment from others were involved. The students ultimately needed more coursework on colorblind ideology and conversational tools about how to talk about race with their peers and their students. White et al. (2017) designed classroom lessons on social class and social mobility to show how wealth afforded privileges to certain groups. Most students showed an increased understanding of meritocratic ideology but despite the results,

some white students still believed that hard work alone could lead to success showing how difficult it is for students to unlearn colorblind ideology.

### **Curriculum and Representation**

CWS literature highlights the importance of addressing the Eurocentric nature of science curriculum. It advocates for more inclusive and diverse representation of scientific knowledge and contributions. Mathias and Mackey's (2016) study used critical whiteness studies as a framework to deconstruct the power of whiteness. They used activities such as deconstructing a Barbie commercial, hands on marshmallow structures built to examine equality, and surveys that question heteronormativity and racial bias. These are some of the activities that were used in a teacher education class of mostly white middle-aged women to identify privilege in education. Their research provided descriptions of the lessons and used comments from the participants to show their struggles to recognize the privileges given by race. While the assignments helped identify racial bias, teachers in the program still had difficulty admitting the curriculum was biased or that there was a systematic set of advantages given to some groups. Sheth (2019) found that the teachers in his study did not accurately represent scientists of color and missed opportunities to engage in conversation with students about why white males were represented in the curriculum.

### **Teacher Identity and Reflection**

CWS encourages science teachers to reflect on their own racial identities, biases, and positions within the system. A teacher's identity is shaped by various influences, such as personal experiences, cultural and social contexts, and professional roles. It emphasizes that a teacher's identity is dynamic and may evolve over time as they gain more experience in the field (Beauchamp & Thomas, 2009). In Ortiz et al. (2018) Positionality refers to the social, cultural,

and personal identities and perspectives that individuals bring into the teaching and learning environment. The article emphasizes the importance of teachers being aware of their own positionality and the potential impact it has on their teaching practices and relationships with students. Tien (2019) discusses how the terms "teaching identity" and "positionality" are often used interchangeably but suggests that there are nuanced differences between the two concepts. Teaching identity refers to an educator's personal and professional identity, including their beliefs, values, and cultural background. Positionality, on the other hand, refers to an educator's social location, which encompasses their race, gender, socioeconomic status, and other factors that influence their perspective and experiences.

### **Resisting Whiteness in Science Education**

#### **Science Multicultural Studies**

Science multicultural studies is the intersection of multiculturalism and science education, examining how diverse cultural perspectives, identities and experiences impact the teaching and learning of science. Science Multicultural studies is a term used by Mary Atwater to describe the need for incorporating cultural relevance and equity in science education. It emphasizes the systematic misuse of science in the past to racially divide the human race and how science has been colorblind. The term is vague and can also be described as a collection of pedagogies such as Multicultural Education, Culturally Relevant Pedagogy, and Culturally Responsive Pedagogy that place an emphasis on promoting diversity, equity, and inclusivity in education.

Pre-service science teacher training is a complex and multifaceted field with a focus on content knowledge, pedagogical skills, practical experiences, and professional development. The importance of effective training programs to ensure that future science educators are well

prepared to inspire and educate the next generation of scientists. Research that aims to improve science teacher education examines how multicultural science education can meet the evolving needs of students because “more Multicultural education in preservice teacher education positively affects teacher’s attitudes and sense of efficacy toward helping culturally and linguistically diverse students” (Bodur, 2012 p50). Dunac and Demir’s (2017) analysis of teacher education programs found that the primary focus is on teacher pedagogy and science methods with little emphasis on cultural studies.

Science teachers are not taught correctly to identify racism in the curriculum. To identify racism in science education Sheth (2019) found foundational practices that inadvertently display racism in a science classroom; the teacher’s inability to; connect to student’s experience, show benefits of learning science, represent scientists of color, and allow students to feel capable of doing science. His case study followed the development of three science teachers and noted the permeance of colorblind ideology and the need for “science education CRT scholars for increased research using CRT as a tool to illuminate how systems of oppression shape science education” (p 56). Like Sheth, Johnson (2011) wanted to document practicing science teacher's classroom practices before, during, and after the application of a Teacher Professional Development program. At the start of the study teachers were guilty of having colorblind and cultural deficit views of their students. Johnson found that with a framework based on Culturally Relevant Pedagogy the teachers were able to change their classroom practice. Some of the changes were home visits, critiquing knowledge in science, inquiry labs replacing cookbook labs so students could construct meaning and performance assessments instead of tests to evaluate student learning. Yerrick and Johnson’s (2011) case study followed one of the authors as he, a self-identified White male taught his Black student Earth Science. His two-year study used CRT

as a framework to view how he instructed culturally different students. Yerrick found that science teachers need to be taught how to address cultural diversity in science classes instead of focusing on the differences, gaps and inequalities teachers need to be taught in research-based practices to reach students. “Without being able to acquire and use this knowledge, new teachers will continually leave diverse teaching contexts they are unprepared to face” (p 937) [0B]

### **Cultural Efficacy**

Bandura's (1997) theory focuses on the concept of agency, emphasizing that individuals are not passive learners but rather proactive agents who can influence and shape their own lives. Teacher efficacy is the teacher's belief in their ability to positively impact student learning. Cultural efficacy is the teacher's ability to effectively and appropriately engage with students from a different cultural background (Flores et al. 2015). Taylor & Wendt's (2023) study found that teachers were confident in their ability to create a collaborative environment among students of different cultures, but less confident in their ability to recognize racial barriers and inequities in society and the more experiences a person has had with diverse ethnic groups, the more confident the person will be to engage in culturally responsive management practices. (p.38) A limitation of the study is that teachers self-reported their behavior and didn't need to provide evidence for their answers. The Culturally Efficacious Evolution Model is an approach in education that focuses on the importance of cultural efficacy in teaching and learning. It is a model that recognizes the importance of addressing cultural and social factors in student success. It seeks to provide educators with the tools and knowledge needed to create an inclusive, equitable, and empowering educational experience for all students regardless of their cultural background. Flores et al. (2015) used the Culturally Efficacious Evolution Model to develop efficacy in math and science teachers teaching EL (English Learners) or Emergent Bilinguals

(EB). The study was done with a large sample size of preservice teachers. They found the following factors helped develop cultural efficacy in teachers; schools and university working in tandem to support clinical teachers, communities of practice within clinical teachers, feedback on instructional practices, and help that support teacher's usage of culturally efficacious practices. Most teacher preparation programs fail to address the needs of EB but the “CEEM exhibits this type of intentionality because the teacher's developmental path is defined, linked to program design and viewed as an evolutionary process” (p 24). Another study of the CEEM model by Flores et al. (2018) used a case study approach with four teachers but provided more insight into teacher's voice as it included narratives and interview pieces with the teachers in the case study. Together, these studies show the effectiveness of the CEEM model with preservice teachers, but research on its use is not yet known with current practicing teachers.

In conclusion, this literature review has provided an exploration of three interconnected frameworks: Critical Race Theory (CRT), Critical Whiteness Studies (CWS), and cultural efficacy. These theoretical perspectives have significantly shaped scholarly discussions around race, identity, and power dynamics, offering insightful analyses that extend beyond conventional paradigms. Critical Race Theory emerged as a powerful lens for examining the pervasive influence of systemic racism in societal structures. Critical Whiteness Studies, on the other hand, has directed attention towards the examination of whiteness as a social construct and a source of privilege. Cultural efficacy emphasizes the agency of marginalized groups in defining and asserting their own cultural identities. Collectively, these frameworks provide a robust foundation for scholars, educators, and activists to critically engage with issues of race, power, and identity.

## **CHAPTER 3: METHODOLOGY**

### **Introduction**

The first chapter introduced my rationale for this study and my conceptual work based on Critical Race Theory, Critical Whiteness Studies, and cultural efficacy. The second chapter included what current research exists on the presence of whiteness in science education, how science teachers are allowed to perpetuate whiteness in the classroom and finally how we can resist whiteness in education with multicultural practices.

This chapter on methodology will explain the rationale for my research type, my data collection methods and how I codified my research. This chapter will also explain the use of the most poignant artifacts from my graduate school or teaching that show my growth as an educator. In addition, it will also disclose the settings and timeline of this research.

### **Restatement of Purpose**

This study explores how as a biracial science teacher I struggled with how to incorporate multicultural education into my classroom. I will explore my own notions of racism and privilege by sharing insight into what research and experiences led to a change in my thinking and transformed my teaching. Given the personal nature of this research an autoethnographic approach was used to give details about my success and failures in teaching multicultural science education. I will share experiences of how I was exposed to literature that forced me to reflect on my practice, my attempts to include multicultural education with science content, and my ultimate transformation into a science multicultural teacher.

### **Research Question**

For this study I am answering the question: In what ways can a multiracial science teacher learn to resist whiteness in education? By answering this question, I hope to have a better



idea of what it means to teach a multicultural science class, be a culturally efficacious teacher and create a curriculum that will teach other science teachers to analyze their practice to make changes that lead to a multicultural classroom.

### **Role of the Researcher**

I am the only author and researcher of this autoethnography. It is a personalized and private look into an introverted person's thoughts and feelings. I am aware that as a Korean and White teacher with a Hispanic last name I am afforded a certain number of privileges because I pass for White. I look at the aspects of my positionality like being able bodied, married, and a college graduate as integral parts of my positionality. Those parts have not always been my truth. My truth changes and realigns my positionality thus my positionality is dynamic. What I know is that I started graduate school with a limited knowledge of what it meant to be a teacher. After watching movies such as *Dangerous Minds* and *Freedom Writers* I developed a savior idea of what a teacher was supposed to look like. I entered graduate school with the singular goal of becoming a better teacher, not realizing that to do that I would go on one of the greatest journeys of my professional life. I am forever changed by the things I have learned and the people that entered my life to challenge me and build a better brain, open my heart, and give me the courage to be a better teacher.

### **Method**

I chose an autoethnographic approach because it was necessary and appropriate to answer the original research question. In what ways can a biracial science teacher learn to resist whiteness in education? This was a very personal journey, but it was done with the help of many people along the way. My own understanding of self and my teaching practice has been unveiled as I combed through graduate school assignments and core memories analyzing my thoughts and

trying to answer the self-question of if I know better, why is it so hard to do better? I used an autoethnographic approach to thoroughly reflect on my own experience as a biracial Korean and White teacher to analyze how my own actions and the actions of others helped me along my journey to identify and accept a multicultural science teaching style (Punch, 2013). Also, a deep reflection of practice was needed to be able to answer ethnographic questions such as; What are the salient behaviors, events, attitudes, structures, processes occurring in the phenomenon? (Marshall & Rossman, 2016). I am not alone in this struggle so I hope that this research can enlighten and enrich another person on their journey. It has helped me identify what I want to do as a teacher educator.

### **Setting**

The settings of this autoethnography takes place in classrooms around San Antonio Texas. The first type of classroom was when I was a teacher at a Title One school from Summer 2018-Spring 2019. The second type of classroom was also when I was a teacher but at an affluent school from Fall 2019 till Spring 2023. The last classroom type was myself as a graduate student in a university classroom which I was in person from Summer 2018- Spring 2020.

### **Timeline**

My story begins in 1980 so small childhood reflections are from my youth, but the first narratives and assignment analysis took place in my first graduate school class in the summer of 2018 and the last reflection was from Spring 2023.

### **Data Collection**

The data that I collected started with artifacts that I found stored on my laptop. I had a lot of assignments saved as Word documents before I submitted, so that I could keep a copy for myself in the event there was a computer error. I also kept drafts as google documents before I

submitted assignments to Blackboard. Some classes allowed us to use reading journals and I kept them as google documents so it was easier to access them from home, work or school. I have stored files from journals, projects, presentations, assignments, literature reviews, and classroom reflections. I have collected different artifacts from my graduate school classes that I will analyze to show my personal growth and development as a classroom teacher. I have written narratives of pivotal moments of learning, reflections on lessons and analyzed graduate school assignments.

To provide an array of resources the artifacts I collected fell into four different types. Any assignment or project that was turned in for a grade during graduate school was classified as Document Analysis. I reread the assignments that I had previously turned in and analyzed the language I used. These artifacts from my courses helped to stimulate more accurate memory recall, a process which is discussed by Ellis et al. (2011). The next classification was dialogic journals, these were kept as I read research so that I could use my own words to express how I felt about the literature, they read sometimes like a diary. Stores fell into two categories either a reflection or a narrative. Reflections were written during graduate school as part of the processing after an assignment, experience or discussion. The narratives were written well after the incident occurred but offer insights into significant events that shifted my paradigm. It is critical to include narratives as a reflection tool so that teachers can reflect on critical incidents (Farrell 2015).

## Data Source Collection and Analysis

**Table 1**

*Codes based on Conceptual Framework*

Conceptual Framework	Codes
Critical Race Theory	Cultural deficit (CD) Lack of Understanding Contemporary Racism (CR)
Critical Whiteness Studies	Colorblind (CB) Exertions of Whiteness (EW)
Cultural Efficacy	Cultural Consciousness (CCS) Cultural Competence (CCE) Cultural Proficiency (CP) Cultural and Critical Responsivity (CCR)

Table 1 shows the codes I derived from the three parts of my conceptual framework. My coding of Critical Race Theory and Critical Whiteness Studies is based on similar codes used in previous research by Mathias et al., (2014). I used Critical Race Theory to deconstruct my own words as potential microaggressions against students and explore inequalities that students of color may have experienced in my classroom. I used Critical Whiteness Studies to show my early struggles to accept my privilege and show how I eventually was able to accept and move forward to a place of cultural efficacy. I was able to measure cultural efficacy using the four main tenets of the CEEM (Flores & Gist, 2018). I was introduced to the CEEM during the initial phase of my research. I used it again when I became a mentor teacher as a tool to measure growth and development with my clinical teacher. Due to my familiarity with this model in measuring growth for my clinical teacher I also found it as a helpful tool to measure growth in myself.

**Table 2***Explanation of Coding*

Codes	Descriptions
Cultural deficit (CD)	Blaming Shifting Ex: parents and or students Meritocratic
Lack of Understanding Contemporary Racism (CR)	Unintentional Racism Resource Advantages Protect the interest of the dominant group
Colorblind (CB)	Privilege Ignoring race and poverty
Exertions of Whiteness (EW)	European perspective Not recognizing Whiteness
Cultural Consciousness (CCS)	Self-Reflection of Practice Acknowledges dispositions, positionality, and bias
Cultural Competence (CCE)	Knowledge of students Knowing student's Funds of Knowledge
Cultural Proficiency (CP)	Cultural connections Application of Funds of knowledge
Cultural and Critical Responsivity (CCR)	Culturally responsive lessons Multicultural Science Education Multiple viewpoints or various lens on lessons

Table 2 explains each code with examples of what I looked for in each artifact. For the cultural deficit codes, I looked for examples of deficit perspective using research from (Choi, 2008; Yosso, 2005) I also looked for examples of meritocratic ideology using (Choi, 2008). For the codes that come from lack of understanding contemporary racism I used research from (Mathias et al. 2014; Sheth, 2019). In searching for evidence of colorblind ideology I based it on research from (Choi, 2008). The research of (Le & Matias, 2019) and (Sheth, 2019) was used for examples of exertions of whiteness. The codes for cultural consciousness, cultural competence, culturally proficient, and cultural and critical responsivity are based on the Culturally Efficacious Evolution Model by (Flores & Gist, 2018). Additional data collection tables can be found in the

Appendix section. Appendix A has artifact names, types of artifacts and what codes were found during analysis. Appendix B calculates the frequency of the code's appearance in all the artifacts.

### **Data Analysis and Interpretation**

I used the Miles and Huberman framework (Miles et al., 2020) for qualitative data analysis. The three main tenets are data reduction, data display, and drawing/verifying conclusions. For data reduction I reread all of my graduation school documents and looked for themes that were present. I was then able to develop coding that I found in the research that mirrored my experiences. I used the assignments that showed evidence of my coding as artifacts in my research. My data displays are above in Table 1 and 2 but I also have additional data displayed as tables located in the Appendix. I wanted to keep clear and concise tables so that if needed the research could be duplicated when read by another researcher. I organized a timeline but also classified each document so that the reader could see the variation of artifacts. I also kept utterance charts to document my findings so that I could draw conclusions but verify them with examples. Punch (2014) notes that all three of these components are happening at the same time and are interwoven. I reread artifacts to ensure coding was correct. In Table 2 I clarified descriptions of each code so that examples were tied to a theme when coded.

### **Ethical Considerations**

As the sole researcher of this study all the work was done by me. The document analysis came from my own graduate schoolwork and the memories are my own, but names have been changed to protect the identity of the people or students involved in the stories. There is no mention of the school I have worked for so that the identity of the people mentioned in the study could remain anonymous. I do mention the city I work in as it is a large urban city with many schools and school districts.

## **Limitations and Impact**

Autoethnography, as a research method, involves the researcher examining their own experiences and reflecting on how those experiences relate to broader social and cultural contexts. I chose to do an autoethnography because I wanted to provide an in-depth explanation of transformation. There are many studies on what is successful to transform teachers but I wanted to be more than a scale questionnaire or quote. I wanted to provide an analysis of experiences I had and how I wrestled with classroom ideas then finally was able to shift my thinking. I also wanted to do a deep reflection of my own practice. I want to be a teacher educator so I was curious as to which assignments or teaching practices helped develop my change of heart I wanted to use my voice to be delve beyond a survey response. As a scientist I would have been much more comfortable doing a survey and analyzing the results. My original plan had a study based on quantitative results. I am not a storyteller so I really challenged myself to tell my story and be a voice beyond a survey. In a lot of the studies I read they would quote students and I wanted to be able to provide explanations to me thinking and not be reduced to a quote

While autoethnography can be a valuable and insightful approach, like any research method, it has its limitations. Findings from autoethnographic studies may not be easily generalizable to broader populations. Since the focus is on the researcher's individual experiences, it may be challenging to apply the findings to other contexts or groups. My hope is that other teachers can read this and be equally empowered to transform their teaching. Another limitation might be the researcher's cultural background and social position can influence the interpretation of experiences. This bias may limit the transferability of findings to individuals from different cultural or social backgrounds. In an effort to be transparent I have disclosed my

positionality in chapter 1. Despite these limitations, autoethnography can provide valuable insights and contribute to a deeper understanding of lived experiences. In my writing I tried to be transparent about my positionality, reflexively consider their biases, and carefully consider the ethical implications of their work.

### **Chapter Summary**

In chapter three I explained my methodology for this autoethnographic study. I started off with the rationale for autoethnography. Next, I shared how I came to my different artifacts in my data collection then I showed how my coding was based on the three parts of my conceptual framework; Critical Race Theory, Critical Whiteness Studies and Cultural Efficacy. I further elaborated on descriptions of each code and what types of descriptions I was looking for in my artifacts. In the next chapter I will discuss my findings.



## Chapter 4: Findings

Previously I have outlined the need to address the structures in place to confront critical whiteness and encourage cultural efficacy in the classroom from an autoethnographic framework. A variety of artifacts were collected and then analyzed with a Critical Race Theory, Critical Whiteness Studies, and Culturally Efficacious lens to answer the question: *In what ways can a biracial science teacher learn to resist whiteness in science education?* In this chapter I will show how analyzing graduate school assignments, reflections, and writing narratives showed a transformation in my teaching that changed it from black and white to technicolor. As I reread my graduate school assignments, I could not help but notice I started this graduate school journey with a very polarized view of teaching. As I met professors who helped me along my journey, I started to feel like a certain girl who traveled to the Emerald City. Most of my students call me Mrs. Oz but I do not relate to the all-knowing Oz from the story Wizard of Oz. I am more like Dorothy because we both are on a journey. Follow me down my yellow brick road as I show how I gained brains, a heart, and the courage to change my teaching from black and white to technicolor.

### **Finding 1: If I Only Had a Brain**

*“It is such an uncomfortable feeling to know one is a fool.”* (Fleming, 1939)

I entered graduate school with large gaps of knowledge. Like the scarecrow in the Wizard of Oz, I felt like if I only had the brains or more knowledge about teaching, I could be a better teacher. This is what Choi (2008) describes as the apprenticeship model of colorblind ideology where there is a universal set of instructional practices that will work on all students and the key to teaching the students is learning how to teach. In the first year of graduate school, I was overwhelmed with research on Critical Race Theory, Critical Whiteness Studies, Culturally

Relevant Pedagogy, Multicultural Studies, and Neoliberalism. While I did not start my journey with intention or a desire to explore these areas of education, the exposure to the abstract theories proved to be the type of knowledge I needed to begin this journey. The two theories that were most pivotal for my growth are Critical Race Theory and Critical Whiteness Studies. I will use examples of the following codes to show where I was guilty of being colorblind, exertions of whiteness, deficit thinking and unintentional racism. In this section I will show you examples of each and explain what it means for my research, which theme is present and how it helped me to resist whiteness in science education.

To resist whiteness in education you must first realize its existence in the classroom, the curriculum and how it is embedded in our concepts of success in education. In engaging with my artifacts, I recognized a lot of examples of my own privilege and ignorance of race and poverty. Using a Critical Whiteness Studies lens from Matias et al. (2014) to analyze the artifacts I saw that I was most often guilty of being colorblind, I found it in nine of the thirty-four artifacts I reviewed. In the real world where no one wants to be seen as racist it becomes easy to fall into the trap of living colorblind and because of applying this colorblind approach to my classroom I lived in a realm where everything from race to curriculum was black and white. While believing it was enough to avoid active racism, I did not consider that my approach so focused on equal treatment was causing me to ignore the effect issues of race and poverty might have on my students and the curriculum I taught. In my first graduate school class I was given a course pre-assessment addressing the goals of the class and documenting who I was and what I believed before I entered graduate school. The bold in the text below are from the professor's pre-assessment and the italics are my response.

**I recognize and acknowledge the significance of curriculum in a diverse society.** *“As a middle school teacher, it is hard for me to see a diverse population among my students because at the age most of them want to fit into a group.”*

-Course Pre-Assessment

Here my response demonstrated a colorblind approach to view my students as members of different races. Thinking back to my own experience in middle school my friends and I didn't talk about the differences in our races. I think here I am projecting what I felt in middle school I just wanted to belong I didn't want to be different and because I pass for White I was able to capitalize on privileges of being White. I think I was more concerned with getting good grades and I thought everyone in my class had the same advantages as me and if a student was struggling they only needed to work harder to do better in school. I was unaware that my middle-class upbringing benefitted me. My privilege blinded me to factors that affected my students of color. This class particularly was about the history of curriculum development for different communities of color. After learning about curriculum development for different cultural groups I could start to see how current curriculum is Eurocentric and how I might have overlooked the marginalization of my students of color.

My next analysis comes from the same document.

**I understand curriculum in the context of my students' lived experiences.** *“One of the TEKS I teach is about Texas ecoregions. I like that the state used examples of a nearby ecosystem so that some students can make connections to their personal travel experience. Some of the students in my school have never left San Antonio. I try to be mindful of the experiences my students have and how it connects to the curriculum.”*

-Course Pre-Assessment

As a science teacher I believed that race and poverty did not have a place in my curriculum because they were not factors I could change directly. I thought that those conversations belonged in history, social studies or English classes, subjects that explored human interactions and society. In this response, I continued to show how I ignored the cultural lived experiences of my students and their families, even though I recognized how poverty might play a role in those

experiences. At the time I was working at a Title One School, and I was mindful of how some student's parents did not have disposable income to spend on vacation and birthday parties. This oversimplification of how poverty played a role in the classroom however did not extend to understanding of the role poverty had in limiting student engagement or the context the students had when approaching the curriculum.

My monochromatic world was also challenged during a class in my second semester of graduate school when we were tasked with using dialogic journaling to capture my own words and observation as I worked to make connections between the real-world classrooms I was teaching in and the research I was working with in class. Previous classes used a formal reflection writing style that was essay based and gave me practice in APA yet lacked emphasis on my voice. Rereading these dialogic journals years later are easier artifacts to analyze because they provide a window into my past self with the use of my own words. They have allowed me to look back on quotes from the research and reflect on the application to my teaching practice and measure my growth as a graduate student and teacher. In addition to reading research this class also had a lot of challenging activities. The material was constantly challenging my identity, race, positionality, and biases. The week we talked about privilege I wrote this in my dialogic journal:

*"I struggled with this week's readings because as a White person with Korean and White ancestry I do not know where I fit in. I benefit from White Privilege, but I am also guilty of being color blind. I grew up with friends that were Mexican, White, and Black. We did not acknowledge our cultures; we were color blind and I thought that was enough. I thought that I could show that I was not a racist because I had friends who were Black. I don't tell jokes that are based on stereotypes and misconceptions. I do not know how to navigate conversations about race."*

-Reading Reflection 4

This was the week where I first realized the privilege that comes from passing for White and how I had benefited from being raised as White despite my mother being Korean. We watched a privilege walk in class and in my mind every time I was able to step forward, I realized how

privileged I was raised and how I benefited from the color of my skin. Awareness of my own privilege allowed me to see how I was given opportunities in my education that allowed me to be successful. I was allowed to take state testing in my native language English. I learned about my ancestors in History class and read stories about them in English. My curriculum was dominated with stories from a White perspective and because I was White I saw myself in the curriculum. As I reflect on my privilege in being from the dominant race I can see ways to resist Whiteness by learning more about my students and embracing out cultural differences. I do genuinely like to get to know my students and learning about their race is something I am open to talking about. I hope that by modeling conversations about race and culture my students can also have these conversations with each other.

In a different week where the theme was Critical Race Theory, we did a fishbowl activity where we were split into two different groups; White and Nonwhite and then separated and had a group discussion using guided questions. Below is what I wrote in my reflection

*“I identify as white although I am a mixture of White and Korean. On the outside I felt slightly out of place in my group of fellow white colleagues. On the outside I looked different. Were they wondering why I chose to be in this group? Do I have privilege in being able to belong to both groups or is it unfair on my part to assume that I can fit in on both sides? Why do I feel like I am the only White person that understands White Privilege? I have never felt oppressed so where does my understanding come from? Does my gender help me understand better? Was it my Liberal California middle class upbringing?”*

-Fishbowl Activity Reflection

This was a pivotal learning moment for me as I came to understand my privilege. I struggled with the realization of my privilege and I was so uncomfortable that I considered dropping out of graduate school. The guilt at realizing that I could be better but was not doing better in my own classroom was stressing me out and I thought about exiting the program to escape the pressure and negativity I was internalizing. DiAngelo (2011), explains this feeling as white fragility. By staying in the program and continuing to engage in weekly class readings and meeting I was able

to confront my personal biases in the classroom while rethinking my identity and ideology. Through this confrontation of my understanding of race and privilege, I was able to confront feelings of guilt and inadequacy through honest reflections of where I was making mistakes and learning how to be better.

So why did I stay? Even though the class material was overwhelming the reason I didn't drop out was the teaching style of the professor. The professor for this class taught using a pedagogy of love and one of his classroom practices was to meet with students twice a semester. In these meetings it was ok to discuss how I was struggling with personal growth or how to apply research to classroom practice. This professor showed me that I was not alone in my growth and never let me suffer on my own by empowering me even when I felt like I was my lowest to continue to work at becoming more aware and critical in my approach to the real-world application of these issues. Throughout the semester I worked with my professor and discussed projects I had for my students along with addressing questions from my professor that were challenging, insightful and helped guide me along the path to keep researching. This semester was foundational in providing me with the basic tools that allowed me to survive and begin the process of reshaping my paradigm to allow me to become a better teacher. This was one of the most challenging classes I took because it forced me to acknowledge who I was, where I came from, and where I was going.

The next code that came up most frequently was exertions of whiteness. As a science teacher I frequently talked about the standards and how they were factual and not related to conversations about race. Here are a few examples:

**I understand curriculum in the context of content I teach.** *I have been teaching 7<sup>th</sup> grade science for 4 years. I understand what I teach based on my college learning experience. I took science courses that were based on middle school TEKS.*

-Course Pre-Assessment

In this Course Pre-Assessment I am confident in my ability to teach science curriculum because of my strong knowledge of science content. Most of my undergraduate classes were taught by a faculty of white professors. I was an Interdisciplinary Major and to pass my teaching certification test I had to have extensive knowledge in Science, Math, and Pedagogy. Many of my classes were content math and science classes where universal truths and facts were the accepted answers and we did not explore ideas of culture or identity. All my classes echoed the Eurocentric Curriculum of white male dominated academia and because I successfully learned I never questioned the validity of the curriculum.

The one exception to this was my history of mathematics class where I learned about how math was developed throughout history all over the world. We learned about mathematical contributions from the Incan and Mayan Empires as well as how math was developed in China, the Middle East, Egypt, and India. The impact of that class on teaching however had a limited role when I ended up becoming a Science teacher and since I never took a course on the History of Science or read material which focused on cultural contributions to science as opposed to scientific facts in a meaningful way I had no way of knowing how to incorporate cultural perspectives it into my classroom.

The next artifact below was from an assignment where I analyzed a curriculum document from my school district and it confirms my Eurocentric view of science.

**Analyzing the Accuracy of Content-***Middle school science is interdisciplinary in nature. During the school year students will learn a combination of chemistry, biology, physics, astronomy, and ecology. The sixth and eighth grade TEKS are concentrated in chemistry and physics while the seventh grade TEKS are mostly biology. The content in the TEKS is factual and provides a basic knowledge that would be considered foundational.*

-Curriculum Document Analysis

In this curriculum document analysis assignment, I thought of the standards as statements of indisputable facts. The exertions of whiteness in the curriculum were never questioned because I was teaching the science that I had learned in school. I only considered Eurocentric ways of knowing Science as the correct ways to learn science. Now I look at the statement Analyzing the Accuracy of Content and I think of other ways of knowing that are valid. According to the dictionary to be accurate is to be correct in all details and exact but when the curriculum only paints the picture that scientist are white male men I would say that is not correct in all details. When I started to accept that the content of the curriculum was not entirely accurate I began to look for ways that I could have classroom conversations about what scientists were worth knowing and why.

The except below came from an assignment in the earlier part of my graduate school classes. It shows my ignorance in how whiteness manifests in the curriculum when we teach a student's expected social class or fail to see how different populations have diverse needs to learn and analyze meaningful science in their lives.

*Then last year I started to teach the population of students who went to the Title One campus. I noticed a change in my teaching style and attributed it to differentiation between the needs of the two populations. Upon reflection I realize that it was more than that. After reading Jean Anyon's study on the hidden curriculum of teachers who taught in different social class communities, I realized that I was unconsciously teaching these students differently because of their social class.*

-Curriculum Development Philosophy

In the Curriculum Development Philosophy quote I was inspired by Jean Anyon's article Social Class and the Hidden Curriculum (1980). This article was pivotal to changing my paradigm. At the time I was teaching at a magnet school with two different social classes, and I was teaching them differently due to their social class. I was ashamed and realized how I had to change my practice. That article inspired me to change my ways of teaching and instead of banking facts in the students head I created a curriculum that was project based and taught 3D printing to my



students so that I could integrate technology into my lesson and challenge students to create instead of memorize. This class project inspired me to take data so that I could see the impact of that lesson on my students.

I was not racist but I do have a lack of understanding contemporary racism. A story that illustrates this point is written below from a memory that is engrained in my memory.

*My first graduate school class was called Theory of Curriculum and Instruction. It was also my first class taught by a Black professor, Dr. Straw. My first presentation for the class was when we broke into pairs and were assigned chapters to read and present. My partner and I were assigned the chapters that covered the history of curriculum for African Americans. I was extremely nervous to present African American history to a Black professor. My partner was an extremely verbose student who often used words that I had no idea what she meant. We divided the work so that my partner could talk about the overall picture of how racism shaped the curriculum development for African Americans, and I could talk about the evidence. We carefully put together our presentation slides but while I was talking about my evidence slides, I was called out in front of the class on a citing error I had made. I was talking about construction and reconstruction, and I had cited all the White construction sources, and I did not cite the African American reconstruction sources. It was a mistake, but I was incredibly embarrassed. The professor explained the errors in my way and gave me the opportunity to make corrections before I turned in the project*

- Class Presentation in Dr. Straw's Class (Narrative)

It was a harmless mistake, but it reeked of unintentional racism. I cannot begin to express the embarrassment I felt over my error and immediately vowed to do better. The professor used this moment not to embarrass me but to teach me. I didn't feel attacked but I did realize that I had a lot to learn about contemporary racism. I also had limited knowledge about how to address racism in class with my students. Below is an excerpt from a reading reflection where I recalled an incident with one of my Black students.

*It is not enough for students to be able to identify racism; we must all teach students how to confront racism. They need to be given tools that they can use in conversation with their friends. How do you call out your friend for a racist joke? How do you call out classmates who are insensitive and uncaring with their words? As a teacher I had an African American student reach out to me because of the racial comments another student had said. After dealing with the students, I reached out to the counselor. I wanted to do a lesson with the students that would teach them about using racist language in my*

*classroom. I asked other teachers, coaches and counselors for advice and lesson ideas and no one had a clue as to what I could do.*

-Reading Reflection 2 Multicultural Edu.

I was really upset on this student's behalf and wanted to address the situation in class with a dialogue but I was discouraged from addressing it publicly and it was handled privately. The sad part was when I reached out for help there were no resources to guide me. It was like the school's counselors never thought issues of race mattered either, so they did not know how to coach me to have those conversations with my students. That is when I realized that not only was I letting my students down, but the entire system was built to protect the interest of the dominant group and could not even acknowledge the struggles of the minority students.

Another idea that I would continue to wrestle with during graduate school would be falling into the trap of deficit thinking. In the below discussion questions from Summer 2018, I could point out other people's deficit thinking from the conversations I had with other teachers about our students' futures.

*"Freire would have labeled the teachers from the "working class" and "middle class" schools as oppressors. The lessons described at each of these schools were all teacher centered. The focus in each of those schools was that the teacher was the smartest person in the room that dictated the rules for the classroom. The student's role was to obey, remain quiet, memorize, and repeat back for tests. The depressing thing is that I have seen this in classrooms at my school. The students get judged by their current lot in life and they are already written off as future gang members, prisoners, or fast-food workers. The teachers have low expectations, so their lessons are not challenging or transformative."*

-Discussion Questions

In this artifact I have labeled other teachers as having deficit thinking. Yet in the next reading reflection from Fall 2018 during a Critical Race Theory unit, I am oblivious to the fact that I also viewed some of my students as having deficits.

*On Deficit Thinking: This is an outlook I am guilty of having. My students come to me with very low skills and knowledge. They do not know how to behave civilly to each other in the classroom so along with my content I must teach them how to be human to each other. It is exhausting to try and teach these things without their parents' support. Some*

*parents are at their wits end with their own kid and express their parenting frustrations to me, their teacher. I feel like I rely too much on the banking method with direct teach because I have too many classroom disruptions by attention seeking behaviors.*

*-Reading Reflection CRT*

This was also the first year I taught sixth graders, and I was unprepared to teach them how to do middle school and my content which I now realize is a big responsibility of being a sixth-grade teacher in middle school. I failed to get to know my students so that I could best teach them and instead blamed them for not caring. When expressing my frustrations in teaching I was told by district trainers and staff that I was too nice to the students and that I needed to go to classroom management training to gain better control of my class. So, I went to the champion of all classroom management training and learned about behavior management and how to set expectations for my classroom. It did not completely change the classroom environment because I was still in denial about the effect the curriculum and the way I taught the curriculum were having on the students.

The artifact below is from the week we read about Culturally Relevant Pedagogy. Instead of giving me hope and ideas about how to make my classroom better it frustrated me and made me doubt the efficacy of the process.

*The 3 principles of culturally relevant teaching are academic success, cultural competence, and critical consciousness. If I had to give myself a report card on these 3 principles in my classroom here is what it would look like with comments and reflection.*  
*Academic success- D. Apathy and helplessness are my daily struggles. I have students who constantly act up and the consequences are so minor they do not care. They do not care and there is no filling their bucket with positive things because they will just upturn the bucket.*  
*Cultural Competence D. I come from a place of understanding when it comes to some aspects of Hispanic culture, but I do not know how to integrate these things into my classroom. I do not know how to talk about science, culture, and race.*  
*Critical Consciousness- F No idea how to do this in my class. What does this look like in a science classroom?*

*-Reading Reflection 8 Culturally Relevant Pedagogy*

I was at an exceptionally low point in the school year, and it shows in the many negative things I said about my students. These artifacts exhibit the negativity I had as I projected blame

on the students and their parents for not caring enough about school. In these writings I showed no appreciation for the students' cultures outside of the classroom and still choose to see them as a single equal unit. Additionally, I taught most of my lessons using the banking method and since I had personally learned that way when I was the age of my students, I became growingly frustrated when they could not grasp the concepts. I was often snarky and sarcastic with them and saw no place for culturally relevant teaching in science, thinking it only belonged in History and English. Looking through my artifacts I can also see the struggles I personally went through accepting difficult truths about myself. Prior to graduate school, I never had to acknowledge or consider the privilege I gained personally by passing for White. Through classroom experiences like discussions, curriculum analysis, dialogic journals, and projects I was able to develop my knowledge and confront my White fragility. Yet knowledge alone was not enough to change my practice. By the end of the Fall 2018 semester, I was knowledgeable about the research but not on implementation. What I needed next was to develop a heart. The tool that I use to measure how much heart I have begun when I was introduced to the Culturally Efficacious Model in the Summer of 2021.

**Finding 2: If I Only had a Heart**

*“A heart is shown not by how much you love, but by how much you are loved by others.”  
(Fleming, 1939)*

In the beginning I put a lot of fun into my classroom, but not a lot of heart. I am a likable teacher and most of my students would say they liked my class because I infused pop culture into the lessons, or I used hands-on labs to help understand science. Others might say I was always fair with grades and gave more than one chance to a struggling student. Yet, I never let them into my life. I kept my private life very private. I never told them if I was going to be absent. I did not tell them stories about my life or try to infuse stories into science lessons. I taught the curriculum as a series of things to just remember, leaning hard on the banking method and keeping my

students and their learning at arm's length. At the time I was teaching with a team, and we all voted to have the same policy to not take late work, which I thought was unfair, but I still adopted it because I wanted to support my fellow teachers. Looking back, I do not keep in touch with a lot of these students, and I think I will be remembered for being their basic science teacher that was in the background, yelling to be quiet or guiding them through their frog dissection.

During graduate school I developed a higher standard for myself, and I really wanted to explore how I could change my practices as a science teacher. I wanted to be more than liked, I wanted students who were usually overlooked to feel seen, and I wanted every student to feel like they could be a scientist if they wanted to. I used the codes for cultural consciousness and cultural competence to show where I identified the beginning of my development of cultural efficacy.

One of the practices that we used in different classes was reflection. We reflected on reading each week and entered them into dialogic journals or formal reflections that were APA formatted, and at the end of each semester a summative project integrated a reflection piece. So, it is not surprising that the code that came up every semester was the code for cultural consciousness. Each class asked us to reflect on our practice and different classes forced me to see my identity, dispositions, positionality, or bias. One step in developing cultural efficacy is for teachers to develop cultural consciousness. It was not until I explored my positionality that I started really being able to reflect on my teaching practice. I am more than my student's test scores. I have benefited from white privilege. I am also an able-bodied person who happens to have a good memory. I was taught a certain way, and, in the beginning, I thought that was enough for my students. I did not stop to think that there was another way to learn another truth

to be seen. Could there be multiple truths in science? As I started to truly reflect on the research and my classroom practices, I became more aware of the changes I needed to make.

In the beginning of my graduate classes my reflections on readings show that I started to learn more about the different factors that contribute to my student's education and development that were outside their own control. I started to look at the historical development of curriculum and it really opened my eyes to the privilege I received when I was able to pass for white. I saw myself in most of the characters we read in English class or learned about in History. I was guilty of assuming a nationalistic ideology where I assumed everyone could relate to the curriculum. In my black and white world of teaching my students needed to work harder, have more parental support or I needed to just find that one singular style of teaching that any students could learn from.

*Too often I rely on methods that have worked for me, expecting similar results from my students. I realized that there are different factors for each of my students' education and development. I need to identify the factors that will help me make connections for my students and use learning theories to help them show growth.*

- Project Script CI

This was again from that first curriculum class that taught me the differences in curriculum development for other ethnicities, and I realized I could not teach all students the same way I had learned. Here I labeled this artifact culturally conscious because I am showing my awareness through self-reflection but I wasn't feeling empowered to action.

The next semester I was introduced to culturally responsive pedagogy.

*It is not enough to understand a student's ethnicity; we must embrace and use culturally responsive materials in our classroom.*

- Reflection 6

Again, I am showing awareness through self-reflection. I started to open my eyes that culture needed to be more than the picture of a black scientist in my classroom. Although I was aware I

was still not sure about the application of what culturally responsive pedagogy looked like in my classroom.

Below is a reflection on power in the classroom from a dialogic journal.

*The article included stories of students who were humiliated when the teacher mispronounced their names. Some students wanted teachers to try, others wanted teachers to not even bother. A teacher's negative comments clearly left lasting impressions on students. The message that is received through microaggressions is that teachers do not value a student's culture or heritage. I have students with unique names. I always try to pronounce the name and ask if I said it correctly. Over time I have had a few students who were comfortable enough to tell me I was saying their name wrong*

- Reading Reflection 8

I spent 6 months pronouncing a student's name incorrectly and I couldn't understand why he didn't correct me the first time I said it wrong. The readings and classroom discussion helped me understand why students may not correct a teacher when they mispronounce a student's name for a semester or how a student with a name that is difficult for most teachers to pronounce will accept defeat and shorten their name. The privilege of having a white name that all teachers could pronounce became clear, also the ignorance of placing the blame on a student for having a difficult name for me to pronounce instead of a difficult name to pronounce. I have since made it a point to call students by their preferred name even if its difficult to pronounce. I express to them that I am willing to learn the correct pronunciation of their name.

Another part of my teaching practice that I started to reflect on was the use of storytelling in my class. I had a personal bias for storytelling that would go off topic, so I eliminated the practice in my classroom. I realized that I also felt very vulnerable opening parts of myself to my students. If I shared my stories, then they would see me as more than their teacher and I wasn't willing to be more so I held back.

*"I always hated when teachers tell stories I always want them to skip to whatever they were teaching." This statement made her stop to process why she was so against*

*storytelling and what she could do to conquer the vulnerable feeling of storytelling and commit to telling stories in her class to help make connections with her students.*

-A Philosophical Reflection on Storytelling

I was able to reflect on the art of storytelling in the classroom. When I realized that I didn't enjoy learning about my teacher I still saw the value in adding it so that students could make connections between learning and doing science. I started with stories about real world connections of science and from there the practice grew into more storytelling about my life and my love for science. In my last class evaluation, I had several students say they loved my storytelling especially when I shared with them my personal adventures in science and I realized that I had grown to be a storyteller.

Another breakthrough I had was getting feedback from students. I started to ask them what they enjoyed or did not from certain projects or assignments. Especially when I tried something new, I wanted feedback to see if I should add it to my curriculum. During my action research class, it gave me a great opportunity to try a new style of warmups in class and using google forms I got great feedback on how to improve the warmups and it also brought my attention to some assumptions I had going into the lesson.

*Using this as a teacher action research project forced me to get feedback from my students and they came through with excellent suggestions. The post survey results showed that most students really enjoyed the glow in the dark process, and I am excited that they would have enjoyed doing them all year. The students who wanted me to elaborate on the highlighting process makes me realize that students don't know how to highlight which was something I noticed in the first week and tried to correct the second week but due to the shutdown of the school due to COVID-19 I was unable to follow through long term on their development.*

-Action Research Project Let your Knowledge Shine

I ran into a student I had three years ago and she remembered my glow in the dark warm ups. This style of warm up grew quite a bit due to student feedback. It started as just a way to prepare for the mandatory state test at the end of the year but turned into a year long way to identify main ideas we were learning each week. It started off as teacher directed what they should have



learned and shifted to student directed what they learned. I started doing stickers on Fridays so the students could pick a main idea that wasn't sticking. The sticker became a reminder and helped a lot of them remember challenging topics.

I always maintained a professional distance between myself and my students. In keeping myself distanced from my students I would say that I did not get to know them very well outside of school and school activities. I can learn a lot about my students from their files. I can pull up records for their state mandated test scores. I can see the emails and phone calls home to parents about behaviors and I can see the legal documentation if the student has special needs or a 504 but that still is not enough to get a full picture of who that student is. When each student enters my classroom, they have a past of other teachers who have helped or harmed them. The students remember both. I still live with the pain of a high school English teacher telling me I wrote like a 3rd grader. Now I try to get to know my students. I try to really listen to them and their stories so that I can understand their actions and motivations.

During graduate school one of the assignments, I created was a song writing project. It is not a new idea to have the students write songs to show their learning. I broke down how to write a song parody with an example of my own process and it helped a lot of students show mastery in a unique way. I had a student who asked me to write an original rap. This student was struggling in class to turn in work and finish tests, but I did allow him to write a rap instead of a song. Here is a class reflection after that semester.

*I had a student who wrote a rap song and incorporated what we were learning in class and mentioned my name. I was floored by his performance because this student was always falling behind and turning in assignments late, but he was able to show he was learning.*

-Philosophical Reflection on Storytelling

That year, I made minor changes to my lessons, but as I went through my artifacts, I realized how I changed throughout my program from a teacher who was liked by her students to

a teacher loved by them. I am not trying to win a popularity contest but what I did notice is that when I paid more attention to who they were outside of the classroom the more they were invested inside my classroom. I also want all my students to feel confident that they can do science. I was then encouraged to make changes to the curriculum to include projects that all students could complete. I eliminated the classic shoebox dioramas of biomes when it turned into a competition of whose parents could spend the most at the craft store. I developed a project where the students-built box biomes out of used materials found in their house and then also another lesson where they had to repurpose recycling to build human body parts. I was starting to change projects, in line with multicultural science because the students began to see themselves as doing science.

**Finding 3: If I only have Courage**

*“You have plenty of courage, I am sure. All you need is confidence in yourself.”* (Fleming, 1939)

Once I gained the knowledge and opened up my heart I found that I still lacked the courage to transform my teaching. Looking at the dimensions of the CEEM the codes that I believed were going to required courage were culturally proficient and cultural and critical responsivity. I measured culturally proficient by finally being able to understand my students' fund of knowledge and develop lessons that had cultural connections. During graduate school I can only see evidence of being culturally proficient on three occasions. One was already mentioned above when I gave a student a choice to show mastery in his own way. The second example was when I created a project-based learning assignment where the students educated the public on the human impact of water in a watershed. The students worked in groups to create unique projects. I worked with the groups to help them develop a project where they could draw from their strengths in art, science investigation, computers, or coding. The first two projects drew on my knowledge of the students and their strengths and weaknesses. The last example of

being culturally proficient is where I made a cultural connection with the students. Here is a reflection of that lesson

*In the Fall of 2018, I was teaching at a Title One school. I had previously taught the magnet school kids at this school and I moved to a different level and out of the magnet school. The graduate school class I was taking emphasized the A in STEAM (science, technology, engineering, art, and mathematics). We had a local artist visit the graduate class and speak to us about his art. It was powerful. He was a Hispanic male that grew up in the same town. He grew up poor without art resources, so he started using napkins and pens to create his art. I felt like my kids could relate to his experiences and be inspired by his art and story. We were studying the periodic table of elements and I wanted to turn this traditional science table into a work of art. I showed the students his art and they used it as inspiration to create their own blocks of art that also included information about an element.*

- Reflection Lesson on Periodic Table Art

Many of the students at my school were Hispanic so I wanted to show students where this artist got his start. He was able to show the students his unique style of doing art on napkins and we talked about the application of science to his art. He was also able to show them how hard he worked so that art could be his full-time job and the students were able to relate to him on many levels and see the fusion of art and science in the real world.

After schools closed in 2020 due to COVID 19 I took a yearlong break from writing my thesis. I returned in Fall 2021 realizing that during the pandemic my teaching style was quite different from a lot of my coworkers due to the impact that my graduate studies had on my practice. I wanted to become a teacher educator to help others recognize their own positionality and biases against students with the hope that they could reflect on their practice and make changes for the betterment of the students. I was introduced to the Culturally Efficacious Evolution Model and used it as a measurement tool of how to successfully measure my cultural efficacy. I started to analyze my practice with the model, and I found myself lacking in two of the four dimensions when it came to evidence in my class. I was able to show cultural consciousness and cultural competence and while I understood the tenets of cultural proficiency

and cultural and critical responsivity, I did not have classroom examples to show where I was doing this in the classroom. The model helped me see where I needed to grow my practice.

In Spring 2021, I had a university student intern who came into my classroom a few times to teach lessons. We developed a great relationship, and when she asked to be my clinical teacher I agreed. I knew that by mentoring her I would be able to practice being a teacher educator. She was attending the undergraduate program at the same university I was studying at so there was some familiarity with the programs. As a mentor teacher I was given the university's rubric for measuring success of the clinical teacher. Four dimensions of the rubric came from the state teacher evaluation and support system, but there was a fifth based on the CEEM. This was particularly helpful to help me analyze my teaching practice and again I found myself short in the categories of cultural proficiency and cultural and critical responsivity but now I had concrete examples of what it meant to be proficient (average) and accomplished or even the highest rating of distinguished. I used the rubric's proficient rating as a basis for a questionnaire for my clinical teacher (Appendix D) and students (Appendix E). As part of her final evaluation in December I asked her to fill out a questionnaire because I wanted to see if she saw and interpreted the ways I was trying to model parts of the CEEM. I also took the questionnaire to see if our answers matched. We both talked about how I used Google translate for a student who spoke Spanish and another who spoke Vietnamese at the beginning of the school year to help them improve their academic vocabulary. We both shared large parts of our cultural identity with students. My student teacher was Vietnamese, and several students recognized her name and some shared that they too were Vietnamese too. The funds of knowledge all about me page was a jumping off point for a lot of students to share their cultural

identity. We both noted that we had a challenging time incorporating students' cultural and ethnic backgrounds.

I also created a student questionnaire (Appendix E) to see if the students could identify ways, I created meaningful lessons that connected to their life or if they felt safe, seen, and heard by me in the classroom. Students felt seen because I supported them and talked to them about non-science topics in the classroom. If a student was going to Big Bend to take pictures I remembered to ask about her trip when she returned. If a student played a sport their name would appear in the world problems we did in class. I also printed out awards with the words "You are Oz-some" to recognize when my students did exceptional work. Most of my students' feedback on the best ways to learn science centered around the hands-on lab activities.

One of the pieces of evidence I looked for during the CCR code was multicultural science education examples to see if colorblind ideology was still observable in my classroom practices. I used Sheth's (2019) research on how racism manifests in colorblind secondary science teaching. There were four findings that I looked for counter examples of in my science teaching. 1 Did I make connections to student experiences? 2. Did I show the benefits to learning science? 3. Did I represent scientists of colors? and 4. Did I empower students to believe they can do science?

An example of connecting to a student's experience was when I created a lesson in their Ecology Unit where we talked about short- and long-term environmental issues that concern our world, state, and city. Then the students read *The Lorax* and picked an environmental issue they wanted to speak up about. Students got to research environmental issues that were meaningful to them and present them in a way that shows their artistic strengths. I had students create their choice of podcast, video, or book. Some students were asked to do projects like animations and

write a collection of poems. The students took ownership over their own idea and the way they wanted to present. One student was inspired to concentrate her research on the pollution of the San Antonio River during Fiesta after a video clip on watershed pollution. An example of showing students the benefit of Science was during our virus and bacteria unit where the students researched viruses that caused pandemics to learn more about the COVID 19 virus and pandemic so that they could talk about public health measures designed to keep people safe and healthy and then classroom discussion on whether or not all groups had the same access to public health.

An example of representing scientists of color was when we were researching scientists and engineers for students to create a pamphlet. Below is a narrative of what happened when I introduced the lesson.

*After state testing, we wanted to have a research project for students to learn how to use the research databases at the school library. We chose to have the students create a brochure with knowledge about the life of a scientist or engineer and something they invented. The teacher that was in charge of the list found a resource that provided a list of scientists that were all White. So, when I introduced the assignment, I had them look at the list and I asked what you noticed about the scientist on the list. They were mostly white males. So, are there no notable inventions by women or people of color? Let us try to expand on the list. I will give you a minute to research a scientist of color or a female scientist and then we will add them to the list. I demonstrated how to google as I googled Korean scientists and showed them the wealth of information of scientists that could be found. My students started to google and together we expanded the list of scientists to represent a more diverse group. It was great to see students find scientists from their culture. I had a few research a Hispanic female scientist and I had one student who researched a Muslim scientist.*

-Narrative

A reflection on that same project below is from how I used past knowledge of the student throughout the year to get him to research a scientist that was meaningful to him.

*During funds of knowledge Umar explained that at home they spoke Arabic. Umar did not like science, but he liked my class. When he went on vacation, I asked about his haircut, but it turned out he took a pilgrimage to Mecca. He offered to show pictures of his trip and narrate parts of his vacation with pictures of his trip. Umar was proud of his religion, and he would share things with me about his culture. When it came time to do the Scientist Research Booklet, I spoke to Umar about doing a Muslim Scientist because I*

*knew there were a lot of significant contributions during the golden ages, but I did not have knowledge of more current scientists. During his project we were both frustrated with the lack of research on current Muslim scientists. I was willing to let him use internet sources outside of the library database due to the limitation on his research, but He did not feel there was enough information to create the booklet, so I let him choose from a different era. Umar showed genuine excitement to complete his project. It was the first one he turned in one time.*

-Reflection

An example of showing students they can do science was showing them when I incorporated hands-on labs throughout the year and had them use scientific processes. I have a little game I play with the students where I like to see who makes observations. I have a Where's Waldo figure and I move him around my room. I wait till a few people mention him before I move him. After a few moves, most of the class catches on, and we talk about how making observations is a big part of what a scientist does. One thing that many students commented on was that I will challenge them to find their own answers by asking them questions. My students know that during labs they can ask questions when they are struggling but I will always answer them back with a question that points them in the right direction.

This chapter described my journey on the road to resisting whiteness in science education. First, I had to become critically aware of my own biases and understand my privilege. I needed the introduction to the research on Critical Race Theory and Critical Whiteness Studies as well as the lessons and the classroom conversations that helped cement that knowledge. I would not have engaged in thoughtful analysis of the research on my own and my graduate school classes helped me wrestle with these ideas among other educators. I also would not have engaged in personal reflections that led to professional growth. Looking back, the final push to transform my teaching was found when I became a teacher mentor.

I have emerged from graduate school a changed educator. I used the title from Black and White to Technicolor to show my growth. I started off wanting to teach science or math because I felt that those topics were black and white. There was one correct answer to solve and I was

comforted by the certainty of one correct answer. I use to believe that science knowledge was a truth universally known regardless of race. Upon entering graduate school, I began to learn the truth about science education and how whiteness is embedded into the curriculum. I had to start by unlearning the ways I was taught science. For instance, I did well at standardized testing so I never questioned the use of tests to measure student achievement. I had to learn that there are many ways to measure student success like allowing them more assignment choices. I went from having a strict grading policy to allowing students more freedom to turn in late work. I went from throwing away paper with no names to changing my system of collecting assignments to an alphabetical file organizer.

Next, I had to gain the heart to teach my students the way they deserved to learn. I use to think what was good enough for me was good enough for my students but now I ask myself what if I am the exception not the rule? I can no longer base my classroom instructional practices on the ones I observed as a student. I began my getting to know my students and using more examples of their lives in classroom lessons. I started my own student appreciation system. I call them “Oz” some Awards. For projects I recognize students for their “Oz” some work by printing out an award and taking a selfie with them. I also recognize desired classroom behaviors with my “Oz” some post it notes by writing out acts of kindness, exceptional classroom discussion contributions or assignment responses.

Through the analysis of my artifacts I see a clear before and after effect of graduate school. I am no longer colorblind; my eyes are open to the technicolor world of teaching. For me teaching in technicolor is about no longer hiding behind a colorblind view of education. My awareness of power and oppression changed my classroom culture. I use storytelling to convey connections between their lives and science and allow my students to give me classroom



feedback so that we all have a vested interest in the way our classroom works. I am intentional about using their names and showing them, I have respect for their diversity and student identity. I know in my heart that I am a better teacher and I have better relationships with my students but seeing the proof in my artifacts just lends more credence to my point that I went from black and white to technicolor in my teaching.

My 2022-2023 school year was one of the most personally fulfilling years of my teaching career where I found the courage to teach in technicolor. There were so many factors in this year that lead to its success. First, I had a collaborative teacher who really helped me teach my students with special needs and together we had some of the best testing scores in the district. I also had a clinical teacher whose presence held me accountable to teach in technicolor. I was slowly changing classroom assignments and lessons but her presence accelerated my classroom teaching and helped me build better relationships with the students. I also have to mention the students in this school year who were exceptional in so many ways, creative, kind, funny, driven, personal, and intelligent. Their trust in me led us to have meaningful classroom conversations about science. Most of my colleagues will say that it is luck, that had a good group of kids, or that this year's kids were better than the last to discount the work I put into creating a transformational classroom environment. Through my analysis I can see the evidence of my growth and I look forward to more years of teaching so that I can keep growing my instructional practices. Chapter four showed how the themes of finding my brain, heart and courage finally transformed my teaching practice. Chapter 5 will include my discussion, recommendations, implications and conclusion.

## **CHAPTER FIVE: DISCUSSION, RECOMMENDATIONS, IMPLICATIONS, AND CONCLUSION**

### **Introduction**

In chapter four, I shared excerpts from graduate school assignments, dialogic journals, reflections and narratives to show how continued studies through graduate school has resulted in a shift in the paradigm that I use in my approach to developing curriculum and communicating with my students for the purposes of answering my research question: *How does a biracial science teacher resist whiteness in science education?* I also discussed how the different codes which appear in my artifacts and were linked to distinct parts of my conceptual framework. In this chapter I will discuss the implications of my findings and make recommendations for future research.

### **Discussion**

When considering the goal of how we can effect change in individual teacher's mindsets and teaching practices, providing individuals with research alone is not enough to trigger a shift in paradigm. As an individual it is easy to ignore research and theory-based arguments when you are never given the tools to apply it in the classroom. In a vacuum, research and theory regarding teaching practices can be helpful to creating new frameworks in the classroom but without concrete examples on how the research/theory can be applied it makes it difficult to bridge the gap from the abstract to the practical. Personally, the primary question I have when I read research is "what does this look like in my classroom?" In my experiences it is incredibly important that professors look for examples of application in all subjects when teaching Critical Race Theory and Critical Whiteness Studies, especially in science and math where the fallacy that those subjects teach absolute truths are still believed. When I did not see examples of application in science it was and still is easy to continue to believe that science is colorblind

because of the basic assumption that it is rooted in fact without consideration given to the lens in which facts are observed or interpreted. Personally, I needed concrete examples of what other multicultural science teachers were doing in science classrooms to resist whiteness and broaden my approach to education in the specific subject.

Further, looking at the issue in reverse, I believe that the use of autoethnographies from graduate students would be beneficial to professors to allow them to consider and learn what teaching practices currently are and how they can be changed or reshaped to promote growth in the classroom. For graduate classes, student feedback is essential to help professors determine what lessons are the most instrumental in changing a student's paradigm. By increasing the focus on personal stories professors can then gain a better understanding of their own students and engage in more focused approaches to transformational teaching of the next generation of educators. Autoethnographies are an underused tool in giving feedback to professors and colleges of education which provide a base point to show where graduate students start and how they are affected by the curriculum in both the abstract as well as the practical application of the theories discussed. I approached my autoethnography as a long exit interview from my graduate program and hope my professors can read this and realize what a difference they made in my life as a person and educator. I hope the university can be assured that their professors are making profound differences in my teaching practice that trickle down to the students I teach.

### **Implications for Future Research**

Further research is needed on the relationship between mentoring teachers and clinical teachers that attended the same university. One of the unique aspects of my relationship with my clinical teacher was that we bonded over shared experiences with professors and my familiarity with the CTESS model that was used for her growth measurements. In understanding this

relationship and common bond as educators and graduate students, teachers providing in classroom training and help to their student teachers can use these tools to maximize the benefit to both parties by encouraging growth in the student teacher's approach to students while learning from the student teacher's background and how they utilize it in the classroom. Creating a more collaborative dialogue between the student teacher and adviser in relation to the application of race theory and multiculturalism allows both parties to strengthen their experiences as teachers in the classroom while providing a more developed sense of cultural efficaciousness that they may otherwise lack.

Additionally, I would also like to see research where the Culturally Efficacious Model is used with practicing teachers to measure and encourage growth and development of educators already working with students. I think there needs to be a study on current K-12 teachers who adopt CEEM and use CTESS to measure their growth in the cultural efficacy dimension to determine long term benefits of the practices as they relate to student performance and engagement. While CEEM and CTESS are great tools developed for clinical teachers, current research shows that there is a significant gap in teacher knowledge and utilization of the practices. This gap is most evident in the documented achievement gap between white students and students of color and the lack of practice CEEM and CTESS by educators based on both external social pressures that chill the practice in the classroom and lack of knowledge base of educators who would be inclined to incorporate the theories in their classroom but have a hard time doing so.

### **Recommendations**

One of the things that pushed me to change my classroom practices was the presence of my clinical teacher. I would suggest that universities look at matching graduate school students

who are current practicing teacher to those in the clinical teaching experience. Both teachers have similar goals and shared professors so there is a similar language for both programs, so that common university experience can aid in the growth and development of both teachers. The skills that are practiced by each teacher can be developed in line with program goals such as gaining cultural efficacy and reflective practice about teaching methods and approaches.

I would also encourage all university professors to look at how whiteness exists in their curriculum and be able to address how to incorporate diverse perspectives into their classroom. We need to call for more classroom practice by professors that encourage open dialogue, intersectionality, and examination of power dynamics. The practices that are taught in the Curriculum and Instruction Department need to be echoed in all departments. The goal should be for all departments in a university to provide a more inclusive educational experience that prepares students to navigate their own journey of self-discovery while building awareness of their own positionality and biases.

Future research questions that spiral off my original research would be: How do we measure cultural efficacy? How can we ensure that graduates from a university have cultural efficacy? Both questions were ones that I was interested in only towards the end of my graduate school classes. I chose to use a method of measuring cultural efficacy that I was most familiar with due to its use in my university but there are other models. I wanted a way to prove that I was not the same teacher that entered graduate school. I wanted evidence of this transformational experience I had so that when I become a teacher educator I can also use the same tools or research to inspire change in my own students.

## Reflection

Writing this thesis was one of the most difficult things I have even done in my entire life. There were so many opportunities to graduate without authoring this thesis, but it was a challenge I was determined to complete. Towards the end I felt like a failure and a fraud. My practice is not completely transformed, and I still have flaws in how I work with my own students. The truth is I am still working on my classroom practices and still make mistakes in trying to apply the principles that I have learned with my own students because it is not easy and there are structural hurdles that stymie the process. My curriculum and practice are not perfect, but I strive every day to be a better teacher for my students on an individual level as well as from a global classroom-based level. I was not prepared for the transformation that occurred through graduate school and continued as I authored my thesis writing. As I finished my coursework for graduate school, I still had a lot of questions about what the practical application of research on Critical Race Theory and Critical Whiteness Studies looked like in the classroom. My thesis research is what brought me closer to those answers so I could start to make real changes to how I approach my students and lessons. I also needed a measuring stick for my success, so the Culturally Efficacious Model helped provide a measuring stick for my own transformation throughout this process.

As I reflect on my journey and the parallels between myself and Dorothy I have to acknowledge that I always had a brain, heart and courage. If you have seen the movie or read the book then you know that the scarecrow always had a brain, the tin man a heart, and the lion courage. Just like these characters I had not yet developed these parts and needed a journey to realize them in myself. So, the question I ask myself is why were others able to recognize these characteristics in myself when I couldn't? The answer is simple. I had an all-knowing Oz of my

own, who shined a light that helped me see that my heart, brain and courage were always there. My thesis committee became my Oz. They guided me along this process with everything from classroom instruction, personal conferences, counseling sessions, guidance and feedback that helped me come full circle in my journey.

### **Conclusion**

Teaching is a difficult profession with lots of obstacles in the way of doing what is best for kids. I feel that this conceptual framework can be helpful for other science teachers that are struggling with theoretical research and the implications for their classroom. Science teachers, I see you out there in your classroom just teaching the basic concepts and trying to get students to memorize facts for a test. While it is understandable that the system has created a framework that allows you to construct symbols of success by teaching like this, you are not doing what is best for students. Students are not just vessels to store information and facts for state mandatory testing. Test scores and the pressure they create develop a system that lets us fall asleep assuming we are doing our best if our students can pass the state tests. This system which rewards simplified teaching fails to encourage teachers to create real connections between them and the curriculum.

If I never went to graduate school, I would still be living in a black and white world where banking facts inside my students was the paramount goal. I would still be keeping my students at arm's length thinking that the next great teaching strategy is just around the corner and if I learn it my students will magically transform and remember all the necessary answers to the tests they will be given at the end of the year. What I realized is that the students did not need to transform, I needed to transform. Authoring this thesis forced me to find the research that I needed to make effective classroom changes that challenged what and how I instruct my

students. I teach a state mandatory tested subject and I have quantitative data that will support that every year my students got better including growth in my Special Education student's test scores. This progress though was not achieved by just hammering facts into the students but instead working to reshape my approach in how I can relate the material to my students' life and cultural experiences. This journey has opened my eyes to the beauty of qualitative data and its correlation to the quantitative. As I saw qualitatively my student became more engaged, from everything to leaving me post-it notes on my desk about how I made their day to asking about how specific science principles apply to the things they saw on social media, I saw the same quantitative increase in student performance on year-end testing. Having students who beg me to teach high school and receiving emails years later inviting me to their events because they know I still support them has demonstrated that the work in the classroom to make sure they felt seen and heard has resulted in a real change in my students and their appreciation for learning. My journey has not ended, and I will continue to grow in the hopes that I can be a teacher educator and inspire the same level of change that I went through with teachers.



**APPENDIX A**  
**Data Collection from Artifacts**

**Summer 2018**

Course Pre-Assessment	Document Analysis	EW, CR, CB
Class Presentation in Dr. Straw's Class	Narrative	CR, EW
Module 3 Reflection	Dialogic Journal	CCE, CCR, CP
Discussion Questions	Dialogic Journal	CD
Project Script-CI	Document Analysis	CB, CCS
Curriculum Document Analysis	Document Analysis	EW, CR, CCS
Module 1 Reflection	Dialogic Journal	CP
Reflection 6	Dialogic Journal	CCS
Project Script-ILT	Document Analysis	CCS

**Fall 2018**

Epistemology Statement	Document Analysis	CB, EW, CCS
Curriculum Development Philosophy	Document Analysis	CD, CCS, EW, CB
Reading Reflection 2 Multicultural Edu.	Dialogic Journal	CR, EW, CCS
Reading Reflection 3 Critical Pedagogy	Dialogic Journal	CCS
Reading Reflection 4 Privilege	Dialogic Journal	CD, CB
Reading Reflection 5 Neoliberalism	Dialogic Journal	EW
Reading Reflection 6 CRT	Dialogic Journal	CD
Fishbowl Activity Reflection	Reflection	CB, EW
Reading Reflection 7 Adler	Dialogic Journal	CCS
Reading Reflection 8 Culturally Relevant Pedagogy	Dialogic Journal	CCS, CD, CCE

**Spring 2019**

Rough draft of poster design for 3D Makerspace project	Document Analysis	CCS, CCR
Lesson on Periodic Table and Art	Reflection	CP, CCR
Reading Presentation Summary Graffiti	Document Analysis	CB

**Summer 2019**

A Philosophical Reflection on Storytelling	Document Analysis	CCS, CCE, CP
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**Fall 2019**

Research Synthesis Rubric Christmas Decoration Project	Document Analysis	CCR
STEAM Reading Response	Dialogic Journal	CCS

**Spring 2020**

Action Research Project Let your Knowledge Shine	Document Analysis	CCS
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**Fall 2021**

CEEM Model Reflection	Document Analysis	CCS, CCE,
Culturally Efficacious Modules	Document Analysis	CCS, CCE, CP, CCR

**Fall 2022**

All about Me Student Questionnaire	Document Analysis	CCE, CP,
CTESS Rubric Reflection	Document Analysis	CCS, CCE, CP, CCR
Mentor Teacher/Clinical Teacher Debriefing Notes	Reflection	CCS, CCE, CP, CCR
Storytime with Alfred Wegner	Narrative	CCE, CP, CCR
Scientist and Engineer Brochure	Narrative	CCE, CP, CCR

**Spring 2023**

Reflection Student Feedback	Reflection	CCS, CCE, CP, CCR
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**APPENDIX B**  
**Frequency of Codes Found in Artifacts**

<b>Codes</b>	<b>Frequency</b>
Cultural deficit (CD)	5
Lack of Understanding Contemporary Racism (CR)	4
Colorblind (CB)	9
Exertions of Whiteness (EW)	8
Cultural Consciousness (CCS)	19
Cultural Competence (CCE)	11
Cultural Proficiency (CP)	11
Cultural and Critical Responsivity (CCR)	10

**APPENDIX C**  
**Types of Artifacts**

<b>Type of Artifact</b>	<b># of artifacts</b>
Document analysis of graduate school assignments	14
Dialogic journals from class readings	12
Reflection on events from personal journal	5
Narratives retelling of stories	5

**APPENDIX D**  
**Document Mentor Teacher Questionnaire**

<p>1. Can you give an example of a time you or your mentor teacher were able to... recognize oppressive classroom, school, and/or societal structures that often serves to marginalize and minoritize students of color. Describe the incident and the outcome.</p>	
<p>2. Can you give an example of a time you or your mentor teacher were able to... validate students' identities through proactive practices, such as examining student responses, respecting diversity in self and others, and valuing diverse ideas</p>	
<p>3. Can you give an example of a time you or your mentor teacher were able to... demonstrate a strong sense of identity to affirm their students' identity.</p>	
<p>4. Can you give an example of a time you or your mentor teacher were able to... build interpersonal relationships by demonstrating authentic caring or helped a student feel a sense of belonging within the classroom and school.</p>	
<p>5. Can you give an example of a time you or your mentor teacher were able to... create a democratic classroom by noting how power is distributed in the classroom</p>	
<p>6. Can you give an example of a time you or your mentor teacher were able to... build and expand on the learner's prior knowledge to promote knowledge acquisition, by valuing students' linguistic knowledge, promoting language development, and building language continuity</p>	
<p>7. Can you give an example of a time you or your mentor teacher were able to observe students' responses to materials, recognize and value the students' cultural knowledge, and build strong home and school relationships by exploring students' cultural, ethnic, and linguistic backgrounds in ways that enhance student learning</p>	

**APPENDIX E**  
**End of Year Class Survey**

At the end of the year, I had my students fill out a class survey. I asked 7 questions and asked them to answer in 1-3 sentences. An exercise I did before the survey was brainstorming lessons we did throughout the year. Most students remembered different labs or investigations that we did. We also brainstormed types of lessons like warmups, note taking, gallery walks and station activities. I left the brainstorms on the boards to help students recall before they wrote their answers. In my annual review with my principal, I did not want to only use my own words but my students' words to show how I grew in the classroom.

Describe a time in class or a lesson where you felt Mrs. Olivarez taught a meaningful lesson about science that connected to your everyday life.

Describe a time in class or a lesson where you felt Mrs. Olivarez taught a lesson driven by something you were interested in.

Describe a time you felt heard, safe, or supported by Mrs. Olivarez.

What are your favorite types of lessons in science or other subjects?

What lessons helped you learn Science the best?

What lessons were not effective in learning about science?

What science content do you want to learn more about after STAAR?

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