AN ABSTRACT OF THE DISSERTATION OF

Alfred McQuarters for the degree of Doctor of Education in Education presented on July 24, 2019.

Title: Racial Battle Fatigue Among Latinx and Black Community College Students in Science, Technology, Engineering, and Mathematics Disciplines: A Quantitative Perspective

Abstract approved:

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The role of community colleges as open-access institutions that bring racial diversity to careers in the science, technology, engineering, and mathematics (STEM) fields is essential (Musante, 2012; Reyes, 2011). Yet, the opportunity to attend postsecondary institutions is not enough to guarantee the success of People of Color as they navigate hostile academic environments (Franklin, 2016). Community colleges must be willing to ensure that students are welcomed in their classes and that they are promoting positive academic environments that are sensitive to racially marginalized and stigmatized groups. The influence on racially marginalized and stigmatized groups is underscored by findings in the literature on how hostile academic environments have led to "alienation, dissatisfaction, academic disidentification, disengagement, and blocked academic aspirations" (Smith, Allen, & Danley, 2007, p. 552).

Smith (2004), a professor at the University of Utah, coined the term racial battle fatigue (RBF) to describe three major stress responses (physiological, psychological, and behavioral) from the accumulation of racial microaggressions and

the energy expended on coping with and fighting against it (Yosso, Smith, Ceja, & Solózano, 2009). *Microaggressions* are everyday subtle or ambiguous racially related insults, slights, mistreatments, or invalidations (Torres-Harding & Turner, 2015). A racial battle fatigue scale (RBFS) was later developed by Franklin, Smith, and Hung (2014) and quantitatively tested in a college classroom using the RBF framework to assess psychological, physiological, and behavioral stress.

The purpose of this study was to use this RBFS to quantitatively measure racial battle fatigue (RBF) for Latinx and African American students enrolled in STEM courses across multiple community college classrooms and campuses. An online questionnaire was administered to 536 students from community colleges in Oregon, Washington, Illinois, and California. The study spanned one term or one semester of an introductory chemistry course intended as a transfer course. Each institution had the same prerequisites, including College Algebra, and similar student learning outcomes.

A multivariate analysis of variance (MANOVA) was performed to test the four statistical hypotheses of the three research questions of this study. Three dependent variables included the three RBF domain scores of (a) psychological, (b) behavioral, and (c) physiological. Two independent variables were included in the model.

The study findings revealed a significance for the race of the student when responding to questions regarding RBF. White students had a significantly lower score than Latinx and Black on the behavioral, physiological, and psychological

domains. Black and Latinx did not differ from each other on any of the three domains.

Maltese and Tai (2011) asserted that classroom environments play a large role in student retention in STEM. Understood in this context, measuring RBS is a crucial first step to raising consciousness within the community college setting for more retention of Latinx and African American students. The findings of this research will be useful to administrators and faculty when considering how to address microaggressions on their campus and how it impacts students, their health, and sense of belonging as a STEM student. The findings of this research will also help guide instructional pedagogy at PWIs, HSIs, and PBIs regarding group work, especially in STEM courses. Most importantly, the results of this research can help identify, disrupt, and dismantle the racism that marginalizes, subordinates, and excludes students in STEM even within the community college environment.

Keywords: racial battle fatigue, critical race theory, STEM, community college, microaggressions, stress

Racial Battle Fatigue Among Latinx and Black Community College Students in Science, Technology, Engineering, and Mathematics Disciplines: A Quantitative Perspective

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I understand that my dissertation will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my dissertation to any reader upon request.

Alfred McQuarters, Author

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> The students, the whole engineering department…they have their own little cliques. They're very anti-social…they study but you're not invited to their study session. You can be at the table across them studying the same thing in the same classroom but they don't even greet you. (Reyes, 2011, p. 253)

Imagine this student is you. What psychological, physiological and behavioral effects would result from being in this classroom environment?

The excerpt presented above comes from an interview in a qualitative study (Reyes, 2011) demonstrating the microaggressions that exist for underrepresented racial groups in science, technology, engineering, and math (STEM). *Microaggressions* are everyday subtle or ambiguous racially related insults, slights, mistreatments, or invalidations (Torres-Harding & Turner, 2015). Far from being benign, racial microaggressions have major detrimental consequences for People of Color (Sue, Lin, Torino, Capodilupo, & Rivera, 2009). Microaggressions like these can fall into five message categories: "You do not belong;" "You are abnormal;" "You are intellectually inferior;" "You are untrustworthy," and "You are all the same" (Sue, 2009, et al., p. 329). In the workplace, microaggressions contribute to the glass ceiling effect for employees by sending messages of exclusion and expectations of failure (Miller & Travers, 2005). In the classroom, students report microaggressive behaviors that negate their contributions, communicate low expectations, and exclude their participation in activities (Solórzano, Ceja, & Yosso, 2000).

Similarly, research has provided valuable evidence that racism is experienced as a stressor of People of Color (Smith, Hung, & Franklin, 2012). *Racism* refers to a process inherent in culture and social order of prejudice or animosity directed towards a person of a different race/culture (Essed, 2002). It is composed of beliefs in racial

superiority and inferiority and is enacted through individual behaviors and institutional and societal policies and practices (Jones, 1997). Studies have shown that students experiencing microaggression-induced stress perform poorly compared to their peers (Beasley, Chapman-Hillard, & McClain, 2016), and there is an association between increased racialized stress and decreased college persistence (Johnson, Wasserman, Yildirim, & Yonais, 2014; Wei, Ku, & Liao, 2011). Recent studies have also shown that exposure to racialized stress has been found to be associated with a range of health-harming biological responses in adults, including elevated glucocorticoids (Mays, Cochran, & Barnes, 2007), de-regulation of pro-inflammatory cytokines (Cooper, Mills, & Bardwell, 2009), and telomere shortening which are the regions on the ends of our DNA chromosomes (Chae, Nuru-Jeter, & Adler, 2014). Most importantly, if racial microaggressions are constant and continuing, a cumulative effect of stress can result (Sue, Capodilupo, & Holder, 2008). Harper and Palmer (2016) described microaggressions as "death by a thousand cuts- an individual one stings, but the cumulative sum of them is quite injurious" (p.150).

Smith (2004), a professor at the University of Utah, coined the term racial battle fatigue (RBF) to describe a person's reaction to the mundane, extreme environmental stress caused by the accumulation of racial microaggressions (Yosso, Smith, Ceja, & Solórzano, 2009). RBF is a "conceptual model supported by health psychology and higher education literature to explain the relationship between racist environments, structural racisms, White supremacy, and perceived health outcomes for historically underrepresented groups" (Franklin, 2019, p. 1). Symptoms of RBF are physiological, psychological, and behavioral in nature, ranging from tension

headaches, insomnia, and rapid mood swings (Smith, Yosso, & Solórzano, 2006). Racial microaggressions can cause RBF to remain "switched on" and symptoms can occur in anticipation of a racist event: rapid breathing, upset stomach, frequent diarrhea, or urination (Smith, 2004). RBF provides a framework which highlights that People of Color can become physically and emotionally drained as a result of coping with and defending against racial microaggressions (Smith & Lilly, 2016). Franklin, Smith, and Hung (2014) asserted that "racism is a psychosocial stressor that compromises health outcomes which impact the educational, social, professional, and interpersonal well-being of People of Color" (p. 307). An instrument to measure RBF was later developed by Franklin, Smith, and Hung (2014) to quantitatively explore these cumulative discriminatory and racist experiences.

Purpose of the Study and Research Gaps

The purpose of this study is to explore quantitatively the levels of RBF for Latinx and Black community college students enrolled in STEM courses and to understand to what extent the racial campus climate correlates with the psychological, physiological, and behavioral stress for Black and Latinx students. Matsubayashi (2010) defined the racial campus environment as one where people interact with in-group and out-group members. These racial campus environments are more pronounced for Black and Latinx students in STEM which makes this environment ideal for measuring RBF.

To date, a large portion of the literature on racial microaggressions and the resulting academic outcomes has primarily been qualitative (Smith, 2004; Smith, Allen, & Danley, 2007; Solórzano, Allen, & Carroll, 2002; Sue, Capodilupo, Torino,

Bucceri, Holder, Nadal, & Esquilin, 2007). The methods used in many of the early and even more recent studies were focus groups. This approach was useful as a first general step to explore the wide range of issues and personal experiences for study in this new area. This study utilized a racial battle fatigue scale (RBFS) applying a quantitative approach in order to measure the level of RBF of students across multiple community college classrooms and campuses. A quantitative approach is vital because it can summarize numerical data in ways that are clear and persuasive to stakeholders (e.g. faculty, administration, policy makers) and can provide large, representative samples of classroom communities (Creswell, 2014).

The equity imbalance in STEM subjects dominates current literature about under-representation in academia and graduates seeking employment in the field (Landivar, 2013; Leggon, 2018). Similarly, there are numerous published research articles that look at culturally relevant curricula and pedagogy. However, there is little research that acknowledges institutional racism and uses a critical race theory (CRT) lens when looking at STEM education (Collins, 2018). Willie and Sanford (1995) warned that researchers and policy makers have not fully understood the social structures and processes that have excluded certain groups in the past. As a result of using a CRT lens in this study, this research contributed to shifting the literature from a skills deficit among Black and Latinx students in STEM perspective, to an opportunity gap in STEM education. If not closed, an opportunity gap leads to unequal outcomes due to structural inequalities in society (Hung, Smith, Voss, Franklin, Gu, & Bounsanga, 2019).

This study is significant because it takes prior work on RBF done exclusively at four-year institutions and contributes to the theoretical literature on RBF at community colleges. To date, RBF has not been studied in a community college setting. However, this is a common phenomenon because the community college student population is not represented in the literature as much as student populations at four-year institutions (Edman, Watson, & Patron, 2016). According to the U.S. Department of Education, over 8 million students enrolled in U.S. community colleges in 2016-17 (Ginder, Kelly-Reid, & Mann, 2018). Excluding community colleges from higher education studies would exclude the voices of over 8 million students per year. In addition, as community college demographics shift and become more (or less) diverse, practitioners' understanding RBF and its relationship to different student populations becomes even more important. For current and future community college instructional administrators (e.g. deans; provosts; vice presidents; directors, and managers), this study will provide information that can guide their efforts to explore racial disparity in STEM courses. For example, the findings from this study can inform the planning, development, and implementation of college-wide strategic planning and program review/evaluation. The study also draws attention to community colleges designated as Predominately Black Institutions (PBI) and Hispanic Serving Institutions (HSI) as a methodological approach to comparing institutional demographics to PWIs. The understanding that not all community college are the same is important for researchers developing research questions using a CRT lens. Similarly, there might be instances where a PBI community college might mirror similar findings from Historically Black Colleges and University

(HBCU) studies regarding losing a very talented population of Students of Color at every educational level (Jackson, 2013).

Recent STEM Education studies at HBCUs and PWIs have focused exclusively on students underrepresented in the STEM field. Studies such as this provide additional research which supports other scholarly literature that examines students not underrepresented in STEM. This addition to the literature provides community college leaders with the opportunity to see how different racial groups within STEM perceive and react to microaggressions. According to Subotnik, Kolar, Olszewski-Kubilius, and Cross (2010), "insufficient research exists to inform educators, researchers, and policy makers about how they contribute to the development of STEM talent" (p. 5). Therefore, this study will help inform leaders that not all students in STEM have the same experience.

Research Questions and Hypothesis

This study addresses the following three research questions:

Research question 1: Do Black and Latinx students in STEM report higher levels of RBF than White students in STEM in both the predominantly White and predominantly Black/Hispanic community college systems combined?

For this first research question, data were collected about the level of racial microaggressions in the classroom as a community college STEM student. Numerous qualitative studies have demonstrated that, unlike their White peers, Latinx students experience hostile campus racial climates, racial microaggressions, and added racial stressors (Harper & Hurtado, 2007;

Hurtado & Carter, 1997; Solórzano, Ceja, & Yosso, 2000). Another qualitative study, which looked at historically White institutions, revealed the existence of racism, blocked opportunities, and extreme environmental stress (Franklin, Smith, & Hung, 2011). I hypothesized that Blacks and Latinos would report higher levels of RBF than White students in STEM, which the previous qualitative studies at four-year institutions appear to suggest.

Null hypothesis 1a. Black students in STEM report no significantly different levels of RBF, or significantly lesser levels of RBF than White students on the dependent variable RBF domain scores of psychological, behavioral, and physiological.

Alternative Hypothesis 1a. Black students in STEM report significantly greater levels of RBF than White students on at least one of the dependent variable RBF domain scores of psychological, behavioral, and physiological.

Null hypothesis 1b. Latinx students in STEM report no significantly different levels of RBF, or significantly lesser levels of RBF, than White students on the dependent variable RBF domain scores of psychological, behavioral, and physiological.

Alternative Hypothesis 1a. Latinx students in STEM report significantly greater levels of RBF than White students on at least one of the dependent variable RBF domain scores of psychological, behavioral, and physiological.

Research question 2: Does the level of RBF among Latinx and Black STEM students differ from White STEM students in the predominately Black/Hispanic community college system?

The second research question compared the RBF of different groups in a campus environment defined as being PBI and HSI. The literature supports that blatant forms of racism are common occurrences for Students of Color at PWIs (Museus, Nicols, & Lambert, 2008; Robertson, 2012). Similarly, Latinx students attending PWIs have been stereotyped as 'under qualified' and 'lacking intelligence' and have been made to feel unwanted in these environments (Yosso, Smith, Ceja, & Solórzano, 2009). In contrast, Jackson (2013) conducted a qualitative study of African American female community college transfer students who were currently enrolled in and pursuing STEM bachelor degrees at HBCU. The study looked at the challenges for students who transition from community colleges to four-year colleges. The participants echoed how the HBCU environment was a "safe" environment to begin developing a student in STEM. The researcher hypothesized that PBI community colleges will provide the networks and resources similar to HBCUs that are vital to protect them against RBF which the current qualitative literature suggests.

Null hypothesis 2. The interaction term of Student Race/Ethnicity Group X School Type will not be statistically significant for the student race/ethnicity groups on the level of Black/Hispanic community college systems as related to the three RBF domain scores.

Alternative Hypothesis 2. The interaction term of Student Race/Ethnicity Group X School Type will be statistically significant for the student race/ethnicity groups on the level of Black/Hispanic community college systems as related to at least one of the three RBF domain scores.

Research question 3: Does the level of RBF among White STEM students differ at the Predominately White community college system as compared to the Predominately Black/Hispanic community college system?

The third research question compared the same racial group within different institutions. This question provided insight regarding whether any degree of RBF exists or "reverse RBF" exists for White students. In a 2011 article on White Fragility, DiAngelo stated that social environments protect and insulate White people from racialized stress. This protection, called White privilege, provides the taken-for-granted benefits and protections afforded to Whites based upon skin color (Bonds, 2016). Also rooted in the five tenets of CRT, in order to truly be a victim of racism, a student must feel inferior to another race (Solórzano, 1997). Hall and Closson (2005) looked at the barriers that White students experience on an HBCU campus compared to Black students. In an exploratory and descriptive study using quantitative and qualitative research methods, Hall and Closson found that White participants in the study reported a general sense of comfort. This is in contrast to the experience of Blacks at PWIs who tend to experience the environment as hostile and foreign. Therefore, the researcher hypothesized that RBF among White community college students in STEM will be the same in all social

environments because of White privilege, which the current literature suggests.

Null hypothesis 3. The interaction term of Student Race/Ethnicity Group X School Type will not indicate statistically significant differences for the student race/ethnicity group of Whites as related to any of the three RBF domain scores between the predominately White community college system and the Predominately Black/Hispanic community college system.

Alternative Hypothesis 3. The interaction term of Student Race/Ethnicity Group X School Type will not indicate statistically significant differences for the student race/ethnicity group of White as related to at least one of the three RBF domain scores between the two school types of predominately White community college system compared to the Predominately Black/Hispanic community college system.

Significance

The following paragraphs provide an overview as to the importance of the present study, first by describing the theoretical significance, and then discussing its practical significance.

Theoretical significance. This study is significant because it takes work on RBF emerging more commonly at four-year institutions and examines RBF at community colleges, contributing to the theoretical literature on RBF and on community colleges. Therefore, a major contribution of this research is the provision of a quantitative tool for community colleges to analyze data sets that address exclusionary classroom pedagogy, racist encounters, implicit bias, and racial literacy

in STEM Education. This study also draws attention to community colleges designated as PBIs and HSIs which might mirror similar findings from emerging HBCU studies. For example, this study may confirm the notions of the benefits of PBIs, and it may confirm the previous findings of White privilege.

This study will help to confirm the reliability and validity of the RBF instrument. This tool can then be used in future research and for theory development purposes. Thus, the findings of this study provide a methodological approach for fostering a positive racial classroom in STEM education while expanding the way in which both educational researchers and practitioners think about psychological, physiological, and behavioral stress.

Given that previous research studies have utilized qualitative approaches, this study will provide insights for future quantitative work. For example, the study should provide an insight into future quantitative research possibilities involving different populations such as multi-cultural races and indigenous populations, subpopulations that may not have received similar attention in educational research.

Practical significance. STEM education is important for the United States (Bangera & Brownell, 2014). Without this type of education, we cannot build communities and transform our nation. However, many students start college intending to pursue a career in STEM but abandon this goal after introductory courses (Harackiewicz, Canning, Tibbetts, Priniski, & Hyde, 2015). Community colleges place a large demand and responsibility on STEM education, because they serve as open-access institutions (Musante, 2012; Reyes, 2011). Therefore, the need to reduce

bias and boost diversity by educating the STEM community is valuable (Intemann, 2009).

More than 11 million Americans each year use the community college as an educational gateway. Community colleges serve as the "entry point into higher education for most first-generation college students, particularly those from low-income, minority and immigrant background" (Bailey, 2004, p. 1). According to the National Science Foundation's Science Indicator 2012, almost 20% of U.S. residents who were awarded science and engineering doctoral degrees and 46% who graduated with bachelor's and master's degrees in science and engineering earned credits at a community or two-year college (Musante, 2012). Despite the large number of African Americans and Latinx students enrolled in community colleges, both White and Asian individuals still dominate the representation in STEM fields (McGee, Thakore, & LaBlance, 2016). According to one recent report on international assessment of mathematics and science,

> …the science scores of white U.S. eighth graders were surpassed only by the scores of three counties (Singapore, Chinese Taipei, and Korea), while Hispanic and black U.S. eighth graders had scores equivalent to those of students in countries ranked in the bottom third of the 45 countries that participated in the 8th grade science assessment. (National Science and Technology Council, 2013, p. 2)

Increasing minority representation in STEM continues to be a major concern for researchers, educators, employers, and government agencies (Agrawl, Stevenson, & Gloster, 2016; National Science Foundation, 2019; Wladis, Hachey, & Conway, 2015). STEM education is special because it is common for someone with STEM education to pursue a career outside of science and engineering. However, it is very difficult for someone without STEM education to pursue a STEM career (Xie, Fang,

& Shauman, 2015). Therefore, the role of community college educators in bringing diversity to the STEM field is essential. Community colleges must be willing to ensure that students are welcomed in their classes and that they are promoting post-graduation environments that are sensitive to the needs and cultures of those who often feel isolated in the STEM area.

The information obtained in this study could help administrators focus on efforts to ensure a welcoming campus climate for students from racial minorities. Examples include campus-based health promotion strategies to address stress management, a campus-wide effort to address diversity and inclusion within the student population, and targeted professional development for STEM.

Freire (2000) argued that education is sexist and racist and promotes the reinforcement of the status quo, with no voice for the underserved. At the college instructor level, there are a number of social-psychological interventions that have been developed to help at-risk students in introductory college classes, with positive outcomes (Yeager & Walton, 2011). One example includes value affirmation interventions based on self-affirmation theory which has shown to address identity threat among Blacks and Hispanics in STEM by taking the focus off the threatened part of identity (Harackiewicz, Canning, Tibbetts, Priniski, & Hyde, 2015). Another example involved utility-value interventions based on perceived value of and engagement with the course content (Harackiewicz, et al., 2015). McGee and Hostetler (2014) suggested teaching and historicizing mathematics and social science together to draw on historical narratives to position social justice in education, as well as mathematics, with other disciplines. Examples of historicizing mathematics could

include describing how mathematics education could be changed to explore the cost of slavery, effects of crime policies, and elimination of rehabilitation. Such approaches can make mathematics a topic of interest to diverse communities (McGee & Hostetler, 2014). These examples of social-psychological inventions could be part of a professional opportunity for STEM faculty to develop new curriculum and pedagogy.

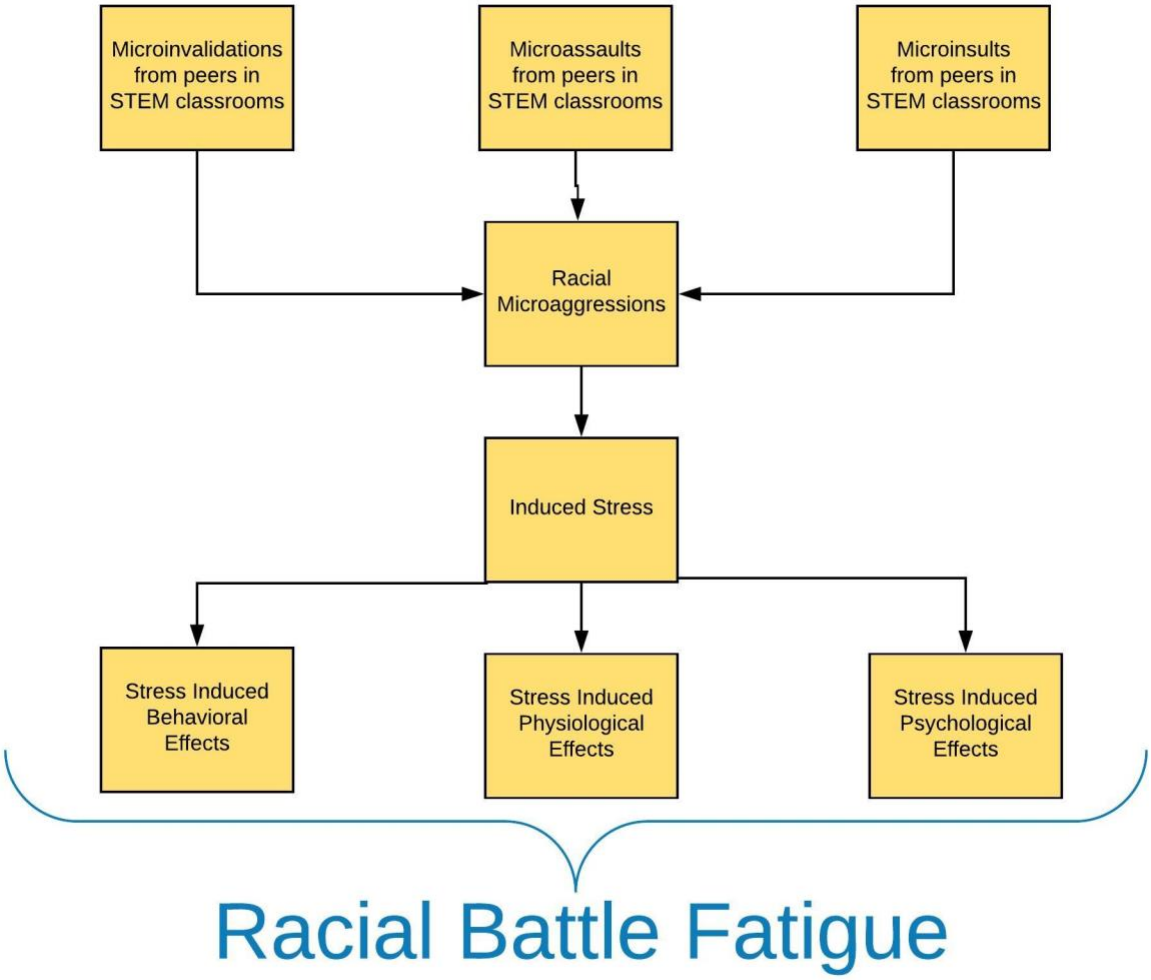
At the student level, this study can support changes that increase the rate of transfer to bachelor's degree programs and increase the number of students earning college credentials of economic value through STEM. On average, just 2% of technology workers at seven Silicon Valley companies that have released staffing numbers were Black, and 3% were Hispanic (Weise, 2014). For those underrepresented students who were able to find jobs, studies have shown that "hostile" STEM work environments result in low retention; for example, both Latinx and Black women reported regularly being mistaken as janitors (Williams, Phillips, & Hall, 2014). In one study that involved 60 in-depth interviews with Women of Color in STEM jobs, 100% reported situations in which they were not recognized at their workplace (Williams, et al., 2014). Therefore, this study can help industry become more conscious of historical and current realities of RBF and challenge framings that prevent movement toward a more inclusive environment.

Summary

Diversity, equity, and inclusion in STEM are critical. Without equity we may exclude some of the best and brightest scientific minds and limit the pool of possible scientists, engineers, and mathematicians (Bangera & Brownell, 2014). Studying RBF

is valuable. The equity imbalance in STEM subjects dominates current literature about underrepresentation in academia and graduates seeking employment in the industry (Landivar, 2013). Yet, the absence of research examining the unique issues of community college, STEM education, and student peer groups is apparent.

The purpose of this study is to quantitatively test RBF for Latinx and African American students enrolled in STEM courses and to understand to what degree racial environment impacts the psychological, physiological, and behavioral stress for Black and Latinx students. The research questions include: (a) Do more Black and Latinx students report higher levels of RBF than White students within STEM?; (b) Does the level of RBF among Latinx and Black students in STEM differ at PBIs and HSIs compared to PWIs?; (c) Does the level of RBF among White STEM students differ at PBIs and HSIs compared to PWIs?


Microinvalidations from peers in STEM classrooms
Microassaults from peers in STEM classrooms
Microinsults from peers in STEM classrooms
Racial Microaggressions
Induced Stress
Stress Induced Behavioral Effects
Stress Induced Physiological Effects
Stress Induced Psychological Effects
Racial Battle Fatigue

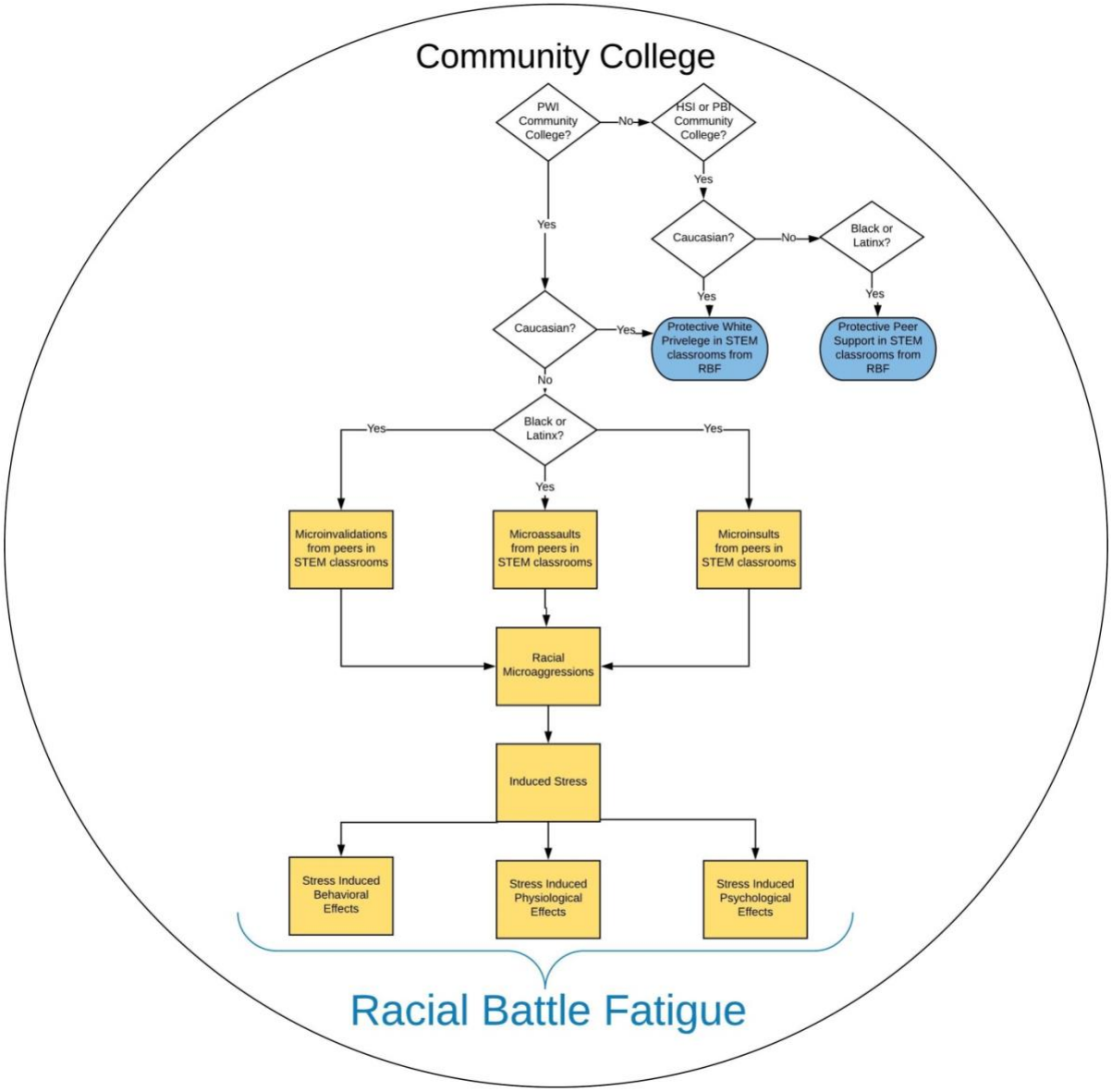


Figure 1.1: Conceptual Model for RBF in STEM

Chapter II: Literature Review

> [they] keep rejecting whatever you say in class, it doesn't matter what you say, [they'd] disagree. They'll say [racial related matter] it's either irrelevant, it's not clear enough, um I don't understand what you're saying, stuff like that…(Sue, Lin, Torino, Capodilupo, & Rivera, 2009, p. 186).

The excerpt presented above comes from an interview in a qualitative study in which racial microaggression results from comments that question intelligence and deny racial reality. Now imagine this student is you. What psychological, physiological, and behavioral effects would result from being in this classroom environment?

Following the Supreme Court's 1954 Brown versus Board of Education decision that the "separate but equal" policy was illegal, People of Color have experienced significant economic gains. But while an increased number of Black students in higher education occurred, disparities in academic achievement have persisted. In the educational realm, the deleterious effects can be witnessed through the differential performance scores and graduation rates of Students of Color. This review examines the literature regarding racial microaggressions and barriers to educational success in STEM. The Cultural Deficit Theory which morphed into the Oppositional Culture Theory provided an explanation, theorizing that non-Whites were somehow intellectually inferior. This rationale allowed racism, with its basis in superiority and power of the White race over non-Whites, to become justified in STEM education.

This literature review provides a background on topics important to understanding RBF for Latinx and Black students enrolled in STEM courses based on the researchers' conceptual model (Figure 1). Topics included are minority student

populations at PWIs; Minority Serving Institutions (including HBCUs, PBIs, and HSIs); CRT; Racial Microaggressions (including microinvalidations, microassaults, and microinsults); race gap and related barriers to student success in STEM courses; stress (behavioral, physiological, and psychological effects), and RBF.

Important considerations include an overview of racial microaggressions in higher education and the need to racially diversify STEM education. The impact on understanding personal biases and prejudices would prove significant to increasing the STEM pipeline.

Literature Search Process

The literature review was conducted narrative style as presented by Rossella Ferrari (2015). This approach is aimed at reducing bias in the selection of articles for review and employing an effective bibliographic research strategy. The electronic search included Google Scholar, Elton Bryson Stephens Company (EBSCO) Host, Education Resource Information Center (ERIC), Science Direct, 1Search, and Dissertation Abstracts. The inclusion criteria were articles pertaining to humans and articles published from 1980 to 2018. The exclusion criteria were articles for which full text was not available and those not in English.

Search terms included “Predominately White Institutions”; “Predominately Black Institutions”; “Hispanic Serving Institutions”; “Historical Black Colleges & Universities”; “critical race theory”; “stress”; “STEM education”; “science education”; “math education”; “engineering education”; “technology education”; “racial microaggressions”; “microinvalidations”; “microassaults”; ”microinsults”; “racial battle fatigue”, and “critical race theory in higher education”. As an extension

of the term “Science”, the terms “Biology;” “Physics”; “Chemistry”; “Geology;” “Anatomy;” “Zoology”; “Botany”; “Microbiology”; “Geoscience”; “Astronomy,” and “Ecology” were used. For Mathematics, “Statistics”, “Calculus”, and “Algebra” were used; and for Technology, the term “Computer Science” was also used. These search terms provided a large number of articles and nascent themes that were used for consideration in this research. Additionally, seminal literature was identified through the appearance of multiple and repeated citations by other authors, and their works were retrieved.

Definitions

This research focused on a broad body of knowledge centered on racial microaggressions. This included using terms such as microinvalidations, microassaults, and microinsults. Because the history of this broader topic is lengthy, key terms are defined to ensure common understanding of their use throughout the research and to avoid ambiguities in definitions across sources.

Microaggressions are commonplace daily verbal, behavioral, or environmental indignities, whether intentional or unintentional, that communicate hostile, derogatory racial slights. These messages may be sent verbally ("You speak good English"), nonverbally (clutching one's purse more tightly), or environmentally (symbols like the confederate flag or using American Indian mascots). Such communications are usually outside the level of conscious awareness of perpetrators.

Microinvalidations refer to communications (often unconscious) that subtly exclude, negate, or nullify the thoughts, feelings, or experiential reality of a Person of Color. For instance, White individuals often ask Hispanic-Americans where they

were born, conveying the message that they are perpetual foreigners in their own land (Pittman, 2012).

Microinsults involve verbal and nonverbal communications (often unconscious) that subtly convey rudeness and insensitivity and demean a person's racial heritage or identity. An example is an employee who asks a Colleague of Color how she got her job, implying she may have landed it through an affirmative action or quota system (Pittman, 2012).

Microassaults are explicit racial derogations (often conscious) characterized primarily by a verbal or nonverbal attack meant to hurt the intended victim through name-calling, avoidant behavior, or purposeful discriminatory actions. Referring to someone as “colored” or “Oriental,” using racial epithets, discouraging interracial interactions, deliberately serving a White patron before someone of color, and displaying a swastika are examples (Pittman, 2012).

Race is a social construct that artificially divides individuals into distinct groups based on characteristics such as physical appearance (particularly skin color), ancestral heritage, cultural affiliation or history, ethnic classification, and/or the social, economic, and political needs of a society at a given period of time. Scientists agree that there is no biological or genetic basis for racial categories. (Adams & Joshi, 2007). In this study, participants self-identifying as Latinx relates to people of Latin American origin or descent, and those who self-identified as Black origins in any of the Black racial groups of Africa.

Critical race theory (CRT) in education challenges the dominant discourse on race and racism as related to education by examining how educational theory, policy, and practice are used to subordinate certain racial and ethnic groups.

Privilege is unearned access to resources (social power) only readily available to some individuals as a result of their social group.

Safer Space is a supportive, non-threatening environment that encourages open-mindedness, respect, and a willingness to learn from others, as well as physical and mental safety.

According to the U.S. Department of Education, PBIs are defined as having at least 40% African American students while HSIs have at least 25% Hispanic students. In contrast, a PWI is defined as an institution that does not meet either the PBI or HSI definition, but yet has over 50% White students.

Predominately White Institutions

Inyama, Williams, and McCauley (2016) discussed the need to meet the predominant culture's norms and expectations in order to be successful in a new society. They found this to be especially true for minority students due to their small numbers in PWIs. As a result, minority students frequently develop coping behaviors in order to integrate into a White dominant culture. In their study involving African students at a PWI, Inyama et al. (2016) found that the students felt isolated and discriminated against and used each other as support systems.

Thompson and Fretz (1991) likewise studied Black students' academic and social adjustment at a PWI. They theorized that, because of a history of oppression, Black people have adopted strategies over time for coping with the dominant culture

and its institutions. One of these strategies is “communal value orientation” (Thompson & Fretz, 1991, p. 4), the sense that one’s identity is tied to that of the group.

Similarly, Grier-Reed and Wilson (2016) reported on the African American Student Network cofounded by two Black psychologists/faculty members at a large Midwestern PWI. The researchers noted how members of the social network differed from their non-participating Black counterparts on campus. The network members met weekly during the lunch hour and began each session with students’ sharing high and low moments from the week. Discussion was student-driven although Black faculty and graduate students served as facilitators. Overall participation in the network resulted in students (Black males and females) being retained on average by an additional semester. Network members also were found to have a greater social network of same-race and same-gender contacts.

Duckworth and Gross (2014) coined a noncognitive trait, “grit” (p. 7), defined here by Strayhorn (2014) as “the tendency to pursue long-term challenging goals with perseverance and passion” (p. 7) and used it as a predictor of academic success in Black male students. Strayhorn also found that personality traits and grit can be positively influenced by parents’ and mentors’ verbal persuasion as well as by students’ exposure to others’ hard-earned success, by group work, and by inspiring speakers. In another study, Strayhorn and Johnson (2014) found that becoming acquainted with others across race increases one’s sense of belonging in college. However, White students come with privilege to choose or not choose peers based on race.

Shahid, Nelson, and Cardemil (2018) explored the intersection of being Black and female at PWIs and found campus racial tension to be a significant predictor of stress among Black females at these institutions which, in turn, put the women's mental health at greater risk. Social support and spiritual and religious practices were identified as useful coping methods with this group and also were found to lead to positive academic performance.

Latinx college students' academic achievement likewise is often negatively impacted by racism and racial microaggressions at PWIs (Robertson, Bravo, & Chaney, 2014). The students studied used fraternities, sororities, classrooms, and relationships with professors as "counter-spaces" (spaces or areas on the PWI campus that Latinx students carve out in order to preserve their culture and to develop a sense of belonging) (p. 720). In spite of adversity, these students maintained high grade point averages by aligning themselves with same-race groups and by working hard to excel.

Discrimination across race/ethnic groups is not confined to minority students at PWIs, but also extends to faculty and professional staff, according to Zambrana, Wingfield, Lapeyrouse, Davila, Hoagland, & Valdez (2017). The authors found significant levels of both blatant and subtle race/ethnic discrimination, devaluing faculty and staff's competency and merit, and assigning them excessive diversity work. Female faculty reported higher percentages of discrimination and unequal treatment than their male counterparts. Zambrana et al. recommended that universities take steps to provide a more welcoming campus culture by including leadership

development, safe spaces for professional skill development, and mentoring committees.

Minority Serving Institutions

Research concerning three types of Minority Serving Institutions (HBCUs, PBIs, and HSIs) will be reviewed in this section. Both student and faculty challenges and successes will be examined.

HBCUs. Historically Black Colleges and Universities (HBCUs) are institutions of higher learning that were founded to give African-American students an option for higher education when they had none. This mission was designed to empower Black men and women no matter where they fell along the academic spectrum. Samayoa & Gasman (2019) found that HBCUs offer a uniquely familial learning environment that provides success and support for disadvantaged students from under-resourced K-12 backgrounds. These institutions also emphasize collaboration over competition. Full-time students at public four-year HBCUs complete at a rate of 61.8%, slightly less than double that of the federal graduation rate for non-HBCUs public four-year institutions (34.1%). Private HBCU completion rates are 66.7% compared to the federal rate of 43.9% for private four-year institutions. Although only approximately 20% of African-American college students attend HBCUs, 40% of African-American engineers received their degrees from an HBCU (Thornton, 2017).

Although research shows that HBCUs present a climate especially conducive to Black students' success, the same frequency of success has not been true for Black students at historically White institutions (Brooms, 2016). As a result, a number of

those historically White institutions have created Black Male Initiative (BMI) programs as an intervention to support students' academic success, social integration, and personal development. Brooms reported that retention and mentoring programs, such as Brother2Brother and Student African American Brotherhood (SAAB), also focus on building "community capital" to increase students' resilience and persistence by providing a welcoming environment that connects these students with other Black males.

Allen and Esters (2018) suggested pipeline partnership programs between HBCUs and PWIs as a means of sustaining the visibility of HBCUs and enhancing PWI's success in graduating Black students. Such partnerships would present opportunities for access to pre-graduate education and graduate experiences for Black students. They also would stimulate diversity recruitment and graduate school preparation. Allen and Esters noted that Purdue University's College of Agriculture program provides upper level undergraduates and master's degree students from HBCUs with the opportunity to visit campus and to engage with faculty, administrators, and students and to explore research opportunities and graduate study. Fisk-Vanderbilt Masters-to-PhD Bridge Program also encourages students to pursue graduate education in both Fisk's masters and Vanderbilt's doctoral graduate degree programs which provide full funding for students to finish their Ph.D. degrees. Partnerships also could extend to faculty through collaborative research opportunities that would benefit both institutions (Allen & Esters, 2018).

PBIs. PBIs have been traditionally known for culturally oriented student mentoring techniques (Obiakor & Algozzine, 2018). Many of the students attending

these institutions are first-generation college students who come from disadvantaged environments. Because of the important role that PBIs have played in preparing outstanding Black graduates, Obiakor and Algozzine called for these institutions to be competitive in recruiting distinguished professors, scholars, and professionals, especially in their teacher preparation programs. Additionally, the authors recommended that PBIs should work with internal and external stakeholders, such as teacher mentors and community members serving on advisory boards and committees.

HSIs. HSIs are typically defined as two-year or four-year, degree accredited, not-for-profit colleges that enroll at least 25% Hispanic students (Núñez, Crisp, & Elizondo, 2016). The number of HSIs has more than doubled since 1994, and approximately three-quarters of them are public institutions. HSIs that enroll between 15% and 24% Latina/os are known as emerging HSIs and likewise are on the rise. HSIs tend to be concentrated in places where Hispanics historically have settled, particularly in the Southwest, West, and in Puerto Rico. Hispanic settlement into new areas, however, has contributed to HSIs' emergence in other regions as well. HSIs tend to have a regional orientation and mission to meet local community needs. This characteristic is consistent with research that has shown that students who choose HSIs prefer staying close to home (Núñez et al., 2016).

Arbelo-Marrero and Milacci (2016) studied undergraduate Hispanic nontraditional students (defined in general as being 25 years and older) to determine factors that contributed to their academic persistence. These students had enrolled in college to complete studies begun earlier but were delayed because of single-parent

status, caring for dependents, and multiple other responsibilities (Arbelo-Marrero & Milacci, 2016). Others returned to college for second career purposes and/or for a desire to improve their earning potential.

Arbelo-Marrero and Milacci (2016) also found that participants' persistent attitudes and behavior were reinforced by relationships within the context of their culture. Peer and mentor networks with those with whom they identified were helpful. Hispanic faculty and administrators also formed a part of the students' sociocultural networks. Prior research has indicated that Hispanic students at predominantly White educational institutions felt that they lacked the "social capital" (p. 33) necessary to be successful in academic environments. In this regard, HSIs may have an advantage if they recruit and cultivate minority faculty who interact with and understand how to serve their student populations.

Rudick, Sollitto, Claus, Sanford, Nainby, and Golsan (2017) also addressed Hispanic students' interaction with White students at both a four-year public HSI and a four-year public PWI. Their study found that Hispanic students' communication approaches did not differ based on their institutional context; but the Hispanic students in the PWI group scored higher on "accommodation (i.e., desire to be a part of dominant culture while maintaining one's own culture)" (p. 106) as their preferred communication style than did their Hispanic HSI counterparts. Rudick et al. proposed a Co-Cultural Theory (CCT) that the situation/context influences Hispanic students' co-cultural communication behaviors. Although their findings suggested that Hispanic students at both PWIs and HSIs may feel that their ability to communicate with White students is equally constrained, the authors suggested that Hispanic

students in the HSI group may feel less need to strive for accommodation in communication with White students because they are able to access social networks that make the need to fit into the dominant culture less compelling. Recommendations from this study indicated that faculty, administrators, and students at four-year public PWIs might be more intentional in recognizing and valuing Hispanic students and their culture and in fostering dialogue between Hispanic and White students within their classrooms.

Garcia (2016a) went further by stating that enhancing and sustaining the culture and education of Latina/o students should be a critical part of an HSI's organizational identity. The author suggested that an approach that validates the background, experiences, and culture of Hispanic students can contribute to their success.

Like Arbelo-Marrero and Milacci (2016), Garcia and Ramirez (2018) emphasized the importance of social capital, especially in terms of access to high school teachers and counselors with college knowledge and resources who can encourage their Latino/a students to attend college. At the same time, efforts must continue to empower "minoritized" (p. 377) college students, a term used by Arbelo-Marrero and Milacci (2016):

> to include Latina/o students, Students of Color, low income students, and first-generation students who may not be the 'minority' on campus but continue to experience systemic oppression within college and across the educational pipeline. (p. 379)

The authors indicated that, rather than assuming that increased access to HSIs will lead to increased graduation rates, HSI leaders must be intentional in their efforts to develop support structures leading to student success.

Although HSIs provide a unique environment for student affairs professionals in particular to make a difference in the lives of students who have been traditionally excluded from higher education, Garcia (2016b) found that the satisfaction of student affairs professionals varied according to the departments in which they worked. Microaggressions (defined here as "brief, everyday exchanges that send denigrating messages to People of Color because they belong to a racial minority group") (Garcia, 2015, p. 29; Sue, Capodilupo, Torino, Bucceri, Holder, Nadal, & Esquelin, 2007, p. 273) were experienced by some student affairs professionals but not by others. Garcia (2016b) argued that HSIs must document and address any such experiences so that HSIs may be institutions that validate all people's realities.

Critical Race Theory (CRT)

For the past 30 years, scholars have relied on CRT to assist them in analyzing and designing "meaningful, provocative, and creative representations of data" (Espino, 2012, p. 31). Espino listed four themes as the foundation for CRT scholarship:

> (a) racism is ordinary and not aberrational; (b) U.S. society is based on a 'White-over-color ascendancy' that advances White supremacy and provides a scapegoat (i.e., Communities of Color for working-class communities; (c) race and racism are social constructions; (d) storytelling 'urges Black and Brown writers to recount their experiences with racism…and to apply their own unique perspectives to assess…master narratives.' (p. 31)

Solórzano, Ceja, and Yosso (2001) found that racial microaggressions exist in both academic and social spaces in colleges and that they have a negative effect for African American students. They further stated that such microaggressions are rarely investigated, thereby leading to "extreme environmental stress" (p. 71). Harper,

Smith, and Davis (2018) also called for an exploration of racism in the classroom alongside other commonly used metrics, such as GPA averages, for determining student access and achievement and/or lack thereof.

Dixson (2018) drew connections between activism, multicultural education (MCE), and the Black Lives Matter (#BLM) movement. The author suggested that CRT scholars in law and in education hold that exposing racial inequity informs social actions that can lead to change. Dixson further theorized that #BLM is a social justice project resulting from public education's failure to provide adequate MCE; consequently, #BLM's goals are consistent with those of CRT. Additionally, quality African American education, stated by Dixson, continues to be the primary focus of its advocates and agitators. Included in African American curriculum concerns is public schools' failure to represent accurately the struggles of historically marginalized groups. All too often, MCE is presented as a "celebration of difference" (p. 236). Dixson cited the Texas Board of Education's recasting of U.S. chattel slavery as a "work program" (p. 238) and enslaved Africans as "voluntary workers" (p. 238). In regard to #BLM, Dixson commented on the difficulty in building a movement while trying also to create and correct the historical record.

Olden (2015) also discussed the historical importance of "*Keyes, et al. v. School District No. 1, et al.*" (p. 251), a law suit filed by White, African American, and Mexican American parents in 1973 against the Denver school system on the basis of the latter's segregating students along racial lines. The case was one of the most important of the postwar era, because it argued that Denver practiced "*de facto*" (p. 251) segregation which was based upon social practice and culture unlike *"de jure*"

(p. 251) segregation (segregation by law), the basis for the 1954 *"Brown v. Board of Education"* (p. 251) decision. Growing out of the *Keyes* case was a lawsuit filed in 1974 by the Congress of Hispanic Educators (CHE) which argued that the interests of Mexican American children were not being significantly addressed by the plaintiffs in the *Keyes* case because Mexican Americans constituted their own, distinct racial category. This was a new development because Mexican American civil rights efforts since the 1920s had emphasized Mexican Americans' whiteness (Olden, 2015). The Mexican American Legal Defense and Education Fund (MALDEF) represented Mexican Americans in the case, and, the case had a significant role in Denver's school desegregation struggles over the next several decades. Olden also cited Omi and Winant's (1994) references to individual racial identity as being "micro-level racial formation" (p. 259) and state-created racial identity as "macro-level" (p. 259) racial formation. The District Court monitored the school district's desegregation plan for several decades and in 1995, declared the Denver Public Schools a "unitary system" (Olden, 2015, p. 259). On numerous occasions during the 1980s, the school system tried to get the Court to release them from court supervision; however, each time, board members were told that they "had not demonstrated a real commitment to desegregation nor had they shown any genuine interest in seeing full integration come to fruition" (259).

Griffin, Ward, and Phillips (2013) built upon CRT to discuss the underrepresentation of Black male faculty in PWIs. The resulting research spoke of persistent and prevalent Black misandric ideology (prejudice against Blacks) and led to a call for colleges and universities to pay close attention to the recruitment and

retention of Black male students, staff, faculty, and administrators at PWIs and to find ways to integrate them fully and equitably into the American educational system.

Solórzano (1998) also used CRT to frame a discussion of racial and gender microaggressions of Chicana and Chicano scholars. In his study, three patterns were found: feeling out of place in the academy because of their race and/or gender; feeling that teachers/professors had lower expectations for them; and accounts of both blatant and subtle racial and gender experiences. Solórzano concluded that, even among scholars with doctoral-level education, inequality and discrimination exist, although the forms may be more subtle. He likewise called for CRT's advancement via the use of multiple voices and experiences with racism and sexism.

Saetermoe, Chavira, Khachikian, Boyns, and Cabello (2017) utilized a CRT-rooted framework as the basis for an undergraduate biomedical research training program at California State University, Northridge, titled Building Infrastructure Leading to Diversity (BUILD); Promoting Opportunities for Diversity in Education and Research (PODER). By employing a CRT-informed curriculum and training, BUILD PODER, students are empowered to gain access to and to thrive in graduate programs and beyond. Poder means "power" or "to be able to" in Spanish (p. 41); consequently, this program uses students' strengths to empower them as learners. The program's curriculum helps students to understand institutional policies and practices that might prevent them from persisting in higher education; to advocate for themselves by confronting social barriers, inequity, and discrimination; to work for campus change; and to research mentoring opportunities. Partnerships were established with five community colleges that enriched student participation and

strengthened mentor diversity. Preliminary evaluation data has suggested that BUILD PODER has been effective in encouraging more egalitarian and respectful faculty-student relationships and that it is a rigorous biomedical research training program that supports students' goals.

Racial Microaggressions

The term racial microaggressions was described by Sue, Capodilupo, Torino, Bucceri, Holder, Nadal, and Esquilin (2007) as "'brief, everyday exchanges that send denigrating messages to People of Color because they belong to a racial minority group" (p. 273). They are "brief and commonplace daily verbal, behavioral, and environmental indignities…that communicate hostile, derogatory, or negative racial slights and insults…. They are not limited to human encounters alone but may also be environmental in nature" (Sue et al., 2007, p. 273). Sue et al. also referred to a taxonomy of racial microaggressions that include microassaults, often unconscious, verbal and nonverbal behaviors that demean a person's racial heritage; microinsults, often conscious and explicit verbal and nonverbal racist behaviors that are intended to hurt a person; and microinvalidations, often unconscious verbal and nonverbal behaviors that negate or minimize the "lived realities of Peoples of Color (POC)" (Wong, Derthick, David, Saw, & Okazaki, 2014, p. 3). All three types of racial microaggressions can be triggered by environmental microaggressions, such as laws, policies, etc. (Wong et al, 2014). Microassaults and microinvalidations have been most researched in the literature; however, Wong et al. (2014) stated that microinsults and microinvalidations actually capture the "true definition " (p. 6) of racial microaggressions because they are more subtle forms of racism.

The first racial microaggressions research was done with Asian Americans and African Americans in 2007, and later was expanded to include those of Latino origin (Wong et al., 2014). Osanloo, Boske, and Newcomb (2016) spoke of "structural racism" (p. 7) in which one group determines what is "right" and exerts power to perpetuate racist practices and policies. Researchers have begun to expand such research to include American Indians and individuals of multiracial heritage as well as ethnic and racial minority groups from countries outside of the United States (Wong et al., 2014). Additionally, Wong et al. stated that racial microaggressions research has expanded greatly in recent years and that it currently is focusing more on the biological, emotional, cognitive, and behavioral effects of racial microaggressions.

One such study involving biological effects of racial microaggressions was conducted by Slaughter-Acey, Sealy-Jefferson, Helmkamp, Caldwell, Osypuk, Platt, Straughen, Dailey-Okezie, Abeysekara, and Misra (2016). Their study, Life-course Influences on Fetal Environments (LIFE), involved 1,410 Black women in Detroit, Michigan. Results showed that among those women with severe depressive symptoms, perceived racism was not associated with Preterm Birth (PTB); however, perceived racism was significantly associated with PTB among women with mild to moderate depressive symptoms.

Microinvalidations. Nguyen (2017) stated that microinvalidation is based upon the belief that POCs do not experience racism because we live in a "race free" (p. 3) world. Also discussed in her research was the assumption that the only thing impeding marginalized groups' progress is their capability, not the fact that they are

not privy to the same privileges as White men (Nguyen, 2017). Sue, Capodilupo, Torino, Bucceri, Holder, Nadal, and Esquilin (2007) described microinvalidations as "communications that exclude, negate or nullify the psychological thoughts, feelings, or experiential reality of a Person of Color" (p. 2). Nguyen (2017) stated that increased awareness will lead to acknowledgement of microinvalidations and the opportunity to educate others.

Microassaults. Sue et al. (2007) characterized microassaults as "'old fashioned'" (p. 1) racism conducted on an individual level. Microassaults are most likely conscious and deliberate although generally expressed in limited "'private'" situations that permit the perpetrator some degree of anonymity.

Race and Racism in Higher Education.

A core premise of CRT is that racism in higher education is endemic, institutional, and systematic (Solórzano, 1997). CRT offers a tool for "interrogating how race and racism have been institutionalized and maintained" (Sleeter, 2017 p. 157) which other racial theories leave untouched (Closson, 2010). This study examines Black, Latinx, and White students to call attention to the "need to look at educational structures and institutions through the eyes of all participants, relying on their lived experiences to ensure that our research questions and methods address these difficult issues" (Bergerson, 2017, p. 60). Engaging White students in this research broadens the analysis of racism in higher education. It acknowledges White students as a source of racism and attempts to examine what it means to be White in a society created for White people, and how this experience as a White student is different from that of racially minoritized students who are marginalized.

Using 10 focus groups at three predominantly White research universities (n=34; 18 female, 16 male), Solórzano, Ceja, & Yosso (2000) examined how racial microaggressions are experienced by Black students; what is their impact; how do the students respond, and how do the microaggressions affect the racial climate of the college? Their research found microaggressions in three situations: in the classroom, outside the classroom, and in social spaces. In the classroom, students felt invisible and that faculty had low expectations of them. When they did well, it was assumed they were cheating, or that they got there through Affirmative Action or sports scholarships, not academic talent.

Suarez-Orozco, Casanova, Martin, Karsiaficas, Cuellar, Smith, and Dias (2015) studied classrooms at three campuses and found instances of microaggressions in 30% of classes. The most common were denigrating the intelligence and competence of students and were delivered by faculty to student, and student to student. It was noted that comments from instructors or students were often sarcastic and directed to a specific student rather than to the class as whole. These kinds of classroom interactions were observed across numerous classroom settings. In one case, the instructor conjured an example from history of an exploited Black slave woman. The faculty member quickly dismissed the likelihood of abuse. In this example, a Black male student asked if Thomas Jefferson raped his slave Sally Hemings. The instructor responded that "He has three or four children with her. He was an honorable guy. He brought her a sandwich" (Suarez-Orozco, et al., 2015, p. 157). The study concluded with recommendations that understanding

microaggressions should be an important component of professional development in order to create more optimal learning environments.

Sue, Capodilupo, and Holder (2008) researched the perceptions, reactions, and interpretations of microaggressions as well as their immediate and cumulative consequences on 13 African American graduate students in New York City. Results of racial microaggressions among the students revealed five domains that were ordered sequentially: incident; perception; reaction; interpretation, and consequences.

Because of the ambiguous nature of many microaggressions, Blacks appeared to be put in the position of ascertaining the meaning of a communication, whether the perceived microaggression was intentional or not, and the appropriate response to it. Reactions to microaggressions in this study were classified as follows: "healthy paranoia, sanity check, empowering and validating self, and rescuing offenders" (Sue et al., 2008, p. 334).

Gin, Martínez-Alemán, Rowan-Kenyon, and Hottell (2017) likewise conducted a study with students with historically marginalized racial identities that explored the way in which technology might encourage positive educational outcomes. The study was conducted at a highly selective, urban, private PWI with approximately 9,000 undergraduate students in the Northeastern United States. Findings showed that anonymous, anti-Black racialized hostility was prominent in social media, especially on the smartphone application Yik Yak; students' online encounters with this hostility contributed to RBF, and the students believed that peer multicultural education was critical to end racism on social media. Gin et al. further

concluded that the psychological outcomes and behaviors normally associated with racial microaggression in the physical environment now are prevalent in social media.

Minority Students in Science, Technology, Engineering, and Mathematics (STEM)

In 2010, Blacks received 7% of all bachelor's degrees awarded in the biological sciences, 6% in the physical sciences, 5% in mathematics and statistics, and 4% in engineering (Upton & Tanenbaum, 2014). This disproportionately low level of STEM participation and degree completion begs the question of whether Blacks have equitable access to STEM academic pathways from undergraduate to doctoral level education (Upton & Tanenbaum, 2014).

HBCUs represented only 3% of the nation's population of higher education institution, yet between 2005 and 2010, data showed that for Black STEM PhD recipients, more than one third earned their undergraduate degrees at an HBCU, and 12% received their doctorates at an HBCU (Upton & Tanenbaum, 2014). According to the authors, Howard University, Meharry Medical College, Florida A&M University, and Alabama A&M University stood out as top HBCU producers of Black STEM PhD recipients across specific STEM disciplines of study. Morgan State University and North Carolina AT&T University were top HBCU producers of Black STEM PhD recipients in engineering. Upton and Tanenbaum theorized that possible reasons for this success are that HBCUs focus on student support rather than the competitive model embraced by many PWIs. Additionally, HBCUs required fewer "weed-out" (p. 10) courses than most PWIs and provided more academic support and encouragement for persistence in STEM as well as peer mentoring and relationship

building among students and faculty. HBCU students reported fewer incidents of racial stereotyping than Blacks at PWIs, and Black women found the transition from HBCU undergraduate programs to PWI graduate programs especially difficult from academic and social perspectives.

Rainey, Dancy, Mickelson, Stearns, and Moller (2018) also noted that Women of Color are more likely than any other demographic group to feel that they do not belong in STEM. The sense of belonging in their major was determined in this study to relate to the presence or absence of interpersonal relationships, personal interest in the field, a sense of competence, and the degree to which the individual had developed a science identity.

Dortch and Patel (2017) further explored the experiences of Black women in STEM by studying currently enrolled Black doctoral students who attended highly selective, research one institutions in the Northeastern and Midwestern United States. The women's experiences were confusing in that, when they adopted characteristics perceived to be consistent with success (e.g., being assertive, competitive, well-spoken, etc.), they were excluded by both men and women. The reasons for this included not adopting specialized roles of women in academia (e.g., "passive, demure, downplaying expertise") (p. 211). According to the authors, for those women engaged in the sciences at PWIs, the challenges resulting from being a Black woman at a White institution in a White male-dominated field can hinder them from completing their degrees. A suggestion that Dortch and Patel made for helping to resolve this situation would be to increase the Black faculty pipeline so that Black women could begin to shift into administrative positions in which they would have

relevant levels of authority and decision-making power such that undergraduate Black women would begin to experience a sense of community at their institutions.

Returning to the positive characteristics of HBCUs for Black male and female STEM students, Upton and Tanenbaum (2014) found that PWIs in contrast generally have larger endowments, provide more academic and financial resources for students, and lead to stronger career prospects for graduates. Students who graduated from PWIs tended to have higher average earnings than HBCU graduates, a factor that is significant because research has shown that Blacks in higher education settings have more economic barriers and are at greater risk of accumulating graduate debt (Upton & Tanenbaum, 2014). Concomitantly, the authors found that lowest level of graduate funding and tuition support appeared among Blacks who earned their STEM doctorate from an HBCU.

Brown, Henderson, Gray, Donovan, Sullivan, Patterson, and Waggstaff (2016) explored the experiences of African American students currently majoring in science with those African- Americans who already had earned science degrees. The major differences that distinguished the groups from one another was their sense of "Alignment" (one's ability to identify and connect with the cultural community) (p. 161) and their experiences with and management of microaggressions. The scientists had developed strategies for managing "racialized" (p. 171) interactions (including claims of exceptionalism and being used as token of diversity), while the students reported additional pressure when confronted with such experiences.

Brown et al. (2016) reached the following conclusions when considering how to plan STEM programs for African-American students. First, Alignment with the

community is essential, meaning that the environment should be welcoming to students from multiple cultural backgrounds, rather than students having to adjust to the environment. Providing academic mentors who share students' cultural and ethnic backgrounds was important as well as creating a culturally and ethnically diverse community of students and scholars. Luedke (2017) likewise agreed with this approach.

McGee and Bentley (2017) broadened the concept of STEM to include the need to place less emphasis on financial success and to include more STEM careers that integrate social justice, empathy, and equity. McGee and Bentley's (2017) study collected data from 38 Black and Latinx (a term used to include all possible gender and sexual identities previously referred to in the binary terms Latino/a) (Logue, 2015). They concluded that STEM should continue to evolve and to represent perspectives beyond the traditional Anglo American orientation, described as less collectivist than the orientation of Latinx Americans and African Americans. For example, students in McGee and Bentley's (2017) study expressed frustration with the lack of humanitarian values in STEM fields and voiced the desire to use science and technology to decrease human suffering and to address environmental issues.

Like others in this literature review, Robinson, McGee, Bentley, Houston, and Botchway (2016) noted that, in their study, Black engineering faculty who had successfully advanced to the full professor rank had one common characteristic: a strong network of faculty mentors who had nurtured their professional career development and who had helped facilitate opportunities with White advocates. Such mentors had helped them to dismiss the "impostor phenomenon" (Robinson et al.,

2016, p. 31), described as one's belief in her- or himself as an intellectual fraud. The faculty studied here had expressed previous feelings that their success was due to coincidence, error, or luck rather than to intrinsic skill or intelligence.

Collins' (2018) research focused on the Black Male Scholar Identity (BSSI) model that operates as a framework for understanding critical characteristics present for Black students who show high interest in STEM. The BSSI model is centered around how Black students internalize four basic questions that influence their motivation to learn and to persist in STEM areas; i.e., "1. Do I belong in a STEM field? 2. Can I succeed in a STEM field? 3. Do I want to succeed in a STEM field? 4. What must I do to succeed in a STEM field?" (p. 160). The students' responses constructed an academic/scholar identity that influences the way in which they understand themselves within their own culture ("internal environment") (p. 160) and in relation to their educational institution ("external environment") (p. 161) which, in turn, shapes their occupational identity and career choices. Students considering a STEM field would conduct an evaluation of what one has to do to succeed and to fit into the STEM culture. If assimilation with the STEM culture reflected a perception of conflict with their core identities, students would question whether or not they belong.

Collins (2018) also noted the importance of understanding factors contributing to and/or detracting from the development of a STEM identity. These included the fact that significant progress has not been made for over 25 years in bridging the underrepresented gaps in the STEM workforce. A "one size fits all" (p. 162) STEM curriculum is innately embedded with racial inequalities. BSSI is offered as a counter

narrative to deficit thinking and racial inequalities relating to STEM identity, and promotion of an early and strong development of BSSI that positively affects achievement outcomes by connecting Black students' cultural values to their STEM interest, talent development, and potential is essential (Collins, 2018).

Alexander and Hermann (2015) studied eight Black women in a predominantly White Southern graduate school who were STEM majors. Blacks were 3.5% of the total student population of 31,000. They used CRT for the theoretical framework for the study. All participants had some experiences of microaggressions, including experiencing racial stereotyping, feeling invisible, feeling that Whites were more intelligent, feeling intellectually intimidated, and lacking support from peers, faculty, and student services.

McGee (2016) studied 38 high-achieving Black and Latino/a STEM students who attended institutions with racially hostile academic environments and examined the strategies that the students used to deflect stereotyping and other racial microaggressions. Among these was "frontin" (p. 1634), the performance of acts that are socially acceptable to the dominant culture but that demand the sacrifice of aspects of one's racial, cultural, and/or ethnic identity. For example, Jerrod, a nuclear engineering student, was frontin' when he pretended not to study for a test. He did so in order to create "maximum shock value" (McGee, 2016, p. 1647) when he scored in the high 90s, because he felt that no matter how well he consistently performed academically, his physics professor always seemed surprised. Students in McGee's (2016) study reported that their STEM faculty overheard or witnessed racial microaggressions and stereotyping but did nothing in response. Stereotype

management of the type that the students in McGee's (2016) study practiced is a less than ideal strategy to combat the racism confronted by SOC in STEM educational and career environments. Institutional leaders should ask for a commitment from STEM faculty to speak out against racial stereotyping, even when they are not the direct perpetrators (McGee, 2016).

Microaggresions and Stress

Definitions of stress generally include two attributes: the inability of an individual to meet a demand placed on him/her, and the judgment made by the individual that he/she is unable to meet this demand (Smith & Lilly, 2016). Their study of interior architecture (IA) students also described three types of stress: positive which produced adjectives such as "excited, stimulated, creative, and enthused" (p. 49); neutral, which engendered words such as "happy, capable, explorative" (p. 49), and negative which used "anxious, overloaded, uncomfortable, distraught, and even suicidal" (p. 49) as descriptors. Because students come to situations with varying understandings, aspirations, needs, and backgrounds, they can understand instructions and expectations differently, resulting in miscommunication (Smith & Lilly, 2016). To create a safe classroom environment, this study showed the need for faculty to make explicit communication rather than assumptions a priority, thereby helping to build shared expectations and understanding. Importantly associated with negative stress are emotional, cognitive, physical, and behavioral factors and this section will explore each.

Emotional. Richardson (2017) conducted a daily diary study with undergraduate students to examine the emotional regulation strategies of

"reappraisal" (p. 150) (altering the way a situation is appraised before it happens in order to change its emotional impact) and "suppression" (p. 151) (cognitively reducing negative emotions after a stressful event). Results showed that daily stress was associated with reduced positive affect and heightened negative affect. However, those students who engaged in reappraisal experienced higher positive affect and lower negative and, in some cases, reduced physiological and behavioral responses to aversive situations. Those students who typically engaged in suppression, however, reported lower positive affect and ability to tend to details, leading to reduced memory performance.

Cognitive. Sheffler, Moxley, and Sachs-Ericsson (2014) studied the extent to which environmental factors, specifically stress, influenced the relationship between the Apolipoprotein E (APOE) ε4 allele and cognitive functioning, and whether this relationship was stronger in African Americans than in Whites. Results showed that although there was no main effect of stress, there was significant interaction between APOE status and stressful life events, such that increased stress in persons with an ε4 allele led to more errors on the Short Portable Mental Status (SPMSQ) than individuals with no allele. There was significant interaction between stress and race that led to cognitive decline (CD) in Whites but not in African Americans. Lower levels of stress did not affect CD in Whites but did so as the number of stressful life events increased.

Behavioral effects. Voisin, Elsaesser, Kim, Patel, and Cantara (2016) examined the association between family stress (including adult substance use, previous incarceration, and mental health problems) and problem behaviors (mental

health problems; delinquency; school problems; drug/alcohol use; risky sexual behaviors; and violence exposure) in African American youth. Although family stress was associated with multiple problem behaviors, it had an especially strong association with risky sexual behaviors. Youth exhibiting higher levels of stress in their family were 1.4 times more likely to have sex while using marijuana or alcohol and 1.5 times more likely to have unprotected sex (p. 2206). Voisin et al. theorized that the risky sexual behavior might be used as a way to escape from or cope with family stress. As a result of these findings, it was suggested that clinical interventions targeting problem behaviors among African American youth may be most effective if they also target family stress. Additionally, because low-income families are more likely to live in environments characterized by crowding, substandard housing, and violence, neighborhood-level stress also should be considered as part of prevention work.

Physiological effects. Richman and Jonassaint (2008) examined the impact of a real-life stressor (the Duke Lacrosse [LaX] scandal) and strength of racial identity on physiological (cortisol) responses to a social threat among a group of African-American students. Mid-way through the study, an African American woman accused White members of the Lacrosse team (LaX) at Duke University of racial derogation, violence, and rape. Examinations of the student newspaper and public dialogues across campus supported the notion that Duke's African-American students and African-American women in particular, experienced high levels of stress in the weeks after the alleged incident (Richman & Jonassaint, 2008). Results indicated that for African Americans, the LaX event was associated with heightened cortisol levels.

Such changes in adrenocortical responses can have a negative impact on long-term health, including increased susceptibility to infectious diseases and depression, and there is some evidence that stressors such as social rejection are related to even more acute responses for women than men.

Smeets, van Ruitenbeek, Hartogsveld, and Quaedflieg (2018) also studied the role of stress-induced cortisol reactivity with 72 healthy undergraduate students. Results showed that cortisol reactivity played a prominent role in provoking habitual behavior following exposure to an acute stressful situation. Moving toward and away from goal-directed behavioral strategies under stress was seen by Smeets et al. as being adaptive since cognitively demanding, effortful processes are superfluous when attempting to cope with stressful situations. Reverting to old habits, then, was considered beneficial in most stressful situations, because the organism relies on previously learned automatic behavior (habits) to adjust to new or varying environmental demands that safeguard it from stressful and potentially hazardous situations.

Epel, Blackburn, Lin, Dhabhar, Adler, Morrow, and Cawthon (2004) approached the impact of stress through a study of its effects upon cellular aging. Their findings showed that both perceived stress and chronicity of stress were significantly associated with higher oxidative stress, lower telomerase (TL) activity, and shorter telomere length, all of which are known determinants of cell senescence and longevity. Telomeres are DNA-protein complexes that cap chromosomal ends, promoting chromosomal stability (p. 17312). Women in the study with the highest

level of perceived stress had TLs shorter on average by the equivalent of at least one decade of additional aging compared to low stress women.

Geronimus, Pearson, Linnenbringer, Schulz, Reyes, Epel, Lin, and Blackburn (2015) approached a study of early aging-related disease and mortality by collecting venous blood samples from 239 Black, White, and Mexican adults in a distressed urban area in Detroit. TL length was measured and regressed on socioeconomic, psychosocial, neighborhood, and behavioral stressors. An intersection was found between poverty and racial-ethnic group; i.e., poor Whites had shorter TL than nonpoor Whites; poor and nonpoor Blacks had equivalent TL, and poor Mexicans had longer TL than nonpoor Mexicans.

Psychological effects. Edman, Watson and Patron (2016) assessed the association between traumatic events and psychological distress on community college students. Findings indicated that Black and Latino students experience higher levels of interpersonal violence than White students. Previous research has suggested that psychological distress, including depression, PTSD, and eating disorders, is associated with poor academic performance (Edman et al., 2016).

Greer (2011) studied the relationship between individual race-related stress and mental health symptoms among 128 African American women at a PWI in the Southeastern part of the United States as well as ways in which they used coping strategies to manage their symptoms. Coping strategies in this study referred to "efforts used to resolve problems and those used to manage, endure, or alleviate distress" (p. 215). Culture-specific strategies such as spirituality and religion (prayers and rituals), connections with friends and families, and reliance on community and

spiritual leaders were examined as a means of diminishing stress-related psychological symptoms (anxiety; somatization; obsessive-compulsive symptoms, depression, and interpersonal sensitivity) (pp. 217, 220). Findings showed, however, that increased use of culture-specific strategies was related to severe anxiety and interpersonal sensitivity. Cognitive-emotional debriefing involving distraction, venting, and processing stressful incidents with others was determined in this study to have some psychological benefits for the consequences of race-related stress.

Racial Battle Fatigue (RBF)

RBF is described as "social-psychological stress responses (e.g., frustration, anger, exhaustion, physical avoidance, psychological or emotional withdrawal, escapism, acceptance of racist attributions " (Smith, Allen, & Danley, 2007, p. 552). It is "associated with being a Person of Color and the repeated target of racism" (Arnold, Crawford, & Khalifa, 2016, p. 895).

Franklin, Smith, and Hung (2014) turned their attention to the effects of RBF on Latino/a students. The 210 undergraduate Latino/a students studied reported physiological stress responses to microaggressions that included muscle aches, back pains, and the inability to sleep; behavior stress responses included eating less, procrastination, and neglecting responsibilities.

Model of Effects of Microaggressions on Students of Color in STEM

The researcher's conceptual model (see Figure 1.1), which was developed based on Huber and Solórzano's (2015a) model of racial microaggression and institutional racism, says that students, not traditionally represented in STEM, experience micro-assaults, micro-insults, and micro-invalidations from their peers. As

a result of the racial microaggressions and hostile classroom climates, the students, not traditionally represented in STEM, experience RBF (psychological, physiological, and behavioral stress). This can quantitatively be assessed with a tool which measures RBF levels.

Based on the literature and the researcher's conceptual model, RBF will help researchers measure structural racism and racialized stress in the STEM classroom, which has been reported in health, sociology, and social psychology literature. The researcher believes this is important, because it has been suggested that students who are more emotionally and socially healthy are more likely to succeed in college (Leafgran, 1989). Research has also shown that racialized stress can specifically impact persistence attitudes for Students of Color (Neville, 2004). Therefore, researchers need to continue asking important questions that address barriers for Students of Color in STEM and the ways in which these barriers might be abated.

Summary

The literature surveyed here presents a comprehensive review of topics important to understanding RBF based on the researcher's conceptual model (Figure 1).

In particular, Students of Color are more likely to experience feelings of isolation and diminished self-esteem as the result of persistent instances of microaggressions encountered over years of negative interactions with the dominant culture. Although minority institutions such as HBCUs, PBIs, and HSIs have been found to be more supportive of their students and to present inspiring role models,

they frequently are underfunded and their graduates are not always viewed as being competitive with those from PWIs.

Critical race theory has provided an important framework for creatively analyzing data that reflect the experiences of Students and Faculty of Color and, through counter-narratives, revealing information that frequently has been suppressed. Once known, these counter-narratives can serve as a compelling antidote to dominant culture narratives and can enable the creation and development of effective multicultural education programs. In this study a CRT lens is used to analyze and understand what type of student can or cannot experience racism regardless of environment.

The STEM field is one that is ripe for implementing new ways to increase minority student and employee recruitment and development. Although HBCUs have graduated significant numbers of doctoral-level scientists, Black and Latinx students have not always found access and integration into PWIs welcoming.

The literature has shown that stress is experienced to a great extent by Black and Latinx students as the result of microaggressions, especially at PWIs. RBF and a cycle of behavior problems and physiological and psychological effects that, in turn, can result in attrition of both students and faculty. Furthermore, the literature surveyed here is essentially unanimous in calling for acknowledgement of the role that racism has played in United States educational institutions and in society at large, and for further research and implementation of programs and policies that will address such discrimination and that will lead to greater access and equity for Students of Color.

Chapter III: Methods

> I'm not really comfortable just being in the classrooms. Just going to class I feel the fact that I know that I'm different and I'm reminded of it everyday…There's me, a Black male and a Black female, and everybody else is White in my classroom. And me and those two Black individuals tend to sit together every session, every class session, whereas everybody else would just kind of tend to sit away from us. So as I put my book bag on the table, I would notice that the rest of the chairs would be empty while the other table would get crowded. It would be sixty people sitting at one table pushing each other off whereas I would be by myself sitting at my own table. (Yosso, Smith, Ceja, & Solórzano, 2009, p. 668)

The excerpt presented above comes from an interview in a qualitative study (Yosso, et al., 2009) in which the racial microaggression has the effect of rejecting, dismissing, or invalidating the racial reality of the Student of Color. Now imagine this student is you. What psychological, physiological and behavioral effects would result from being in this classroom environment? To examine the answer to this question, the following are the research questions and hypotheses:

Research question 1: Do Black and Latinx students in STEM report higher levels of RBF than White students in STEM in both the predominantly White and predominantly Black/Hispanic community college systems combined?

Null hypothesis 1a. Black students in STEM report no significantly different levels of RBF, or significantly lesser levels of RBF, than White students on the dependent variable RBF domain scores of psychological, behavioral, and physiological.

Alternative Hypothesis 1a. Black students in STEM report significantly greater levels of RBF than White students on at least one of the

dependent variable RBF domain scores of psychological, behavioral, and physiological.

Null hypothesis 1b. Latinx students in STEM report no significantly different levels of RBF, or significantly lesser levels of RBF, than White students on the dependent variable RBF domain scores of psychological, behavioral, and physiological.

Alternative Hypothesis 1a. Latinx students in STEM report significantly greater levels of RBF than White students on at least one of the dependent variable RBF domain scores of psychological, behavioral, and physiological.

Research question 2: Does the level of RBF among Latinx and Black STEM students differ from White STEM students in the predominately Black/Hispanic community college system?

Null hypothesis 2. The interaction term of Student Race/Ethnicity Group X School Type will not be statistically significant for the student race/ethnicity groups on the level of Black/Hispanic community college systems as related to the three RBF domain scores.

Alternative Hypothesis 2. The interaction term of Student Race/Ethnicity Group X School Type will be statistically significant for the student race/ethnicity groups on the level of Black/Hispanic community college systems as related to at least one of the three RBF domain scores.

Research question 3: Does the level of RBF among White STEM students differ at the predominately White community college system compared to the Predominately Black/Hispanic community college system?

Null hypothesis 3. The interaction term of Student Race/Ethnicity Group X School Type will not indicate statistically significant differences for the student race/ethnicity group of White as related to any of the three RBF domain scores between the two school types of predominately White community college system compared to the Predominately Black/Hispanic community college system

Alternative Hypothesis 3. The interaction term of Student Race/Ethnicity Group X School Type will not indicate statistically significant differences for the student race/ethnicity group of White as related to at least one of the three RBF domain scores between the two school types of predominately White community college system compared to the Predominately Black/Hispanic community college system.

This quantitative study used a non-experimental design (Creswell, 2014) and was guided by a postpositive orientation that utilizes empirical findings due to my lens as a scientist. The researcher also used a critical quantitative approach where issues of race were at the center of the quantitative analysis (Gillborn, Warmington, & Demark, 2017). It was based on data collected through a questionnaire which was administered to 536 community college students. The outcome of interest was the level of RBF. The purpose of this section is to describe the methods used in this study

in detail and to explore the research topic. But first I will describe my assumptions, positionality, and philosophical approach.

Positionality

> There's no enunciation without positionality. You have to position yourself somewhere in order to say anything at all (Hall, 1990, p. 18).
>
> Positionality represents a space in which objectivism and subjectivism meet. As Freire suggests, the two exist is a "dialectic relationship" (Freire, 2000, p. 50).
>
> To achieve a pure objectivism is a naïve quest, and we can never truly divorce ourselves of subjectivity. We can strive to remain objective, but must be ever mindful of our subjectivities. Such is positionality. We have to acknowledge who we are as individuals, and as members of groups, and as resting in and moving within social positions (Bourke, 2014, p. 3).

Positionality refers to values and beliefs a researcher brings to their work and the ways in which that may influence their choice of processes and interpretation of outcomes. This research project has led me to consider the interaction among the participants, the methods, and me as the researcher. I have asked myself questions about the experience:

1. What role did my positionality as an African American male studying issues of race in both STEM and higher education play?

My background as an African-American Molecular Biologist and Instructional Administrator who was born and raised in a large metropolitan city and attended three PWIs (Pennsylvania, Oregon, Ohio) and attended a Historically Black College & University (Washington, DC) supports my social justice lens from a CRT perspective. Therefore, the researcher recognizes that a STEM education is a gateway to social mobility and access to jobs of economic value for Students of Color. Yet I also realize

privilege often serves as a critical filter controlling entry into higher education and many higher-paid occupations (Ellington & Prime, 2011; Ellis, 2008; Martin, Gholson, & Leonard, 2010), because the Black male graduation rate severely lags behind the 55% national rate for all males (Brooms, 2018). In fact, there are more African American males under correctional control today -- in prison or jail, on probation, or parole -- than were enslaved in 1850, a decade before the Civil War began (Alexander, 2011). Therefore, I recognize my bias to expose and challenge the dominant perspective that "STEM is not for everyone" and long-established notions of objectivity, privilege, meritocracy, color blindness, and equal opportunity in STEM.

2. How did I use my positionality as current Vice President of Instruction at Mt Hood Community College and former Tenure Professor at City Colleges of Chicago?

After spending several years as a scientist, I entered the field of community college academia. Initially, I was hired at City Colleges of Chicago (a PBI and HSI) and later went into administration at Portland Community College and Mt Hood Community College (both PWIs). In each position my job has been focused on student success and access. Most academic institutions struggle with identifying appropriate strategies and/or interventions necessary to actively engage and educate students from under-represented groups (Whittaker & Montgomery, 2012). Evaluation works towards increasing effectiveness of strategies and/or interventions, and can help with organizational development (Russ-Eft & Preskill, 2009). Therefore, I recognize my approach to this research is influenced by how my experience has contributed to the

pursuit of my educational and professional goals, and having a desire to add to the body of knowledge, which helps the mission of Community Colleges.

3. Why did I include White students in my research questions even though this is a study with a Critical Race framework?

The deliberate use of White students in a study with a Critical Race framework has implications for debate among some CRT scholars. However, in this study White students were included for three reasons. First, to statistically show that RBF is not measuring the stress of being a STEM student, which all students can experience, but the accumulation of racial microaggressions only Students of Color can experience. Second, students learn through interactions with their peers so, for me, including White students in this study helps practitioners to better understand the power and structural components which exist in STEM education. For example, this study offer validation to Black and Latinx students that the behavioral, psychological, and biological effects of RBF are real even though their White colleagues are not experiencing them. In turn, White practitioners who attempt to dismiss RBF because of their disbelief that others in the same classroom have a different experience, can grapple about White privilege. Third, White students who think that if "the tides where turned," reverse RBF would occur to them if they attended a PBI/HSI community college, will have the comparative data. Other studies exist that have used CRT to examine White students. In one study, CRT was used to examine White students enrolled in a student affairs master's program in a predominantly White institution and ways that institutions protected Whiteness (Bondi, 2012). Another study used CRT as a lens for analyzing the Whiteness of teacher education (Sleeter,

2017). Fundamental to these examples is the notion that there is a myriad of ways to include White participants in research studies and to maintain a CRT framework.

Philosophical Approach

I take an epistemological stance anchored in the constructivist paradigm, which presupposes that knowledge is "constructed" based on human perception and social experience. This knowledge is the foundation for my theoretical model that supports the hypothesis that racial microaggressions can influence the level of stress in the classroom. However, my approach to analyze this knowledge and construct students' experiences uses a postpositive orientation method. As a formally trained scientist, my ability to quantify data, evidence, and rationale considerations shapes my knowledge. Consequently, I use a critical quantitative approach where I place issues of race at the center of quantitative analysis (Gillborn, Warmington, & Demark, 2017; Teranishi, 2007).

Based on the primary aim of this study, the ontological stance of this research acknowledges that racial microaggressions that shape the social and personal experiences of Students of Color exist in higher education. I also believe that clearly demonstrating racial microaggressions may help to ameliorate them. Many current STEM diversity initiatives rest on the theory that exposing evidence of bias will ultimately reduce bias and enhance diversity (Moss-Racusin, Van der Toom, Dovidio, Brescoll, Graham, & Handelsman, 2014).

Data Sources and Description of Data and Variables

The target population of this research was community college students in STEM. The sampling procedure was through a process of convenience sampling.

Community colleges were selected with different racial demographics from Oregon, Washington, Illinois, and California. The student demographics for the PWIs in this study were 51% to 67% White. The student demographics for the PBIs and HSIs in this study were 11% to 30% White. A total of seven different institutions were chosen because they were large and had contrasting student racial demographics. All of the institutions' IRB committees granted the researcher approval to conduct this study.

From each of these institutions, general chemistry classrooms being offered during the same term/semester were identified. Chemistry is a recommended course for pre-professional degrees in chemistry, natural science, engineering, medicine, and dentistry. Subsequently, obtaining the sample from degree-seeking students who are currently enrolled in chemistry courses would have a variety of students pursing STEM degrees (e.g. biology, physics, chemistry, engineering, computer science) who have successfully completed at least one other STEM course. It is also a course in which students (a) interact individually with course material and reading, (b) interact with classmates in general on class topics, and (c) work in small groups (Abrahamse, 2015). In each of the courses, there were no conscious attempts by the instructors to separate students by ability.

The study spanned one term or one semester of an introductory chemistry course intended as a transfer course. Each institution had the same prerequisites including College Algebra, and similar student learning outcomes. It must be acknowledged that the data collected are derived from a small group of individuals, but designed to give a greater degree of diversity than if the seven institutions were not selected.

Recruitment. After obtaining internal IRB approval from each of the community colleges, the participant recruitment procedure involved the identification of faculty at each of the institutions. I reviewed the chemistry departments' websites to identify the faculty and sent each instructor an email that included the description of the study, what would be required of the instructors and students, and the IRB approvals from Oregon State University and their institution. Each faculty member was asked to respond with any questions and was given time to confer with his or her colleagues prior to moving to the next step.

Each instructor participant used five minutes of class time to distribute the study information and URL to students. A student commitment of less than 10 minutes to complete the online questionnaire outside of class time was needed. A gift card was provided for each participant by the researcher. To claim the gift card, students had to print the survey completion page provided at the end of the questionnaire and give it to their instructor within seven days. Students who did not consent to the study also had access to an identical survey completion page. Unclaimed gift cards were returned by the instructor in the self-addressed, stamped envelope provided. Participants could send all incentives back to the researcher for a variety of reasons (e.g. because they felt it was not necessary to receive an incentive, or for religious reasons).

Instrument. RBF was studied using a racial battle fatigue scales instrument developed by Franklin, Smith, and Hung (2014) at the University of Utah. The researchers specifically constructed a quantitative measure of RBF in the higher

education setting to capture three domains: psychological, behavioral, and physiological.

According to Franklin, Smith, and Hung (2014), the first step in developing the RBF items involved reviewing relevant literature that provided information on existing instruments that were already available. Using an iterative process, the researchers selected and revised relevant items as well as drafted new ones. Both expert and user reviews were conducted to assess content validity. Exploratory factor analysis was used in the initial development of a scale to measure the three main stress responses of RBF using data collected from a prospective national study of 931 current and prior students. The initial RBF scale constructed contained 78 items for measuring stress responses and racial microaggressions. However, after a bivariate correlation and a principal components factor analysis, the questions were narrowed down to an optimal number of 21 questions. Racial microaggressions were made up of six observed variables; psychological stress was made up of seven variables, and physiological stress was made up of four variables as was the behavioral stress response factor. The four factors include observed variables that reflect the domains that make up RBF (Franklin, Smith, & Hung, 2014). Three fit indices were utilized to evaluate the model and that were determined to produce adequate to good fit: root mean square error of approximation (RMSEA) was 0.070, Comparative Fit Index (CFI) was 0.945, and standardized root mean square residual (SRMR) was 0.044. These same 21 questions have quantitatively linked racial microaggressions with RBF-related stress responses for Latinx students.

A Memorandum of Understanding was given to this researcher from the instrument developers with established provisions for the use of the RBF instrument in this study. This 52-item, self-report questionnaire assessing RBF has questions pertaining to four domains: behavioral items, physiological items, psychological items, and microaggressions. Each item consisted of five response options: (1) Never; (2) Almost never; (3) Sometimes; (4) Fairly often, and (5) Very often. Each question contributes to a subscale representing one of the domains and a total score. In this study the student-to-student interactions in STEM classrooms as a community college student represented the focus.

Data collection. This was a prospective study. The online questionnaire URL was distributed during the Winter/Spring of 2019 by the course instructor of chemistry (approximately 540 students). Only students over the age of 18 who were currently enrolled for credit were eligible to participate. Participation was completely voluntary, and students could opt out of the study without any course penalty. Instructors provided a total of five minutes for distribution of the study information and URL to students. Students completed the online questionnaire outside of class time to increase privacy and to create a safer space option. A student time commitment of 10 minutes to complete the online questionnaire online outside of class was needed. A gift card of equal value was provided by the researcher for all participants (those who consented and those who did not consent to complete the questionnaire). To claim their gift card, each student printed the survey completion page provided at the end of the questionnaire and provided it to their instructor within seven days. Five minutes of class time was needed to distribute gift cards to students

who submitted the questionnaire completion page. Participation was completely voluntary, and students could opt out of the study without any course penalty. An identical questionnaire completion page was also available for participants who attempted to complete the questionnaire but ended the questionnaire after deciding not to consent.

The researcher utilized, the web-based application, Qualtrics © (Provo, UT) to electronically distribute and compile questionnaire responses. Qualtrics is FedRamp Authorized. FedRAMP is the gold standard of U.S. government security compliance, with over 300 controls based on the highly-regarded NIST 800-53 that requires constant monitoring and periodic independent assessments.

The study was approved by several IRBs (both Oregon State University and each participating community college's IRB), and participants consented prior to participating. No direct identifiers (e.g. names, social security numbers, addresses, instructor names, section numbers, student ID numbers) were part of the questionnaire. Moreover, the out-of-class format created more privacy for participants than an in-class format.

Limitations. There are several limitations to this study. Racial microaggressions are manifestations of racism that People of Color encounter in their public and private lives (Huber, 2015b). Therefore, even though the questionnaire asked about in-class peer experiences in STEM, it is not possible to control for all external factors outside of the classroom which might have contributed to students' RBF during the term unrelated to the course. Other limitations include the generalizability of students from using participants from chemistry courses to other

STEM courses. In addition, this study did not take into consideration sexual diversity, gender, socio-economic status, disabilities or foster care status, all of which have been linked to barriers in STEM. Hence, this study may not be generalizable to these populations as well as to other underrepresented populations besides Black and Latinx. Similarly, since this study was conducted at the response of participants recruited through collegial and professional assistance, the results may not be generalizable to other populations, settings, or regions. Lastly, the creators of this RBF instrument recognize that questions only provide a snapshot of RBF and do not indicate health outcomes which could result from RBF (Franklin, Smith, & Hung, 2014).

Analyses

One MANOVA model was tested in this study. Three dependent variables included the three RBF domain scores of (a) psychological, (b) behavioral, and (c) physiological. Two independent variables were included in the model. The first independent variable was student race/ethnicity group with three classifications of (a) White, (b) Black, and (c) Latinx. The second independent variable was school type with two classifications of (a) predominantly Black/Hispanic community college system and (b) predominantly White community college system. Additionally, the interaction term of Student Race/Ethnicity Group X School Type was included in the model. Variables were coded/scored as follows:

Dependent variable of psychological domain score. The psychological domain score was computed for each participant by averaging items 7 through 13 of the RBF questionnaire. Each of the seven items was scored from 1 to 5, with 1 =

never and 5 = very often. Using an average score for each participant allowed for inclusion of the participant's score for analysis even if all items were not answered on the domain. The psychological domain score ranged from 1 to 5, with higher average scores indicative of greater psychological RBF. Psychological domain score is a continuous variable.

Dependent variable of behavioral domain score. The behavioral domain score was computed for each participant by averaging items 14 through 17 of the RBF questionnaire. Each of the four items was scored from 1 to 5, with 1 = never and 5 = very often. Using an average score for each participant allowed for inclusion of the participant's score for analysis even if all items are not answered on the domain. The behavioral domain score ranged from 1 to 5, with higher average scores indicative of greater behavioral RBF. Behavioral domain score is a continuous variable.

Dependent variable of physiological domain score. The physiological domain score was computed for each participant by averaging items 18 through 21 of the RBF questionnaire. Each of the four items was scored from 1 to 5, with 1 = never and 5 = very often. Using an average score for each participant allowed for inclusion of the participant's score for analysis even if all items are not answered on the domain. The physiological domain score ranged from 1 to 5, with higher average scores indicative of greater physiological RBF. Physiological domain score is a continuous variable.

Independent variable of student race/ethnicity group. Student race/ethnicity group included three classifications of (a) White, (b) Black, and (c)

Latinx. The race/ethnicity for each participant was derived from survey items 24 and 25. If a participant answered "yes" to item 24, "Would you describe yourself as Latinx or Hispanic?", the participant was classified as Latinx. Participants who answered "no" to item 24 and gave their ethnicity origin (or Race) in item 25 as "White" were classified as White, and participants who answered "no" to item 24 and gave their ethnicity origin (or Race) in item 25 as "Black" were classified as Black. Participants who answered "no" to item 24 and chose "Native/American or American Indian", "Asian/Pacific Islander", or "None of the above" for item 25 were included in the frequency statistics table(s) of students, but were not included in the MANOVA model.

Independent variable of school type. The researcher is aware of which school systems are predominantly White or predominantly Black/Latinx, and used the answers provided by the participants for survey item 30, "What is the name of your primary campus within this institution", to classify each participant as belonging to either (a) a predominantly Black/Hispanic community college system or (b) a predominantly White community college system.

Power Analysis for MANOVA Sample Size.

A Power analysis was conducted to calculate the required sample size for the MANOVA model. Three factors are considered when calculating sample size including the effect size of the study, the power of the study, and level of significance. Effect size is the measurement of the strength or magnitude of the relationship between the independent and dependent variables in the analysis (Cohen, 1988). Effect size is usually defined as small, medium, or large; and for this study, the

effect size is defined as small [f^2(V) = 0.10], medium [f^2(V) = 0.25], or large[f^2(V) = 0.40]. A medium effect size [f^2(V) = 0.25] was assumed for the study.

Level of significance is represented by alpha level, which is the probability of a Type I error. The alpha level corresponds to the probability of a Type I error which is the probability of rejecting the null hypothesis given that the null hypothesis is true. Usually, the alpha level is set at 0.05 or 95% confidence interval (Tabachnick & Fidell, 2013). The power of the study represents the probability of being able to reject a false null hypothesis. A power of 80% is conventionally used for quantitative research.

The sample size for this study was calculated using G*Power, a computer program designed to calculate sample sizes for numerous statistical methods. For this study, settings used to determine sample size were power = 0.80, effect size [f^2(V) = 0.25] and alpha for the level of significance = 0.05. The number of groups was 5 (three student groups and two school type groups), and the number of outcomes was 3 (the number of dependent variables). Based on these parameters, the sample size required for this study is 100 participants. Equal groups of student race/ethnicity and school types are desired, and all attempts were made to have 33 students of each race/ethnicity group, and 50 students in each school type group. However, if sample sizes are unequal, adjustments can be made to the MANOVA model to accommodate the unbalanced design as long as the number of participants in each cell of the MANOVA classification table is greater than the number of dependent variables in the model (Tabachnick & Fidell, 2013).

Protection of Human Participants

Protecting the rights and welfare of those who volunteer to participate in research is a fundamental tenet of ethical research (Creswell, 2014). For this study, the researcher sought and gained approval from the Oregon State University Institutional Review Board (IRB) and all seven Institutional Review Boards (IRB) prior to the commencement of the study. Participants were anonymous, and instructors' identification was not included in the data collected. To protect the rights of the students who participated in the study, this research followed the informed consent guidelines as required by the Oregon State University's IRB.

The study was described and assurance given that their identities would be protected. Since both are multi-campus institutions with multiple sections of chemistry at each campus, this reduced the risk associated with identifying the instructor associated with this study.

Conclusion

To summarize, a quantitative, cross-sectional survey was selected as a research method in order to attempt to grasp the RBF among STEM students. Over 900 students were invited to complete the questionnaire. MANOVAs were applied to the collected data to determine RBF. The SPSS computer program was employed to carry out these statistical analyses. The integrity of this research was ensured through an approval of the study by the IRB at the research site. Furthermore, participation in the questionnaire was completely voluntary.

The literature suggests a correlation between RBF and microaggressions. Therefore, in this study, stress (psychological, physiological, and behavioral) are

variables being used to measure RBF. Together, the methods proposed in this study allow the researcher to quantify RBF among Black and Latinx students in STEM.

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Chapter IV: Results

Chapter four includes the descriptive statistics of the sample dataset as well as the results of the quantitative analysis. It is divided into four sections (a) population and descriptive findings, (b) investigation of assumptions as relates to inferential analysis, (c) presentation of the multivariate analysis of variance (MANOVA) model, and (d) tests of hypotheses. The chapter concludes with a summary of the results. SPSS v22.0 was used for all descriptive and inferential analyses. All inferential analyses were tested at the 95% level of significance.

The purpose of this quantitative study was to explore the levels of the RBFS for Latinx and Black community college students enrolled in STEM courses and understand to what extent the racial campus climate correlates with the psychological, physiological, and behavioral stress for Black and Latinx students. Matsubayashi (2010) defined the racial campus environment as one where people interact with in-group and out-group members. These racial campus environments are more pronounced for Black and Latinx students in STEM, which makes this environment ideal for measuring RBF. For example, Asian and Asian American students feel similar to Latinx and Black students but experience different pressure (e.g. stereotyped as model students, praised for their work and study ethic and pursuit of excellence), as STEM college students (McGee, 2016). This study utilized a RBFS applying a quantitative approach in order to measure the level of RBF of students across multiple community college classrooms and campuses. One MANOVA model was tested to address the null hypotheses of the following three research questions:

Research question 1: Do Black and Latinx students in STEM report higher levels of RBF than White students in STEM in both the predominantly White and predominantly Black/Hispanic community college systems combined?

Null hypothesis 1a. Black students in STEM report no significantly different levels of RBF, or significantly lesser levels of RBF, than White students on the dependent variable RBF domain scores of psychological, behavioral, and physiological.

Alternative Hypothesis 1a. Black students in STEM report significantly greater levels of RBF than White students on at least one of the dependent variable RBF domain scores of psychological, behavioral, and physiological.

Null hypothesis 1b. Latinx students in STEM report no significantly different levels of RBF, or significantly lesser levels of RBF, than White students on the dependent variable RBF domain scores of psychological, behavioral, and physiological.

Alternative Hypothesis 1b. Latinx students in STEM report significantly greater levels of RBF than White students on at least one of the dependent variable RBF domain scores of psychological, behavioral, and physiological.

Research question 2: Does the level of RBF among Latinx and Black STEM students differ from White STEM students in the predominately Black/Hispanic community college system?

Null hypothesis 2. The interaction term of Student Race/Ethnicity Group X School Type will not be statistically significant for the student race/ethnicity groups on the level of Black/Hispanic community college systems as related to the three RBF domain scores.

Alternative Hypothesis 2. The interaction term of Student Race/Ethnicity Group X School Type will be statistically significant for the student race/ethnicity groups on the level of Black/Hispanic community college systems as related to at least one of the three RBF domain scores.

Research question 3: Does the level of RBF among White STEM students differ at the predominately White community college system compared to the Predominately Black/Hispanic community college system?

Null hypothesis 3. The interaction term of Student Race/Ethnicity Group X School Type will not indicate statistically significant differences for the student race/ethnicity group of White as relates to any of the three RBF domain scores between the two school types of predominately White community college system compared to the Predominately Black/Hispanic community college system.

Alternative Hypothesis 3. The interaction term of Student Race/Ethnicity Group X School Type will not indicate statistically significant differences for the student race/ethnicity group of White as related to at least one of the three RBF domain scores between the two school types of predominately White community college system compared to the Predominately Black/Hispanic community college system.

Study Population and Sample Demographics

The target population of this study was community college students in STEM. The sampling procedure was through a process of convenience sampling. Community colleges were selected with different racial demographics from Oregon, Washington, Illinois, and California. Each of the participating community colleges were grouped into PWI, HSI, and PBI based on compiled data by the Penn Center for Minority Serving Institutions after the Salzburg Global session in partnership with Educational Testing Service (The Penn Center for Minority Serving Institutions, 2018; The Rutgers Center for Minority Serving Institutions, 2018). The percentages were then verified by the researcher to confirm that each institution met federal designations (United States Department of Education (n.d.). Students who agreed to participate in the study were given the URL of the online RBF survey and information needed to complete the survey outside of class time. Students who completed the survey and delivered a printed copy of the completion page located at the end of the survey to their instructor within seven days received a gift card for their participation.

A total of 536 students reviewed the survey. Forty students did not answer any questions and were removed from the study sample. Of the 496 records remaining, 206 students answered only the first seven questions for the RBFS variable construct of racial microaggressions and the demographic questions. These students did not experience any level of RBF at their institutions. A total of 290 students answered the racial microaggression questions, and most of the questions of the psychological domain, behavioral domain, and physiological domain scores, as well as most of the demographic questions. Eleven students left comments for the optional survey item,

"Please explain any of your racialized experiences you expressed above." A table of the pertinent comments to this study is presented in Appendix 3.

Table 4.1 includes the demographic and school information collected for (a) all comers (N = 496), (b) students who answered only the racial microaggression questions of the RBFS (N = 206) and (c) students who answered the majority of the RBFS (N = 290). The proportions of students in each classification across the demographic and school variables were similar regardless of which of the three survey completion groups that the students belonged. Over 50% of the students were female. Approximately one-third of the students did not describe themselves as Latinx or Hispanic. Approximately one-third of the students in the all comers group (34%) described themselves as White. However, close to one-half (47%) the students who answered only the racial microaggression questions of the RBFS described themselves as White, while only 25% of students who answered the majority of the RBFS questions described themselves as White. Thirty-eight percent of all comers were Asian/Pacific Islander. A smaller percentage (32%) of students who answered only the racial microaggression questions of the RBFS were Asian/Pacific Islander. But 42% of the students who answered the majority of questions on the RBFS were Asian/Pacific Islander. The majority of students in all three RBFS groups had completed 1 to 6 terms or semesters at their school, and over 80% of the students had taken other STEM classes at their institution. Approximately 25% of the students had transferred to their current institution from another institution. Approximately 11% of all comers were concurrently attending classes at a 4-year institution, 9% of students who answered only the racial microaggression portion of the RBFS were concurrently

attending a 4-year institution, and approximately 12% of the students who completed the majority of the RBFS were concurrently attending a 4-year school.

Sample demographics of students included in the MANOVA model. I made the assumption that those who answered only the racial microaggression questions did not feel they were subject to RBF. Prior to performing the MANOVA analysis, the students who answered only the racial microaggression questions were coded with a score of 1 = never on all items of the three domains used as dependent variables in the MANOVA model.

Criteria for the tests of hypotheses included students who were either White, Black, or Latinx and attended a PWI or a PBI/HSI. Asian/Pacific Islander and American Indian students took part in the survey, and some predominantly Asian American/Native American/Pacific Islander schools were included in the data collection. The race/ethnicities or school types representing Asian American, Native American, or Pacific Islander were not included in the MANOVA model because the sample size in the cells were too small which violated the sample size assumption of the MANOVA, namely, that all cells must have a sample size of at least the number of dependent variables in the model (Tabachnick & Fidell, 2013). Also, the plan in the Methods chapter did not specify inclusion of Asian American, Native American, or Pacific Islander students for the MANOVA model. Hence, a total of $N = 255$ students were included in the MANOVA model and tests of hypotheses for this research.

Table 4.2 includes the demographic and school information collected for the $N = 255$ students who were included in the MANOVA model and inferential analysis.

The majority of students were female (60%), and 42% of the students considered themselves to be Latinx or Hispanic. Eighty-seven percent of the students had taken other STEM courses at their institution. Twenty-four percent of the students had transferred to their current institution from another institution. Over 70% of the students had completed 1 to 6 courses. Nine percent were concurrently taking courses at a 4-year institution. Forty-seven percent of the students attended a PWI, 42% of the students attended a HSI, and 11% of the students attended a PBI.

Dependent Variable Constructs for MANOVA Model

One MANOVA model was tested in this study. Three dependent variables included the three RBFS domain scores of (a) psychological, (b) behavioral, and (c) physiological. The domain scores were coded according to the following criteria:

Dependent variable of psychological domain score. The psychological domain score was computed for each participant by averaging items 7 through 13 of the RBFS. Each of the seven items was scored from 1 to 5, with 1 = never and 5 = very often. Using an average score for each participant allowed for inclusion of the participant's score for analysis even if all items were not answered on the domain. The psychological domain score ranged from 1 to 5, with higher average scores indicative of greater psychological RBF. Psychological domain score is a continuous variable.

Dependent variable of behavioral domain score. The behavioral domain score was computed for each participant by averaging items 14 through 17 of the RBFS. Each of the four items was scored from 1 to 5, with 1 = never and 5 = very often. Using an average score for each participant allowed for inclusion of the

participant's score for analysis even if all items were not answered on the domain. The behavioral domain score ranged from 1 to 5, with higher average scores indicative of greater behavioral RBF. Behavioral domain score is a continuous variable.

Dependent variable of physiological domain score. The physiological domain score was computed for each participant by averaging items 18 through 21 of the RBFS. Each of the four items was scored from 1 to 5, with 1 = never and 5 = very often. Using an average score for each participant allowed for inclusion of the participant's score for analysis even if all items were not answered on the domain. The physiological domain score ranged from 1 to 5, with higher average scores indicative of greater physiological RBF. Physiological domain score is a continuous variable.

Assumptions for MANOVA Model

One multivariate analysis of variance (MANOVA) model was used to test all hypotheses. MANOVA analysis requires statistical assumptions of absence of missing data and outliers, adequate sample size, univariate and multivariate normality, homogeneity of variance-covariance matrices, linearity, and absence of multicollinearity.

Data were not missing for the $N = 255$ records used in analysis. Outliers in a dataset have the potential to distort results of an inferential analysis and are especially problematic for a MANOVA model (Pallant, 2013; Tabachnick & Fidell, 2013). A check of boxplots for the three dependent variable constructs was performed to visually inspect for outliers. The boxplots did not indicate outliers on the

psychological domain. The behavioral domain had five outliers due to a right skew, and the physiological domain had 27 outliers. The values of the physiological domain were standardized to check for the presence of extreme outliers (z-score of +/- 3.3), of which 14 outliers were extreme. The behavioral and physiological domains also had a right skew in their data distributions.

Since outliers are problematic for a MANOVA model transformations, including logarithmic, square root, and quadratic, were attempted to bring the data of the behavioral and physiological domains into a normal distribution and reduce the number of outliers in the higher ranges. Transformations were not effective. I then considered the use of a 5% trimmed mean for the behavioral and physiological domain scores. However, removal of the records at the ends of the distribution would eliminate high scores on the variables which were important to retain as an adequate representation of the range of students' answers on the variables. Rather than use a 5% trimmed mean, I winsorized the data distributions (Dixon, 1960). The behavioral domain was winsorized 5% and the physiological domain was winsorized 10%. The winsorization brought the number of outliers to zero for the behavioral domain and seven for the physiological domain, and none of the outliers remaining after the winsorization were extreme. Thus, the outlier assumption was tenably met and the winsorized variables for the behavioral and physiological domains were used in all inferential tests. The values of the psychological domain were used as measured.

A requirement for adequate sample size for a multivariate analysis of variance (MANOVA) is that there should be more research units in the smallest cell size of the MANOVA table than there are dependent variables (Tabachnick & Fidell, 2013).

This was the case for this study, as the smallest cell size included 24 students with student of the Black race/ethnicity in the PWI school type (n = 13) and PBI/HSI school type, (*n* = 11). There were a total of three dependent variables included in the MANOVA model. Therefore, the number of units in the smallest group was larger than the number of dependent variables. The assumption of adequate sample size was met.

Univariate normality for the scores of the four variable constructs and the overall ESCI score was investigated with SPSS Explore. The Kolmogorov-Smirnov Test (K-S) for normality indicated that all three domain scores were not normally distributed ($p < .0005$). A visual check of histograms and Normal Q-Q plots for the variable construct indicated right skew on all three RBFS domains. As noted earlier, the outliers and skew were not adversely affecting the distribution of the physiological domain variables. Tabachnick and Fidell (2013) and Pallant (2013) noted that MANOVA is robust to deviations from normality if minimal outliers are present and each cell in the MANOVA model has at least 20 records. Therefore, the assumption of univariate normality was considered met.

Multivariate normality for the scores of the three variable constructs was investigated with SPSS. Mahalanobis distance is the distance of a particular case from the centroid of the remaining cases, where the centroid is the point created by the means of all the variables (Tabachnick & Fidell, 2013). The Mahalanobis Distance Test for multivariate normality indicated that two of the cases had a score of ($z > 16.27$). According to Tabachnick and Fidell (2013) as long as there are at least 20 cases in the smallest cell size of the model, the MANOVA is robust to deviations

from multivariate normality. There were enough cases in each cell of the MANOVA model. Therefore the assumption of multivariate normality was considered tenably met.

Investigation of homogeneity of variance-covariance matrices is not necessary if sample sizes are equal (Tabachnick & Fidell, 2007). The sample sizes were different. An additional check was made during inferential analysis with the Box's M test using SPSS. If the significance value on this test is less than .001, then robustness is not guaranteed and the assumption of homogeneity of variance-covariance matrices may be violated (Tabachnick & Fidell, 2007). The significance value of Box's M test for this study was $p < .0005$. Tabachnick and Fidell also noted that Box's M test can be too strict when used with larger samples sizes, and the sample size of this study was considered large. Therefore, to account for the possibility of a violation of the homogeneity of variance-covariance assumption, I used Pillai's trace rather than Wilk's lambda in assessing the multivariate F statistics of the model (Tabachnick & Fidell, 2013. p. 252).

Assumptions of linearity between study variables and homoscedasticity for MANOVA were checked with scatterplots of the data. The assumptions of linearity and homoscedasticity were not violated. Multicollinearity diagnostics for the MANOVA was performed using SPSS via correlational analysis. Multicollinearity may be assumed if a correlation coefficient between two variables is .90 or greater, (Pallant, 2013). No violations were noted, and the assumption of absence of multicollinearity was met.

Table 4.3 includes the measures of central tendency and variability as well as the Cronbach's alpha coefficients which measure internal consistency reliability for the three RBFS domains with the sample collected. A Cronbach's coefficient alpha value of .70 or greater indicates good reliability of an instrument with the data collected (Pallant, 2013). The three RBFS domains were reliable with the data collected for this study. Pearson's correlation coefficients for the bivariate relationships between the three dependent variables are presented in Table 4.4.

Although the assumptions were met or tenably met, the F statistics of Pillai's Trace were used to infer model significance. According to Tabachnick and Fidell (2013, p. 271), Pillai's Trace is more robust in situations where the sample size is small, group sizes are unequal, or any assumptions are violated.

MANOVA Model

A multivariate analysis of variance (MANOVA) was performed to test the four statistical hypotheses of the three research questions of this study. Three dependent variables were included in the MANOVA, (a) psychological domain, (b) (5% winsorized) behavioral domain, and (c) (10% winsorized) physiological domain. Two between-groups independent variables were included in the MANOVA. The first independent variable was student race/ethnicity group with three classifications of (a) White, (b) Black, and (c) Latinx. The second independent variable was school type with two classifications of (a) predominantly Black/Hispanic community college system and (b) predominantly White community college system. Additionally, the interaction term of Student Race/Ethnicity Group X School Type was included in the model. The MANOVA model was not statistically significant for the interaction term

or the main effect of school type on any of the three dependent variables. The main effect of student race/ethnicity group was statistically significant for all three dependent variables combined $F(6, 496) = 3.27$, $p = .004$; Pillai's trace = 0.08; $\square_p^{\square} = 0.04$. When the results for the three dependent variables were investigated separately, all three of the dependent variables were statistically significant for the main effect of student race/ethnicity group. An inspection of the mean scores indicated that the student race/ethnicity group of White scored significantly lower on the psychological domain ($M = 1.75$, $SEM = 0.11$; $F(2, 249) = 4.34$, $p = .014$, $\square_p^{\square} = 0.03$) than both the Black group ($M = 2.31$, $SEM = 0.23$; $p = .029$), and the Latinx group ($M = 2.15$, $SEM = 0.12$; $p = .013$). The Black and Latinx groups did not differ significantly on the psychological domain scores. The student race/ethnicity group of White scored significantly lower on the (5% winsorized) behavioral domain ($M = 1.31$, $SEM = 0.07$; $F(2, 249) = 8.38$, $p < .0005$, $\eta_p^2 = 0.06$) than both the Black group ($M = 1.74$, $SEM = 0.15$; $p = .009$), and the Latinx group ($M = 1.70$, $SEM = 0.08$; $p < .0005$). The Black and Latinx groups did not differ significantly on the (5% winsorized) behavioral domain scores. The student race/ethnicity group of White scored significantly lower on the (10% winsorized) physiological domain ($M = 1.12$, $SEM = 0.03$; $F(2, 249) = 6.81$, $p = .001$, $\eta_p^2 = 0.05$) than both the Black group ($M = 1.37$, $SEM = 0.07$; $p = .002$), and the Latinx group ($M = 1.26$, $SEM = 0.04$; $p = .006$). The Black and Latinx groups did not differ significantly on the (10% winsorized) physiological domain scores.

The results of the MANOVA multivariate tests table are presented in Table 4.5. The results of the significant main effect for the independent variable of student

race/ethnicity group on the three dependent variables are presented in Table 4.6. The estimated marginal means, standard errors, and 95% confidence intervals of the means for each of the independent grouping variables are presented in Tables 4.7, 4.8, and 4.9, for the dependent variables of psychological domain, (5% winsorized) behavioral domain, and (10% winsorized) physiological domain respectively.

Tests of Hypotheses

The MANOVA model was not statistically significant for the interaction term or the main effect of school type on any of the three dependent variables. The main effect of student race/ethnicity group was statistically significant for all three dependent variables combined $F(6, 496) = 3.27$, $p = .004$; Pillai's trace = 0.08; $\eta_p^2 = 0.04$. When the results for the three dependent variables were investigated separately, all three of the dependent variables were statistically significant for the main effect of student race/ethnicity group.

The conclusions for each hypothesis test are presented following to each research question and set of statistical hypotheses.

Research question 1: Do Black and Latinx students in STEM report higher levels of RBF than White students in STEM in both the predominantly White and predominantly Black/Hispanic community college systems combined?

Null hypothesis 1a. Black students in STEM report no significantly different levels of RBF, or significantly lesser levels of RBF, than White students on the dependent variable RBF domain scores of psychological, behavioral, and physiological.

Alternative Hypothesis 1a. Black students in STEM report significantly greater levels of RBF than White students on at least one of the dependent variable RBF domain scores of psychological, behavioral, and physiological.

Conclusion as relates to Null Hypothesis 1a. An inspection of the mean scores indicated that the student race/ethnicity group of White scored significantly lower on the psychological domain (M = 1.75, SEM = 0.11) than the Black group (M = 2.31, SEM = 0.23; p = .029). The student race/ethnicity group of White scored significantly lower on the (5% winsorized) behavioral domain (M = 1.31, SEM = 0.07) than the Black group (M = 1.74, SEM = 0.15; p = .009). The student race/ethnicity group of White scored significantly lower on the (10% winsorized) physiological domain (M = 1.12, SEM = 0.03) than the Black group (M = 1.37, SEM = 0.07; p = .002).

Therefore, the findings rejected Null Hypothesis 1a. There was sufficient evidence to indicate that Black students in STEM report significantly greater levels of RBF than White students on at least one of the dependent variable RBF domain scores of psychological, behavioral, and physiological.

Null hypothesis 1b. Latinx students in STEM report no significantly different levels of RBF, or significantly lesser levels of RBF, than White students on the dependent variable RBF domain scores of psychological, behavioral, and physiological.

Alternative Hypothesis 1b. Latinx students in STEM report significantly greater levels of RBF than White students on at least one of the dependent variable RBF domain scores of psychological, behavioral, and physiological.

Conclusion as relates to Null Hypothesis 1b. An inspection of the mean scores indicated that the student race/ethnicity group of White scored significantly lower on the psychological domain (M = 1.75, SEM = 0.11) than the Latinx group (M = 2.15, SEM = 0.12; p = .013). The student race/ethnicity group of White scored significantly lower on the (5% winsorized) behavioral domain (M = 1.31, SEM = 0.07) than the Latinx group (M = 1.70, SEM = 0.08; $p < .0005$). The student race/ethnicity group of White scored significantly lower on the (10% winsorized) physiological domain (M = 1.12, SEM = 0.03) than the Latinx group (M = 1.26, SEM = 0.04; p = .006).

Therefore, the findings rejected Null Hypothesis 1b. There was sufficient evidence to indicate that Latinx students in STEM report significantly greater levels of RBF than White students on at least one of the dependent variable RBF domain scores of psychological, behavioral, and physiological.

Research question 2: Does the level of RBF among Latinx and Black STEM students differ from White STEM students in the predominately Black/Hispanic community college system?

Null hypothesis 2. The interaction term of Student Race/Ethnicity Group X School Type will not be statistically significant for the student race/ethnicity groups on the level of Black/Hispanic community college systems as related to the three RBF domain scores.

Alternative Hypothesis 2. The interaction term of Student Race/Ethnicity Group X School Type will be statistically significant for the student race/ethnicity

groups on the level of Black/Hispanic community college systems as related to at least one of the three RBF domain scores.

Conclusion as relates to Null Hypothesis 2. The findings do not reject Null Hypothesis 2. There was not sufficient evidence to indicate that the interaction term of Student Race/Ethnicity Group X School Type was statistically significant for the student race/ethnicity groups on the level of Black/Hispanic community college systems as related to at least one of the three RBF domain scores.

Research question 3: Does the level of RBF among White STEM students differ at the predominately White community college system compared to the Predominately Black/Hispanic community college system?

Null Hypothesis 3. The interaction term of Student Race/Ethnicity Group X School Type will not indicate statistically significant differences for the student race/ethnicity group of White as related to any of the three RBF domain scores between the two school types of predominately White community college system compared to the Predominately Black/Hispanic community college system

Alternative Hypothesis 3. The interaction term of Student Race/Ethnicity Group X School Type will not indicate statistically significant differences for the student race/ethnicity group of White as related to at least one of the three RBF domain scores between the two school types of predominately White community college system compared to the Predominately Black/Hispanic community college system.

Conclusion as relates to Null Hypothesis 3. The findings do not reject Null Hypothesis 3. There was not sufficient evidence to indicate that the interaction term

of Student Race/Ethnicity Group X School Type indicated statistically significant differences for the student race/ethnicity group of White as related to at least one of the three RBF domain scores between the two school types of predominately White community college system compared to the Predominately Black/Hispanic community college system.

Summary

Chapter 4 included a presentation of the results of the analyses from data that were gathered online from the RBFS. Chapter 4 started with a description of the demographics of the participants in the study. Following the report of demographics, assumptions of the MANOVA model were checked and the findings of the assumption check were presented. The inferential analysis as outlined in Chapter 3 (MANOVA) was performed to investigate the three research questions of study. Statistical significance was found for the main effect of student race/ethnicity group. The student race/ethnicity group of White was significantly lower on each of the three dependent variables than the student race/ethnicity groups of Black and Latinx. The Black and Latinx groups did not statistically differ on any of the three dependent variables. Null hypotheses 1a and 1b were rejected and Research Question 1 was supported. Statistically significant findings were not found for the tests of Null Hypotheses 2 or 3. Research questions 2 and 3 were therefore not supported.

In Chapter 5 the data are summarized and a discussion of the results, as well as implications of the findings as it relates to the literature review and further research, is presented. Chapter 5 includes a discussion of the implications, the

benefits of the results, the recommendations to the field of academic leadership based on the findings of this research, as well as the recommendations for future studies.

Table 4.1

Frequency Counts and Percentages of Demographic and School Variables for (1) All Comers (N = 496), (2) Students who Answered Only the Racial Microaggression Questions (N = 206), and (3) Students who Completed the Majority of the Questions of the Racial Battle Fatigue Survey (RBFS; N = 290)

	All Comers (N = 496)		Answered Only Racial Microaggression Questions (N = 206)		Answered the Majority of the RBFS (N = 290)	
Variable	Freq.	%	Freq.	%	Freq.	%
Gender						
Female	273	55.0	111	53.9	162	55.9
Male	195	39.3	82	39.8	113	39.0
Non-binary/Third gender	8	1.6	3	1.5	5	1.7
Prefer not to say	9	1.8	2	1.0	7	2.4
Missing/No response	11	2.2	8	3.9	3	1.0
Would you describe yourself as multiracial?						
No	333	67.1	139	67.5	194	66.9
Yes	152	30.6	59	28.6	93	32.1
Missing/No response	11	2.2	8	3.9	3	1.0
Would you describe yourself as Latinx or Hispanic?						
No	371	74.8	162	78.6	209	72.1
Yes, Mexican American/Chicano	61	12.3	22	10.7	39	13.4
Yes, Puerto Rican	13	2.6	6	2.9	7	2.4

Table 4.1 (Continued)

Variable	All Comers (N = 496) Freq.	%	Answered Only Racial Microaggression Questions (N = 206) Freq.	%	Answered the Majority of the RBFS (N = 290) Freq.	%
Would you describe yourself as Latinx or Hispanic? (cont'd)						
Yes, Central American	18	3.6	3	1.5	15	5.2
Yes, Other Latinx or Hispanic	22	4.4	5	2.4	17	5.9
Missing/No response	11	2.2	8	3.9	3	1.0
Please specify your ethnicity.						
White	167	33.7	96	46.6	71	24.5
Black or African American	30	6.0	7	3.4	23	7.9
Native American or Amer. Indian	6	1.2	2	1.0	4	1.4
Asian/Pacific Islander	188	37.9	66	32.0	122	42.1
None of the above	94	19.0	27	13.1	67	23.1
Missing/No response	11	2.2	8	3.9	3	1.0
How many terms/semesters have you complete at this institution?						
This is my first term/semester	41	8.3	16	7.8	25	8.6
1-3	193	38.9	84	40.8	109	37.6
4-6	171	34.5	61	29.6	110	37.9
7-9	48	9.7	22	10.7	26	9.0
Greater than 9	32	6.5	15	7.3	17	5.9
Missing/No response	11	2.2	8	3.9	3	1.0

Table 4.1 (Continued)

Variable	All Comers (N = 496)		Answered Only Racial Microaggression Questions (N = 206)		Answered the Majority of the RBFS (N = 290)	
	Freq.	%	Freq.	%	Freq.	%
Have you taken other science, technology, engineering, or mathematics courses at this institution?						
No	51	10.3	16	7.8	35	12.1
Yes	434	87.5	182	88.3	252	86.9
Missing/No response	11	2.2	8	3.9	3	1.0
Did you transfer to this institution from another one?						
No	360	72.6	144	69.9	216	74.5
Yes	125	25.2	54	26.2	71	24.5
Missing/No response	11	2.2	8	3.9	3	1.0
Are you concurrently taking classes at a four-year institution?						
No	432	87.1	180	87.4	252	86.9
Yes	53	10.7	18	8.7	35	12.1
Missing/No response	11	2.2	8	3.9	3	1.0

Table 4.1 (Continued)

Variable	All Comers (N = 496)		Answered Only Racial Microaggression Questions (N = 206)		Answered the Majority of the RBFS (N = 290)	
	Freq.	%	Freq.	%	Freq.	%
School Type Attended						
Predominantly White institution	172	34.7	81	39.3	91	31.4
Predominantly Black institution	32	6.5	11	5.3	21	7.2
Hispanic serving institution	236	47.6	88	42.7	148	51.0
Asian American Native American Pacific Islander serving institution	36	7.3	15	7.3	21	7.2
Unknown	20	4.0	11	5.3	9	3.1

Note: RBFS = Racial Battle Fatigue Survey.

Table 4.2

Frequency Counts and Percentages of RBFS Demographic and School Variables for Students Included in the MANOVA Model and Hypothesis Testing (N = 255)

Variable	Freq.	%
Gender		
Female	154	60.4
Male	94	36.9
Non-binary/Third gender	6	2.4
Prefer not to say	1	0.4
Would you describe yourself as multiracial?		
No	173	67.8
Yes	82	32.2
Would you describe yourself as Latinx or Hispanic?		
No	147	57.6
Yes, Mexican American/Chicano	59	23.1
Yes, Puerto Rican	12	4.7
Yes, Central American	17	6.7
Yes, Other Latinx or Hispanic	20	7.8
Please specify your ethnicity.		
White	123	48.2
Black or African American	24	9.4
Latinx	108	42.4
How many terms/semesters have you complete at this institution?		
This is my first term/semester	24	9.4
1-3	99	38.8
4-6	88	34.5
7-9	24	9.4
Greater than 9	20	7.8
Have you taken other science, technology, engineering, or mathematics courses at this institution?		
No	34	13.3
Yes	221	86.7
Did you transfer to this institution from another one?		
No	193	75.7
Yes	62	24.3

Table 4.2 (Continued)

Variable	Freq.	%
Are you concurrently taking classes at a four-year institution?		
No	232	91.0
Yes	23	9.0
School Type Attended		
Predominantly White institution	119	46.7
Predominantly Black institution	28	11.0
Hispanic serving institution	108	42.4

Note: RBFS = Racial Battle Fatigue Survey.

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Table 4.3

Measures of Central Tendency and Cronbach's Coefficient Alpha for the RBFS Domain Scores used in the MANOVA Model (N = 255)

Variable	*M*	*SD*	*Mdn*	Range	Cronbach's α
Psychological domain	1.93	1.16	1.00	1.00 – 5.00	.963
Behavioral domain (5% Winsorized)	1.47	0.76	1.00	1.00 – 5.00	.926
Physiological domain (10% Winsorized)	1.19	0.36	1.00	1.00 – 5.00	.936

Note. RBFS = Racial Battle Fatigue Survey. *M* = Mean; *SD* = Standard Deviation; *Mdn* = Median.

Table 4.4

Pearson's Product Moment Correlation Coefficients for Variable Constructs Used for Inferential Analysis (N = 255)

Variable	1	2
1. Psychological domain	---	
2. Behavioral domain (5% Winsorized)	.722	---
3. Physiological domain (10% Winsorized)	.621	.783

Note. All correlations are significant at the $p < .01$ level.

Table 4.5
Pillai's Trace and F Statistics, Non-Centrality Parameters, Effect sizes, and Power for MANOVA Model Multivariate Tests (N = 255)

Variable Groups	Pillai's Trace	*F*	*df1*	*df2*	η_p^2	p-value	Power
Race/Ethnicity	0.08	3.27	6	496	0.04	.004	0.93
School type	0.01	0.85	3	247	0.01	.470	0.23
Race/Ethnicity X School Type	0.05	2.08	6	496	0.03	.054	0.75
Intercept	0.89	662.71	3	247	0.89	<.0005	1.00

Table 4.6
MANOVA Results for the Main Effect of Student Race/Ethnicity Group on Each of the Three Dependent Variables of study (N = 255)

Variable Groups	Type III Sum Of Squares	*F*	*df1*	*df2*	η_p^2	p-value	Power
Psychological domain	11.36	4.34	2	249	0.03	.014	.75
(5% winsorized) Behavioral domain	8.93	8.38	2	249	0.06	<.0005	.96
(10% winsorized) Physiological domain	1.65	6.81	2	249	0.05	.001	.92

Table 4.7

Estimated Marginal Means, Standard Error of the Means, and 95% confidence Intervals for the Independent Groups as Relates to the Dependent Variable of Psychological Domain (N = 255)

			95% CI of the Mean	
Independent Group	*M*	SE_M	LCL	UCL
Grand mean	2.07	0.10	1.88	2.26
Student Race/Ethnicity = White	1.75	0.11	1.54	1.96
Student Race/Ethnicity = Black	2.31	0.23	1.85	2.77
Student Race/Ethnicity = Latinx	2.15	0.12	1.91	2.39
PWI	2.14	0.13	1.87	2.40
PBI/HIS	2.01	0.14	1.74	2.27
White X PWI	1.61	0.13	1.35	1.87
White X PBI/HSI	1.88	0.17	1.56	2.21
Black X PWI	2.51	0.32	1.88	3.13
Black X PBI/HSI	2.12	0.35	1.44	2.80
Latinx X PWI	2.29	0.21	1.88	2.70
Latinx X PBI/HSI	2.01	0.13	1.76	2.27

Note. *M* = Mean; SE_M = Standard Error of the Mean; CI = Confidence Interval; LCL = Lower Confidence Limit; UCL = Upper Confidence Limit; PWI = Predominantly White Institution; PBI = Predominantly Black Institution; HSI= Hispanic Serving Institution.

Table 4.8

Estimated Marginal Means, Standard Error of the Means, and 95% confidence Intervals for the Independent Groups as Relates to the Dependent Variable of (5% Winsorized) Behavioral Domain (N = 255)

			95% CI of the Mean	
Independent Group	*M*	SE_M	LCL	UCL
Grand mean	1.58	0.06	1.47	1.70
Student Race/Ethnicity = White	1.31	0.07	1.18	1.45
Student Race/Ethnicity = Black	1.74	0.15	1.45	2.04
Student Race/Ethnicity = Latinx	1.70	0.08	1.54	1.85
PWI	1.67	0.09	1.50	1.84
PBI/HSI	1.50	0.09	1.33	1.67
White X PWI	1.20	0.08	1.03	1.37
White X PBI/HSI	1.43	0.11	1.22	1.64
Black X PWI	1.94	0.20	1.54	2.34
Black X PBI/HSI	1.55	0.22	1.11	1.98
Latinx X PWI	1.87	0.13	1.60	2.13
Latinx X PBI/HSI	1.53	0.08	1.37	1.69

Note. *M* = Mean; SE_M = Standard Error of the Mean; CI = Confidence Interval; LCL = Lower Confidence Limit; UCL = Upper Confidence Limit; PWI = Predominantly White Institution; PBI = Predominantly Black Institution; HSI= Hispanic Serving Institution.

Table 4.9

Estimated Marginal Means, Standard Error of the Means, and 95% confidence Intervals for the Independent Groups as Relates to the Dependent Variable of (10% Winsorized) Physiological Domain (N = 255)

			95% CI of the Mean	
Independent Group	*M*	SE_M	LCL	UCL
Grand mean	1.25	0.03	1.19	1.31
Student Race/Ethnicity = White	1.12	0.03	1.06	1.19
Student Race/Ethnicity = Black	1.37	0.07	1.22	1.51
Student Race/Ethnicity = Latinx	1.26	0.04	1.19	1.33
PWI	1.27	0.04	1.19	1.35
PBI/HSI	1.23	0.04	1.15	1.31
White X PWI	1.10	0.04	1.02	1.18
White X PBI/HSI	1.44	0.05	1.04	1.24
Black X PWI	1.37	0.10	1.18	1.56
Black X PBI/HSI	1.36	0.11	1.16	1.57
Latinx X PWI	1.33	0.06	1.21	1.46
Latinx X PBI/HSI	1.19	0.04	1.11	1.26

Note. *M* = Mean; SE_M = Standard Error of the Mean; CI = Confidence Interval; LCL = Lower Confidence Limit; UCL = Upper Confidence Limit; PWI = Predominantly White Institution; PBI = Predominantly Black Institution; HSI= Hispanic Serving Institution.

Chapter V: Discussion

At the commencement of my doctoral research, I set out to establish an understanding of RBF among Black and Latinx students in STEM. My mode of approaching this problem stemmed from my experience in the field of STEM as a student, instructor, and administrator. I believe that measuring RBF will give practitioners the critical consciousness of racial microaggresssions which currently exist within our classrooms, and that community college educators will be empowered to transform learning as a result of this quantitative data.

To begin my probe of the theory's validity and to develop its potential applications for community colleges in the U.S., I constructed a multi-phase research process. The first chapter of this study outlined the purpose and significance of researching quantitatively the levels of RBF for Latinx and Black community college students enrolled in STEM courses. Symptoms of RBF are physiological, psychological, and behavioral in nature. Historically, the classroom represents racial climates where Students of Color must combat subtle attacks on their identities and various levels of environmental stress. This suggests that colleges need to understand the classroom environment in order to create a safer space. For community colleges to reduce RBF among Black and Latinx students in STEM, research on RBF can fill a gap in existing research to better understand their experiences in different environments.

The second chapter was a literature review exploring relevant areas of existing research. This included exploring literature on Minority Serving Institutions, Critical

race theory (CRT), racial microaggressions, minority students in STEM, microaggressions and stress, and racial battle fatigue (RBF).

The first finding from the literature review was that HBCUs, PBIs, and HSIs historically have played an important role in preparing Black and Latinx students in higher education. The unique environment created by HBCUs, PBIs, and HSIs can make a difference in the lives of students who have been traditionally excluded from higher education. For example, Students of Color are less likely to experience feelings of isolation and diminished self-esteem at HBCUs, PBIs, and HSIs.

The second finding of the literature review was that CRT draws connections between microaggressions and the racial climate for Black and Latinx students in STEM. CRT has provided an important framework for analyzing the experiences of Students of Color, revealing information that frequently shows the superiority or dominance of one race - in particular, Whites over others. CRT can serve as a compelling antidote to the dominant cultural narratives and can be used to minimize the barriers which exist in higher education. CRT as applied to RBF acknowledges that White students should not experience RBF because they retain power within the classroom, and once they leave the classroom and campus.

The third finding of the literature review was that racial microaggressions are real experiences that students face in higher education. These racial microaggressions occur both inside and outside of the classroom. Each time one of these microaggressions occurs, the body reacts. Anger and anxiety produce a stress response, and over time, chronic exposure turns these microaggressions into RBF.

The fourth finding of the literature review was that Black and Latinx students are underrepresented in the STEM fields. However, HBCUs play an integral part of the Black and Latinx education STEM experience by providing an environment that builds confidence and a greater success rate than PWIs. The benefit to students at HBCUs and HSIs is more positive college experiences and outcomes.

The fifth finding of the literature review was that stress is experienced to a great extent by Black and Latinx students as a result of microaggressions. Each microaggression that a student experiences makes the classroom environment feel less safe. This cycle of microaggressions results in physiological, psychological, and biological effects and, in turn, RBF.

Research Questions

This study addresses the following three research questions:

Research question 1: Do Black and Latinx students in STEM report higher levels of RBF than White students in STEM in both the predominantly White and predominantly Black/Hispanic community college systems combined?

Research question 2: Does the level of RBF among Latinx and Black STEM students differ from White STEM students in the predominately Black/Hispanic community college system?

Research question 3: Does the level of RBF among White STEM students differ at the predominately White community college system compared to the Predominately Black/Hispanic community college system?

Review of the Methods

Due to my lens as a scientist, I applied a quantitative methods, non-experimental design (Creswell, 2014), which was guided by a postpositive orientation that utilizes empirical findings. It was based on data collected through a questionnaire which was administered to 536 community college students.

Major Findings

The collective findings of my doctoral research demonstrated that there is a significant difference in the quantitative assessment of RBF for Latinx and Black community college students in STEM as compared with White students at the same institutions and same courses.

For this first research question, data were collected about the level of racial microaggressions in the classroom experienced by a community college STEM student. Numerous qualitative studies have demonstrated that Latinx students experience hostile campus racial climates, racial microaggressions, and added racial stressors unlike their White peers (Harper & Hurtado, 2007; Hurtado & Carter, 1997; Solórzano, 2000). One Latinx student who responded to the survey described how a story about his mother was derided by another student. “Someone decided it was okay to mock the everyday lifestyle I described.” In another qualitative study which looked at historically White institutions, it revealed that racism, blocked opportunities, and extreme environmental stress existed (Smith, Hung, & Franklin, 2011). The results in the present study revealed that Blacks and Latinx report higher levels of RBF than White community college students in STEM. This is significant because there is often an assumption that Blacks and Latinx students drop out of science, technology,

engineering, and mathematics courses because they have a deficit in knowledge. However, this research shows that the student-to-student classroom experience is not even the same. The narrative of a Black or Latinx student in STEM is different from that of a White student in STEM. Black and Latinx students do not have the option of walking into a STEM classroom as individuals: they walk into the classroom as Students of Color and deal with daily microassaults, microinsults, and microinvalidations. The impact of these microaggressions are beyond their control and are systemic and structural.

The second research question compared the RBF of different groups in a campus environment defined as being PBI and HSI. The literature supported that blatant forms of racism are common occurrences for Students of Color at PWIs (Museus, Nichols, & Lambert, 2008; Robertson, 2012). Similarly, Latinx students attending PWIs have been stereotyped as 'under qualified' and 'lacking intelligence' and have been made to feel unwanted in these environments (Yosso, Smith, Ceja, & Solórzano, 2009). In contrast, Jackson (2013) conducted a qualitative study of African American female community college transfer students who were currently enrolled in and pursuing STEM bachelor degrees at HBCUs. The study looked at challenges for students who transition from community colleges to four-year colleges and found that these difficulties are normally multiplied and magnified. The participants echoed how the HBCU environment was a "safe" environment to begin developing a student in STEM. However, the results in this study did not support that PBI community colleges provide the networks and resources similar to HBCUs which the current qualitative literature suggests are vital to protect them against RBF. The

researcher gives two possible explanations for why RBF would exist at all at a PBI/HSI and why these quantitative results do not resemble qualitative studies at HBCUs. First, PBI community colleges (like HBCUs) are not absent of White students, and the privilege of being White transcends institutional demographics allowing RBF to exist (even if at lower levels) everywhere for Latinx and Black students. In other words, institutional racism permeates the walls of all institutions of higher education giving RBF permission to exist in STEM. Second, while PBI/HSI and HBCUs share some similarities, they are different types of institutions. PBI/HSI community colleges obtain their designates simply based on demographic numbers which are often geographical in nature. In contrast, HBCUs obtained their designations based on a historical context and for having a mission around their commitment to function as places that support Black students and preserves culture. In addition, faculty and instructional administrators at HBCUs often are uniquely equipped to provide support, and spaces are created to help Students of Color succeed socially, academically, and professionally.

The third research question compared the same racial groups within different institutions. This question provided insight regarding whether any degree of RBF or "reverse RBF" exists for White students. In DiAngelo's (2011) article on White Fragility, she stated that social environments protect and insulate White people from racialized stress. This protection, called White privilege, provides the taken-for-granted benefits and protections afforded to Whites based upon skin color (Bonds, 2016). Also rooted in the five tenets of CRT, in order to truly be a victim of racism, a student must feel inferior to another race (Solórzano, 1997). Hall and Closson (2005)

looked at the barriers that White students experience on an HBCU campus compared to Black students. In an exploratory and descriptive study using quantitative and qualitative research methods, Hall and Closson found that White participants in the study reported a general sense of comfort. This finding is echoed in the optional verbatim responses of this study in Appendix 3. While one White student attending a HSI did report being mocked for not being Latinx, another White student attending a PWI reported that he witnessed "People being racist towards other people, rarely towards me." The results of this study supported the findings that RBF among White community college students in STEM does not emerge for White students attending a PBI or HSI. This is in contrast to the experience of Blacks and Latinx students at PWIs who tend to experience the environment as stressful and hostile. This is significant because it counters the notion that RBF results from being in an environment of peers who are racially different or that the stress associated with being a STEM student is the same as the racialized stress which results from the microaggressions experienced by Black and Latinx students. It is also significant because it supports the notion that White students can have isolated incidents such as being mocked for not being Latinx but still retain a position of power due to institutional racism and, consequently, not experience RBF. The analogous example of racial microaggressions described by Harper and Palmer (2016) of "death by a thousand cuts" (p. 150) appears be noncumulative and not injurious for White students. I would go as far to say that White privilege, as we have come to know it, provides a built-in advantage which provides protective factors against RBF. Therefore, community colleges should utilize best practices to help White students in

STEM learn about their privilege and how microaggressions negatively impact their peers.

Limitations of the Present Study

This study is not without limitations. The following limitations to the study, some deliberate and some methodological, can lead to ideas for future research:

1. As a quantitative study, this study did not gather incidents or experiences of the students in a way that a qualitative study would have captured the data.
2. Although this study had a sufficient sample size, there were non-respondents. These non-respondents may have experienced more or less RBF or RBF in ways different from the respondents.
3. This study was conducted at the response of participants recruited through collegial and professional assistance from community colleges located in the western and central regions of the United States. Therefore, the results may not be generalizable to other populations, settings, or regions (e.g. community colleges located in the southern and eastern regions of the United States).
4. Oregon State University IRB limited the questionnaire for this study to an online format that was completed outside of class. The response rate might have been greater if the questionnaire had been administered during class.
5. This study did not take into consideration sexual diversity, gender, socio-economic status, disabilities or foster care status, all of which have been linked to barriers in STEM.

6. Although the literature indicates that Black and Latinx students are marginalized in STEM, this study did not examine the effects of RBF on individual student performance. It is unknown if the students experiencing RBF performed worse or better in STEM courses than those not experiencing RBF.
7. The participants in this study were all enrolled in a general chemistry course that had an algebra prerequisite. The researcher cannot exclude a possibility that the findings represent a subset of STEM students whose perceptions may not necessarily match the experience of every STEM student. In addition, the findings regarding RBF may be the same or different among pre-STEM or non-STEM students.
8. This study only included one PBI. It is unknown if more PBIs participated in this study and, if separated out from PBIs/HSIs, the RBF for Black students who attend PBIs would provide more, or potentially different, data.
9. Racial microaggressions are manifestations of racism that People of Color encounter in their public and private lives (Huber, 2015b). Therefore, even though the questionnaire asked questions specific to their experience within their STEM classes, it is not possible to control for all external factors outside of the classroom which might have contributed to students' RBF during the term unrelated to their STEM course experiences.

10. The creators of this RBF instrument recognize that the RBF questions only provide a snapshot of RBF and do not collect long term health outcomes which could result from RBF (Franklin, 2014).

Implications for Future Research

This study demonstrates a significance for the race of the student when responding to questions regarding RBF. White students had a significantly lower score than Latinx and Black students on the behavioral, physiological, and psychological domains, but Black and Latinx participants did not differ from each other on any of the three domains. These findings have implications for future racial microaggressions and campus climate research that look at each of these three domains disaggregated by race. As similarly concluded in a study which looked at Latinx students in Hispanic Serving four-year institutions (Franklin, Smith, & Hung, 2014), scholars should include physiological and behavioral stress responses of students when investigating racism and discrimination for historically underrepresented and marginalized students.

This study also offers a starting point for future RBF research in the community college setting. It provides an insight into future research possibilities involving different populations such as multi-cultural races and Indigenous populations, subpopulations that have not received much attention in educational research.

Implications for Practice

This study has a number of implications for higher education. The findings of this research will be useful to administrators and faculty when considering how to

address microaggressions on their campuses and how to holistically support Black and Latinx STEM students. Some of the physiological stress responses included muscle aches, back pains, and the inability to sleep. The behavioral stress responses included eating less, sleeping less, procrastination, and neglecting responsibilities. Many of these stress responses require an institutional effort involving both academic and student affairs to support students. An implication for higher education also concluded by Franklin (2019) is that institutions "need to be held accountable for their hostile and unhealthy environments that are rife with microaggressions" (p. 15).

The findings of this research will also help guide instructional pedagogy at PWIs, HSIs, and PBIs regarding group work, especially in STEM courses. At the college instructor level, there are a number of social-psychological interventions that have been developed to close the opportunity gap for students in introductory college classes (Yeager & Walton, 2011). One example includes value affirmation interventions based on self-affirmation theory which has shown to address identity threat among Blacks and Latinx students in STEM by taking the focus off the threatened part of identity (Harackiewicz, Canning, Tibbetts, Priniski, & Hyde, 2015).

Conclusion

This research quantitatively demonstrates that racial microaggressions can contribute to a stress response that causes real physiological, behavioral, and psychological effects. The charge using the CRT framework from this study is to push beyond a superficial analysis and to acknowledge that hostile racial climates and racism exist in community colleges. Community colleges need to create learning environments and interactions that are sensitive to the needs and cultures of those

who often feel isolated in the areas of STEM. This study shows that community colleges are not immune to the institutional racism embedded in our higher education system. The same oppressive nature often associated with maintaining the status quo in STEM at PWI four-year colleges and universities is also embedded within the community college system. No institution, including community colleges, can afford to focus only on STEM recruitment while allowing Black or Latinx to experience RBF as they access newly created STEM pathways.

This study is also an awakening call to PBI and HSI community colleges that often have levels of complacency due to having larger Black and Latinx enrollments and the false belief that this is enough. A sense of urgency is vital to removing the structural racism that exists in all institutions of higher education. Similarly, more accountability and allocation of resources are needed to counter the practices and classroom environments that pose a threat to Black and Latinx students in STEM. As community colleges attempt to define and redefine both missions and outcomes, instructional leaders must consider the findings of this research and their role in the pursuit of justice, equity, and social mobility.

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APPENDIX 1

Racial Battle Fatigue Questionnaire

The following questions will ask you to reflect on your experiences as a community college student **at this institution**. The researcher is interested in understanding some of the student-to-student experiences in Science, Technology, Engineering, and/or Math (STEM) classrooms (**not** instructor-to-student experiences). Therefore, please think about how often the following things occurred while working in groups for any of your STEM courses at this institution.

1. **Because of my racial/ethnic background**, I am treated with less respect than other people.
A) Never, B) Almost never, C) Sometimes, D) Fairly often, E) Very Often

2. **Because of my racial/ethnic background,** I receive inferior peer help than other people.
A) Never, B) Almost never, C) Sometimes, D) Fairly often, E) Very Often

3. **Because of my racial/ethnic background**, people act as if they think I am not smart.
A) Never, B) Almost never, C) Sometimes, D) Fairly often, E) Very Often

4. **Because of my racial/ethnic background**, people act as if they are afraid of me.
A) Never, B) Almost never, C) Sometimes, D) Fairly often, E) Very Often

5. **Because of my racial/ethnic background**, people act as if they think I am dishonest.
A) Never, B) Almost never, C) Sometimes, D) Fairly often, E) Very Often

6. **Because of my racial/ethnic background**, I have experiences I think are racially discriminatory in nature.
A) Never, B) Almost never, C) Sometimes, D) Fairly often, E) Very Often

If you answered "never" to all six questions above, go to questions 22-30

If you answered "almost never", "sometimes", "fairly often", or "very often" to any of the questions 1-6, please complete questions 7-30

7. **After you experienced racialized incidents in class**, how often were you frustrated?
A) Never, B) Almost never, C) Sometimes, D) Fairly often, E) Very Often

8. **After you experienced racialized incidents in class**, how often did that incident make you more aware of racism?
A) Never, B) Almost never, C) Sometimes, D) Fairly often, E) Very Often

9. **After you experienced racialized incidents in class**, how often did you become irritable?
A) Never, B) Almost never, C) Sometimes, D) Fairly often, E) Very Often

10. **After you experienced racialized incidents in class**, how often did your mood dramatically change?
A) Never, B) Almost never, C) Sometimes, D) Fairly often, E) Very Often

11. **After you experienced racialized incidents in class**, how often did you feel in shock?
A) Never, B) Almost never, C) Sometimes, D) Fairly often, E) Very Often

12. **After you experienced racialized incidents in class**, how often did you feel disappointed in your peers?
A) Never, B) Almost never, C) Sometimes, D) Fairly often, E) Very Often

13. **After you experienced racialized incidents in class**, how often were you agitated?
A) Never, B) Almost never, C) Sometimes, D) Fairly often, E) Very Often

14. **After you experienced racialized incidents in class**, I ate more or less.
A) Never, B) Almost never, C) Sometimes, D) Fairly often, E) Very Often

15. **After you experienced racialized incidents in class**, I slept too much or too little.
A) Never, B) Almost never, C) Sometimes, D) Fairly often, E) Very Often

16. **After you experienced racialized incidents in class**, I procrastinated.
A) Never, B) Almost never, C) Sometimes, D) Fairly often, E) Very Often

17. **After you experienced racialized incidents in class**, I neglected my responsibilities.
A) Never, B) Almost never, C) Sometimes, D) Fairly often, E) Very Often

18. **After you experienced racialized incidents in class**, I experienced muscle aches.
A) Never, B) Almost never, C) Sometimes, D) Fairly often, E) Very Often

19. **After you experienced racialized incidents in class**, I experienced back pains.
A) Never, B) Almost never, C) Sometimes, D) Fairly often, E) Very Often

20. **After you experienced racialized incidents in class**, I experienced sleep disturbances.
A) Never, B) Almost never, C) Sometimes, D) Fairly often, E) Very Often

21. **After you experienced racialized incidents in class**, I experienced pains in joints.
A) Never, B) Almost never, C) Sometimes, D) Fairly often, E) Very Often

Optional: please explain any of your racialized experiences you expressed above.

Comment box:_____

Everyone should complete questions 22-30

Demographic

22. What is your gender?
A. Female
B. Male
C. Non-binary/third gender
D. Prefer not to say

23. Would you describe yourself as multiracial?
A. No
B. Yes

24. Would you describe yourself as Latinx or Hispanic?
A. No
B. Yes, Mexican American/Chicano
C. Yes, Puerto Rican
D. Yes, Central American
E. Yes, other Latinx or Hispanic

25. Ethnicity origin (or Race): Please specify your ethnicity
A. White
B. Black or African American
C. Native American or American Indian
D. Asian / Pacific Islander
E. None of the above

26. How many terms/semesters have you completed at this institution?
A. This is my first term/semester
B. 1-3
C. 4-6
D 7-9
E. Greater than 9

27. Have you taken other science, technology, engineering, or mathematics courses at this institution?
A. No
B. Yes

28. Did you transfer to this institution from another one?
A. No
B. Yes

29. Are you concurrently taking classes at a four -year institution?
A. No
B. Yes

30. What is the name of your primary campus within this institution?
_____

APPENDIX 2

Memorandum of Understanding
(Information Exchange)

Alfred McQuarters and Darlene Russ-Eft
And
William A. Smith, Jeremy D. Franklin, and Man Hung

This Memorandum of Understanding (MOU) establishes provisions for the exchange and use of the racial battle fatigue instrument between Alfred McQuarters & Darlene Russ-Eft and William A. Smith, Jeremy D. Franklin, and Man Hung to conduct research on racial battle fatigue.

Background
William A. Smith, Jeremy D. Franklin, and Man Hung have conducted peer-reviewed research on racial battle fatigue using an instrument developed as a team. There has been recent interest in the instrument and using it in other research for dissertations, peer-reviewed research, reports, and general interest. Laura E. Hamilton demonstrated interest in using the instrument for her own research.

Purpose
This MOU will primarily be an exchange of the instrument from William A. Smith and research team to Alfred McQuarters and Darlene Russ-Eft for the purposes of research that will further develop the racial battle fatigue instrument and conduct additional research on racial battle fatigue.

Additionally, the partnership will require some additional conditions:
1. Any publication, report, manuscript will need to acknowledge that William A. Smith, Jeremy D. Franklin, and Man Hung developed the instrument.
2. The receiver of the instrument needs to share the data of any research with William A. Smith, Jeremy D. Franklin, and Man Hung. The data share is for William A. Smith, Jeremy D. Franklin, and Man Hung to review to further refine the instrument, but not for publication.
3. Any instrument modifications should be shared with William A. Smith, Jeremy D. Franklin, and Man Hung prior to publication.

Duration
This MOU is effective from June 1, 2016, through June 1, 2020. upon signature by the authorized officials from William A. Smith, Jeremy D. Franklin, Man Hung, Alfred McQuarters and Darlene Russ-Eft. It will remain in effect until modified or terminated by any one of the partners, William A. Smith, Jeremy D. Franklin and Man Hung.

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APPENDIX 3

Verbatim Responses to the Racial Battle Fatigue Survey Optional Question, "Please explain any of your racialized experiences you expressed above." (N = 496)

	Student's ID and Comment	Student 's Race/Ethnicity Group	Student's School Type
4	People being racist towards other people, rarely to me.	White	PWI
39	Really not that many, a lot of people are nice at this Campus	White	PWI
47	Other students don't speak to me after I initially spoke to them. I have been left out of group quizzes, left to myself.	Black	PWI
56	Someone decided it was okay to mock the everyday lifestyle I described in a story I told them about my mother's childhood.	Latinx	PWI
83	People have made assumptions that I will give inferior work in a group project when in fact I provided the detailed, well executed work of my part in project. People assume I'm lazy.	Black	PWI
97	Mainly stuff you would expect giant black guys to experience on the daily.	Black	PWI
104	I try not to let people get to me. I usually end up trying to do more so that I can show these individuals that I am just as smart or sometimes smarter than they are. It's like putting a screen door up you let the breeze and keep the bugs out.	Latinx	PWI
157	I wanted friends but it came at the cost of being made fun of because I am white and not a Latina.	White	HSI
433	When I have a lab partner and I would answer a question and they wouldn't believe that I was correct and he/she would ask someone else.	Latinx	PWI
435	I have never experienced that moment in class	Latinx	HSI
447	I'm white so obviously I'm not the one being targeted, but there have been MANY incidents where my peers who are POC have experienced treatment that was not only completely unfair to them, but obviously due to their race.	White	HSI

Note. A total of 11 responses were reported on the 496 Racial Battle Fatigue surveys that were completed.

APPENDIX 4

The following paragraphs provide some literature regarding racism experienced by K-12 students. It also describes experiences of higher education faculty and staff of color.

Studies of K-12 Students

Brown, Mangram, Sun, Cross, and Raab (2017) addressed the problem of academically preparing African American boys while simultaneously helping them manage subtle attacks on their identities as African American males and scientists. In a yearlong study of the school's design and implementation, three groups were included: school board members, teachers, and staff members. The charter school was started in 2012 by a small subgroup of the 100 Black Men School of Oakland, a group that included physicians, lawyers, educators, and politicians who had become disenchanted with the underperformance of African American boys in Oakland, California's public schools. The school enrolled 76 male students in kindergarten, first, second, and fourth grades. Its strategy was to model a synergy between an identity as a scientist and as a Black male. Three primary principles were used to accomplish this agenda: an attempt to craft an African American science identity for students, development of an achievement ideology for students, and a carefully constructed college going culture from an early age. In regard to the latter point, college pennants were posted throughout the school as well as photos of staff wearing sweatshirts from their respective colleges. The strengths of being an African American male also were emphasized as opposed to pointing to the notion that African American males are failing in school and in life in general.

McGee (2013) told the story of Tamara (pseudonym), a mathematically gifted student who might have benefited from a program such as the one at the charter school described above. At her urban high school, Tamara was praised for her academic and mathematics achievements while being subtly underestimated for being Black; for example, she heard comments such as, "Tamara, you are so smart, I can hardly believe it!" (p. 258).

Tamara received a full scholarship to attend a private school but chose not to go because she felt that although she could summon the energy to do well on one test, she did not believe that she could do it for the next two years (her junior and senior high school years). McGee (2013) theorized that Tamara's decision may have reflected her operating from the frameworks of stereotype threat and stereotype management. Gelbgiser and Alon (2016) also commented on the negative effects of stereotype threat on the academic achievements of Black math-oriented students.

Simpkins, Price, and Garcia (2015) identified parents as a motivating resource for supporting adolescents in science through a variety of behaviors at home, including positivity, co-activity, and school-focused. For instance, parents might praise their children and support them when things do not go well. They also could engage in school-related tasks such as going to their students' schools, making sure that they have time and space to do their homework, or just talking to them about how their science class is going. Watching science shows together, talking about current events or the importance of doing well in science also could be helpful. None of these activities require extraordinary knowledge in the field or doing their students' homework for them (Simpkins, et al., 2015).

Racism Experienced by Higher Education Faculty and Staff of Color

DeCuir-Gunby and Gunby, Jr. (2016) studied racial microaggressions in the workplace and their impact upon African American educators. Their research showed that racial microaggressions for higher education participants were more frequent than those experienced by their K-12 counterparts. Additionally, the higher education workplace was half as racially diverse as that of the K-12 educators (20.4% versus 40.9% respectively) (p. 405). Typically, People of Color (POC) experienced more racial microaggressions in workplaces that are less racially/ethnically diverse. CRT has inferred that racism is systemic, unconscious, and historical; therefore, environments that have more members of the majority race are more likely to have persons who exhibit racial microaggressions. DeCuir-Gunby and Gunby, Jr. stated that the anecdote that microaggressions will be experienced less frequently as POC attain higher social status, more education, and higher incomes, has been shown to be false.

Harris (2017) expanded the concept of racial microaggressions and racism by studying 24 Multiracial professionals in higher education and student affairs (HESA) at their individual institutions. Harris' work explored how monoracism and White ideological understanding of race influenced study participants' everyday experiences with race on campus. While White ideology is pervasive in many environments, it does not, on its own, always produce inequities and oppression for Multiracial individuals; when coupled with institutional monoracism, however, it constructs and maintains social arrangements that legitimize inequitable positions of Whites and non-Whites (Harris, 2017). Adding to this situation is the lack of conversations

concerning Multiraciality in higher education institutions and organizations. As a result, professionals' experience with microaggressions caused them to feel excluded, isolated, and to experience RBF, thereby making it difficult for them to work and thrive within postsecondary institutions. Harris concluded that HESA needs to show greater commitment to building and supporting inclusive, socially just, and welcoming campus communities. One way that this can be done is to have conversations concerning multiraciality across campuses and national organizations. In such a way, monoracial understandings of race can begin to destabilize.

Carroll (2017) studied gender-based microaggressions toward Faculty Women of Color. She identified three microaggressions: gender-stereotypical assumptions; sexual objectification, and gender blindness. In Carroll's study, Faculty Women of Color expressed a perception that the institutions for whom they worked could not be trusted to support them if they spoke out, a condition known as "institutional betrayal" (p. 43). Betrayal trauma can result when the institution on which one is dependent for survival violates that person's trust or well-being. Carroll also found that CRT tenets intersect with institutional betrayal and suggested that if colleges and universities can acknowledge that intersectionality, they can engage Faculty Women of Color in ways that affirm their talent and professional skills. Such a response, she said, could lead to discussions about systemic oppression across campuses which could, in turn, lead to positive experiences for Faculty Women of Color.

Louis, Rawls, Jackson-Smith, Chambers, Phillips, and Louis (2016) found similar results in their study of four Black faculty members who were employed at large PWI research universities. These faculty members experienced racial

microaggressions on a routine basis and frequently felt isolated, discouraged, and diminished by their colleagues as a result. Like the Faculty Women of Color in Carroll's study (2017), their faith in their institutions was reduced, and they felt disempowered to approach their aggressors. Consequently, according to Louis, et al. (2016), the faculty members worked harder, a coping response termed "*John Henryism*" by Clark, Adams, and Clark (2001, p. 270). Research has found "*John Henryism*" to be associated with higher levels of stress and increased blood pressure (Louis et al., 2016).

Louis et al. (2016) emphasized that Black faculty members were not unique in experiencing microaggressions; rather, such behaviors were likewise a concern for Latina/o, Asian, Native American, women, Lesbian Gay Bisexual Transgendered Queer (LGBTQ) populations, as well as individuals with disabilities. Recommendations stemming from Louis et al.'s study included the creation and/or strengthening of minority faculty organizations to assist targeted populations with coping and formulating solutions to address and minimize microaggressions in the workplace. Such organizations could assist universities in acknowledging that racism does exist on their campuses and in designing training and developing policy that would include consequences for violators and rewards for advocates of non-aggressive environments.

A study by Arnold, Crawford, and Khalifa (2016) focused on two Faculty of Color, Nina and Hassan, engaged in the promotion and tenure (P&T) process at a research-intensive PWI in the Midwestern United States. The P&T process frequently serves as a source of RBF because of racial microaggressions experienced by Faculty

of Color. Nina was a Black female professor with seven years' faculty experience who earned P&T in spring 2013. Hassan was a Black male professor with five years' experience in the academy who submitted P&T materials in summer 2014.

Research indicates Faculty of Color generally devote more time to service than White faculty (Arnold et al., 2016). This was true in the cases of Nina and Hassan who were often expected to serve on department and college committees concerning diversity, race, and gender, which resulted in their sacrificing time that otherwise would have been spent on research. Both felt that refusing committee service might result in their being perceived as "un-collegial" (p. 908). Both commented on how much of the P&T process involved "likability" and "congeniality" (p. 909).

Resiliency has been viewed as a way to reexamine RBF, not by denying its conditions or effects, but by a refusal to accept the degree of RBF (Arnold et al., 2016). Nina and Hassan decided to survive and thrive throughout the process; however, such determination also can lead to "excessive coping" (p. 912), a condition in which individuals may continue striving even though their physical and mental health decline. Arnold et al. recommended educating the larger campus community about RBF and resultant dangers when its physiological symptoms remain unacknowledged, resulting in failed efforts at recruiting and retaining Faculty of Color.

Hotchkins (2017) studied the effects of cumulative racial stressors on Black women leaders at a PWI; in particular, "gendernoir" (p. 145) RBF, described as the intersection of being women and being Black. The women's reactions were

manifested in two specific ways: “buffered leadership” (p. 152) (creating proximal distance between themselves and adverse racial interactions with White males), and “holistic leadership” (p. 152) (educating White women about the wholeness of being Black and a woman). Proactive coping strategies such as holistic leadership aided study participants in decreasing the frequency of “gendernoir” RBF, but enacting buffered and holistic leadership also truncated their ability to participate in organizations. Hotchins concluded that how PWI administrators nurture Black women leaders is fundamental to determining their success.

Related to these findings is a study by Corbin, Smith, and Garcia (2018) of 13 Black women at PWIs in a Western U.S. state. The women represented 1.1 percent of the total campus population, while Black women faculty averaged less than a full percent. Presented in this study were the stereotypes of the “STRONGBLACKWOMAN” (p. 4) who exhibits self-reliance and assertiveness. Juxtaposed to the “STRONGBLACKWOMAN” is the “Angry Black Woman” (p. 10), an aggressive, emasculating woman whose anger is irrational and baseless. In environments where the Angry Black Woman schema is frequently encouraged, the STRONGBLACKWOMAN can be an effective coping response (Corbin et al., 2018). The responsibility, however, for ensuring adequate numbers of available role models for Black women and other SOC, Corbin et al. said, rests with senior college and university administrators.