WHAT INFLUENCES THE ACADEMIC PERFORMANCE OF STUDENTS OF COLOR IN CALIFORNIA HIGH SCHOOLS?

A Thesis

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MASTER OF PUBLIC POLICY AND ADMINISTRATION

by

Norma Y. Mendoza

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Department of Public Policy and Administration

Abstract

of

WHAT INFLUENCES THE ACADEMIC PERFORMANCE OF STUDENTS OF COLOR IN CALIFORNIA HIGH SCHOOLS?

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Despite progress over the last decade, California's teacher workforce remains far from reflecting the diversity of its students. California is the leading state with the largest percentage-point difference between the race/ethnicity of the student and educator population. The disproportionate mismatch concerns policy makers and advocates who argue the lack of teacher diversity has negative consequences on the academic performance of students of color, which this thesis defines as African American, Hispanic/Latino, Asian, Pacific Islander, Filipino, or Native American. Yet questions remain about the accuracy of such claims. This thesis aims to contribute to the limited academic research surrounding this topic by researching whether there is a positive correlation between the percentage of teachers of color and standardized test scores of same-race/ethnicity students in California high schools.

The data consists of the California Academic Performance Index (API), an aggregated test score provided by the California Department of Education used to measure the performance of the state's K-12 schools throughout 1999 and 2013. The

sample data includes 2013 API scores of 755 traditional high schools across the state, with scores ranging from a low of 200 to a high of 1000.

Using a standard regression model, I did not find statistically significant regression coefficients for the match between teacher and student race/ethnicity for most groups, while the coefficient for African Americans was negative. Adding interaction variables in a modified regression model, I found that under special circumstances, educator race/ethnicity exerts both positive and negative impacts on the test scores of students of the same race/ethnicity. This suggests the relationship between teacher-student race/ethnicity and academic performance is more complex than might initially be expected. Additionally, further analysis indicates that other factors, aside from teacher and staff race/ethnicity, may have a larger impact on the aggregated standard test scores of students at a California high school.

_____, Committee Chair
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Gracias to my mother, Graciela because I am a manifestation of her dreams. And to everyone who contributed to this journey, mil gracias también, thank you! It was not an easy road, but along the way mentors and people who love and support me unconditionally motivated me to lead by example. They also made sure I did not forget that I can accomplish anything I set my mind to and above all, they reminded me that there are sacrifices worth making. Lastly, to all the advocates who fought for policy change to make my higher education attainable, I am forever indebted to you.

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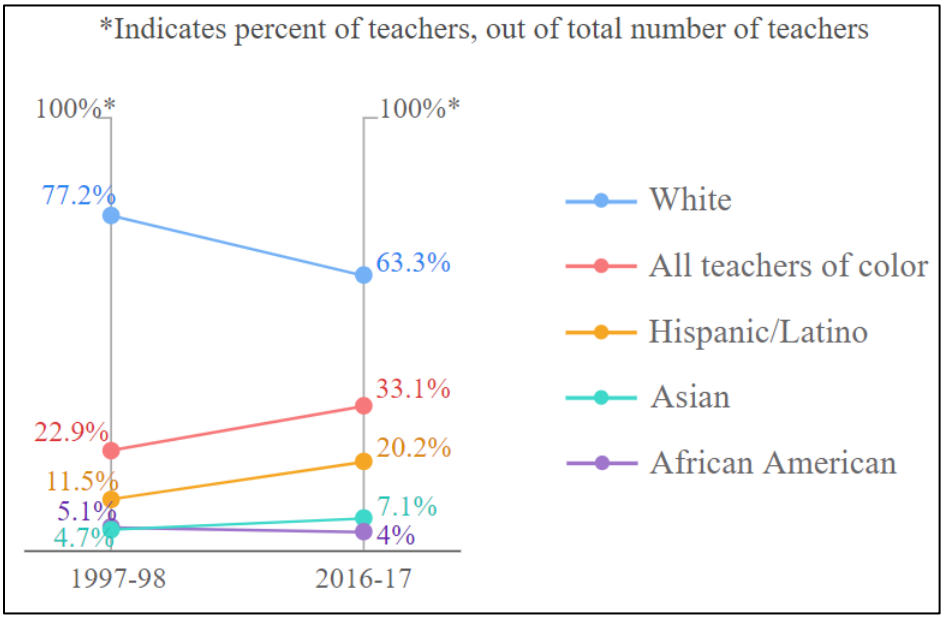
CHAPTER 1: INTRODUCTION

For much of California's history, there have been more White teachers than teachers of color in the state's K-12 education system. Perhaps this was appropriate when the state's population was vast majority White, but that is no longer the case. As of 2014, students of color have outnumbered White students (Egalite & Kisida, 2018, p. 59), yet White teachers dominate the teaching profession (see Figure 1). Despite progress over the last decade, the state's teaching workforce remains far from reflecting the diversity of its students and a significant unequal ethnic and race representation amongst teachers and students exists (California Department of Education, n.d.).

Figure 1.
Teacher Diversity in California's K-12 Public Schools
(1997-1998 compared to 2016-2017)



Source: California Dept. of Education, Dataquest; Graphic by Yuxan Xie.

The disproportionate mismatch between the ethnicity and race of the student and educator populations has been a concern for advocates who argue that the lack of teacher diversity has negative consequences on the academic performance and experience of students of color (Freedberg, 2018), which I define as being African American, Hispanic/Latino, Asian, Pacific Islander, Filipino, or Native American. Undoubtedly, there is a significant teacher diversity gap in California—the state leads the nation with the largest percentage-point difference between teachers and students of color (Center for American Progress, 2017). In other words, the percentage of students of color is far larger than the percentage of teachers of color in California. What is lacking in this educational policy concern, and efforts to address it, is substantial empirically-based evidence demonstrating the academic value teachers of color impart on similar-demographic students.

California leaders aim to address the diversity gap in the teacher workforce in spite of insufficient and unclear empirical work in this field. New research is still emerging and it is possible that the benefit of teachers reflecting the ethnicity of their classrooms is yet to be fully validated by scientific methods. In efforts to address the overall shortage of teachers, policy makers have focused on ways to help teacher demographics keep up with the state's student population (Freedberg, 2015). Nevertheless, California continues to struggle with diversifying its educator workforce through sustainable and affordable policy programs.

Thesis Roadmap

The purpose of my master's thesis is to investigate whether there is a positive correlation between teachers and the test scores of students of the same ethnicity or race in California high schools. Does a larger percentage of teachers of color increase the standardized test scores for same race or ethnic students? To better frame this question, in the introductory chapter, I offer three sections. Section one provides a description of the teacher diversity gap at the state and district level, as well as by type of ethnicity. In section two, I explain the issues associated with the lack of ethnic diversity in the teaching industry. In the last section, I outline some of the known contributing factors to the ethnic mismatch between California's students of colors and the teachers in their classrooms.

In chapter two I review literature that uses a regression analysis method to study the effects of teacher demographics on student academic outcomes. The chapter consists of four sections, which includes a description of the types of measurements of student academic achievement, teacher characteristics and other categories of explanatory variables, types of sample data, and whether overall findings show a positive, negative, or neutral correlation.

In chapter four I describe my methodology and the data I use to investigate my master's thesis questions, including the regression equation, model specification, and analysis of the regression. In the findings chapter, I interpret the results, address the limitations of my methodological approach, and whether the findings align with the literature review I conducted. In the last concluding chapter, I provide policy

recommendations for the state of California to increase teacher diversity to help increase the academic outcomes of minority students.

The Policy Landscape of Student and Teacher Diversity in California

Diversity Gap at the State Level

Recent demographic data from 2014-2015 highlights the significant diversity gap between minority teachers and students in California (California Department of Education, n.d.). Students of color account for approximately seventy-five percent of the total student population, while only about thirty-five percent of the teacher workforce consists of teachers of color. This forty percentage-point difference between Nonwhite students and Nonwhite teachers is one of the largest teacher diversity gaps in the country (see Figure 1.2). Three years ago, the percentage-point difference in California was forty-four percent, demonstrating a small reduction of only four percent since 2011 (Brown & Boser, 2017). While the gap appears to be closing, the pace is too slow to keep up with the diversifying student population.

California is not the only state with this problem. Other populous states like Texas and Florida have significant diversity gaps with each state accounting for a thirty percentage-point difference. Table 1 shows how California compares to other states experiencing high percentage-point differences in their teacher workforce diversity.

Table 1.
Share of Nonwhite Students and Nonwhite Teachers in Public Schools, by State

State	School year	Nonwhite students	Nonwhite teachers	Share of Nonwhite students	Share of Nonwhite teachers	Percentage-point difference
California	2014-15	4,696,066	103,339	75%	35%	40
Texas	2014-15	3,717,697	133,767	71%	38%	30
Florida	2014-15	1,648,632	50,327	60%	30%	30
Illinois	2015-16	1,051,933	21,107	51%	17%	34
New Jersey	2015-16	735,969	17,664	54%	15%	39
Maryland	2014-15	525,308	14,476	60%	24%	37
Michigan	2014-15	523,638	9,838	34%	10%	24

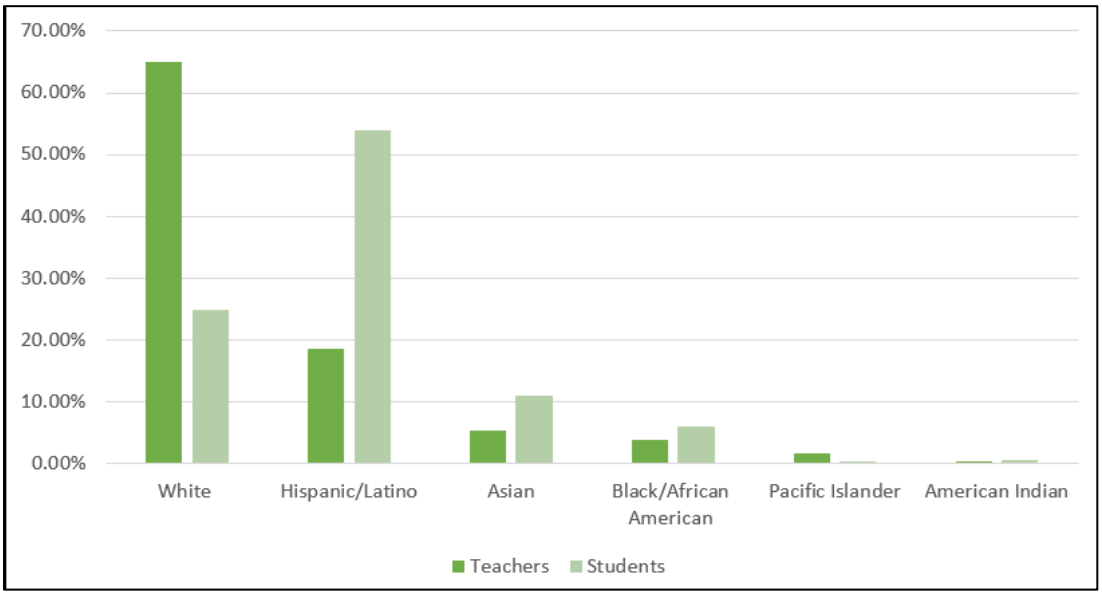
Source: Center for American Progress, "Revisiting the Persistent Teacher Diversity Problem: Tables and Sources" (2017)

Diversity Gap by Ethnicity and Race

The teacher diversity gap is not the same across all races and ethnicities and it impacts certain groups more than others. Figure 2 shows a demographic breakdown of student and teacher diversity per ethnic group. While White students only make slightly over twenty percent of the student population in California, White teachers account for over sixty percent of the teacher workforce. On the other hand, Hispanic/Latino students are the majority across the state, accounting for more than half of the state's student population—yet less than twenty percent of teachers are Hispanic/Latino. Among Asian and African American students there is also a disproportionate number of teachers and same-ethnicity students. Asian students constitute over ten percent of the student population, while less than five percent of their teachers are of same-ethnicity. African American students make up six percent of all students and teachers of the same

demographic background only make up four percent of California teachers. In contrast, Pacific Islander and Native American students and teachers of the same race or ethnic background have similar population sizes.

Figure 2.
Student and Teacher Diversity Per Ethnic/Race Group in California (2016-2017)

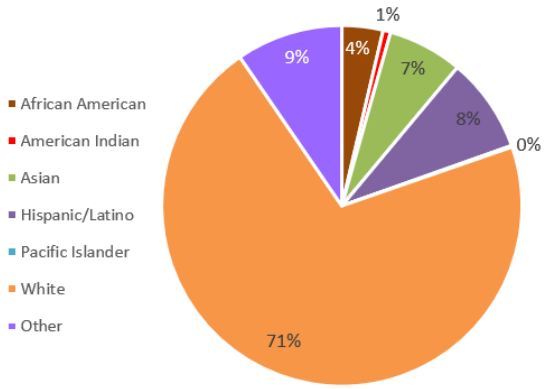


Source: Center for American Progress, "Revisiting the Persistent Teacher Diversity Problem: Tables and Sources" (2017)

Diversity Gap at the District Level

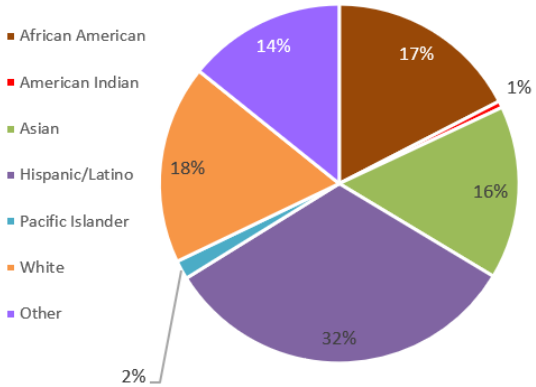
While the teacher diversity gap appears to be closing at the state level, district-level data indicates that some districts are experiencing an even wider demographic divide between teachers and students of color. A 2014 report produced by the Center for American Progress revealed some school districts employ a teacher workforce that does not all reflect its student population. For example, Santa Ana Unified School District has a student body that is about ninety percent Hispanic, but less than thirty percent of teachers are Hispanic. That is nearly a sixty percentage-point difference, larger than the gap represented at the state-level. The lack of diversity among the teacher workforce is also salient in the Natomas Unified School District, where most of its teachers are White (75 percent), while more than 80 percent of its students are students of color (See Figures 3 and 4). The percentage-point gap between African American students and teachers is also significant: only four percent of teachers are African American, yet 17 percent of students are of the same ethnicity. These two districts illustrate that while the diversity gap may be closing at the state level, some local communities are still experiencing a significant gap.

Figure 3.
California Teacher Population by Ethnicity, Natomas Unified School District, 2016-2017



Source: California Department of Education, DataQuest Staffing Report (2016-2017)

Figure 4.
California Student Enrollment by Ethnicity, Natomas Unified School District, 2016-2017



Source: California Department of Education, Dataquest Student Enrollment Report (2016-2017)

Issues with Teacher Diversity Gap

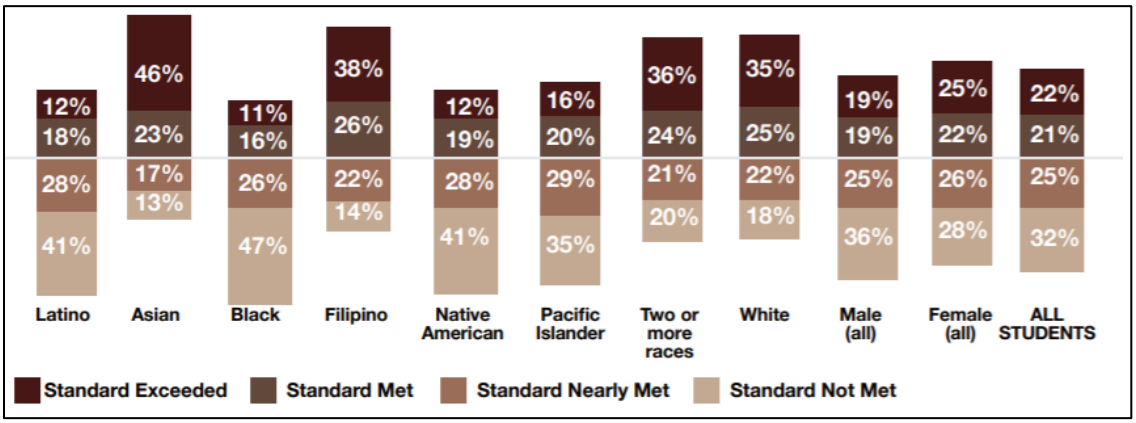
The lack of teacher diversity is a national issue and one that California is particularly concerned about given it is the leading state with a race and ethnic gap amongst its student and teacher population. While the topic is rooted in debate about how to address it and controversy regarding some of the proposed solutions, there is some consensus that minority teachers may have a positive impact on same ethnicity or race students in the forms of improving student participation, motivation, and attendance (as cited in Dee, 2004; Chern & Halping, 2016; Egalite, Kisida, & Winters, 2015).

Minority Students' Academic Performance

As previously mentioned, the largest minority demographic in California is Hispanic/Latino, yet compared to White students, Hispanic/Latino students underperform in various academic aspects, ranging from performance in academic assessments to high school completion rates (The Education Trust-West, 2017). Disparities in the language arts begin early for Hispanic/Latino and other students of color (see Figure 5). Figure 1.6 demonstrates that nearly fifty percent of African American students do not meet standard levels by the time they reach the third grade, accounting for the largest percentage point difference between White students. High school graduation rates amongst Hispanic/Latino and African American students are also of great concern, given the small number that complete their secondary education (The Education Trust-West, 2017). Even when they enroll in post-secondary, both populations are more likely than other groups to enroll in remedial, non-college level course work (see Figure 6). Not only are students of color academically performing more poorly and graduating from high school

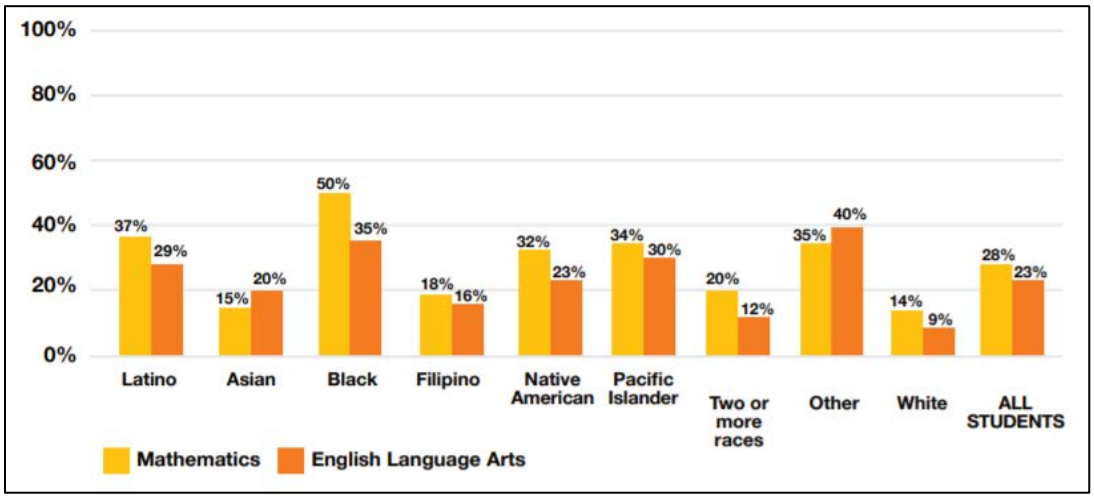
at lower rates than their White peers, but they are also less likely to pursue or obtain higher education. Their academic performance, high school completion rates, and pursuit of a college degree, are alarming to educators and policy makers. A fragmented education amongst these populations means they experience more limited social mobility and disproportionate access to quality employment opportunities.

Figure 5.
Performance on Smarter Balanced English Language Arts Grade 3 Assessment, by Ethnicity, (2016-2017)



Source: The Education Trust-West, California Department of Education, (2017)

Figure 6.
Percentage of CSU First-time 2016 Fall Freshmen Needing Remediation, by Subject and Ethnicity



Source: The Education Trust-West, California State University (CSU), (2017) *How Teachers of Color Make a Difference*

Some qualitative research shows teacher race or ethnicity may influence students in areas such as academic performance, classroom discipline, and self-confidence (NYU, 2017; Dee, 2014). Certain students of color taught by a same-ethnicity teacher might be more likely to complete high school, be engaged in the classroom or complete homework (Bryk & Thum, 1989), as well maintain school attendance and have more confidence in their academic abilities (Johnson, Crosnoe, & Elder, 2001). Some studies have also found what researchers call “teacher bias”, referring to the way teachers may relate to or perceive student behavior and classroom engagement (Cherng & Halpin, 2016). For example, a study found that teachers of color are less likely to perceive normal adolescent behavior from students of color as willful defiance, while White teachers tend to view similar behavior as defiant. Thus, students of color in a classroom taught by Nonwhite

teachers are more likely to be expelled or suspended, causing a disruption to their school attendance and performance in the classroom.

Nevertheless, many of these qualitative studies have findings that are not definitive, applicable to all student ethnicities, grade levels, and have not been duplicated by other researchers. In the area of quantitative research, fewer studies exists on how teachers of color impact the test scores of same-race/ethnicity students. In the literature review chapter of this thesis, I will examine the effects of teacher demographics on student academic achievement in greater detail.

Why the Teacher Diversity Gap Exists

There are assorted reasons why there are not enough teachers of colors teaching California classrooms today. The Learning Policy Institute noted one reason students of color are put off from entering the teaching profession is that they often end up with more student loans to pay off, and then have difficulties paying them down (Sutcher, Carver-Thomas, & Darling-Hammond, 2018). According to one of its studies, 12 years after earning a bachelor's degree, African American students nationally owed $43,000 more than White graduates. Hispanic/Latino students borrow as much as White students, but they default on their loans at twice the rate, according to a Brookings Institution report (Scott-Clayton, 2018). Because of the relatively low teacher salaries they can expect, these high debt burdens dissuade students from entering the teaching profession.

Teacher retention is another reason there is a teacher diversity gap. There is little administrative support for teachers of color who often are given more responsibilities that fall out of their scope of work, such as translating for parents when a school does not

have a translator on site (Griffin, 2018). Being the primary communicators for their entire school requires teachers to not only serve as translators at parent teacher conferences and student teacher conferences but assist with other administrative duties.

Policy Efforts to Address Teacher Diversity Gap

California has been experiencing an overall teacher shortage since 2014. In attempts to recruit more candidates to the profession, state efforts have simultaneously encompassed increasing teacher diversity. In 2015, the California Commission on Teacher Credentialing (CTC), which creates standards for preparation, licensing and credentialing of professional educators, revamped its common standards for teacher preparation programs. It asked that programs include efforts to recruit and enroll more diverse candidates and provide them support with entering and remaining in the profession (Chiu, 2018). In addition, since 2017, the U.S. Department of Education has granted over $34 million to various campuses in the California State University—the system that produces the largest number of teachers than all other education institutions combined (Zinshteyn, 2017)—to implement initiatives to help reduce the teacher shortage and increase the diversity of teacher candidates (Ruble, 2018).

State policymakers have also approved funding in the last couple of years for programs to enhance the teacher pipeline, such as increasing the number of certified teachers, assisting school staff to obtain a teaching credential, and developing undergraduate programs that lead to a teacher credential (Lambert, 2018). Addressing the lack of teacher diversity amongst the teacher workforce will continue to be a policy concern for state leaders and various stakeholders.

In this introductory chapter I have provided a general description of the policy landscape concerning teacher ethnicity and race and its effects on the academic performance of students of color. I also explained the benefits and arguments previous research has made for increasing diversity in the teacher profession, as well as reviewed some of the recent effort by advocates and policymakers to address the gap. In the next chapter, I will include a summary of existing research that explores whether there is a positive correlation between teacher ethnicity and same-ethnicity student academic outcomes, including test scores and other types of measurements for student success.

CHAPTER 2: A REVIEW OF THE LITERATURE

In this chapter I provide a review of the literature and academic studies that have attempted to identify or quantify whether there is a positive relationship between student academic success and exposure to same-ethnicity teachers. As discussed in chapter one, there is a consensus amongst educators, based upon a limited amount of research, that teachers of color impart academic benefits on same-ethnicity students. Such consensus has fueled some of the efforts mentioned in chapter one to recruit more candidates of color into the educator profession. Despite these well-intended efforts, there is no substantial amount of research or clear, consistent, empirical evidence that indicates that there is an unequivocal positive relationship between a student's academic achievement and his or her teacher's race or ethnicity (Villegas & Irvine, 2010).

Since 2010, the gap in literature on this topic has started to close as new research has emerged (Egalite & Kisida, 2018; Gershenson, Holt, & Papageorge, 2016; Grissom, Rodriguez, & Kern, 2017; Lindsay & Hart, 2017). Despite this, there are still deficiencies in the literature to be able to definitively promote a research-based rationale (Villegas & Irvine, 2010) for diversifying the race/ethnicity of teachers. For this chapter, I have gathered a number of regression analysis-based research studies and divided my discussion into the following themes: (1) studies of qualitative dependent variables; (2) studies of quantitative dependent variables; (3) teacher characteristics and other explanatory variables; and (4) an overall summary of research findings and possible limitations of these.

Studies of Qualitative Dependent Variables

What distinguishes a qualitative variable from one that is quantitative is that the data is not in numerical form, in other words, it is not "measured in units of measurement" (McLeod, para. 26, 2017). Rather, qualitative research is distinguished by data collected through observation of participants or through interviews that solicit a participant's thoughts, feelings, or opinions (see Table 2). Half of the regression analysis articles I incorporate into my literature review involve a quantitative analysis of qualitative findings. Qualitative findings are subjective (i.e. teacher perceptions or student beliefs) and partially the interpretation of the researcher, both of which can impose limitations on the reliability of the study's findings (McLeod, 2017). In the following paragraphs, I describe the different ways that earlier studies measure factors related to student academic success.

Table 2.
Differences Between Qualitative and Quantitative Research

Qualitative Research	Quantitative Research
Conceptual: • Concerned with understanding human behavior from the informant's perspective • Assumes a dynamic and negotiated reality	Conceptual: • Concerned with discovering facts about social phenomena • Assumes a fixed and measurable reality
Methodological: • Data are collected through participant observation and interviews • Data are analyzed by themes from descriptions by informants • Data are reported in the language of the informant	Methodological: • Data are collected through measuring things • Data are analyzed through numerical comparisons and statistical inferences • Data re reported through statistical analyses

Source: Difference between qualitative and quantitative research. Reprinted from SimplyPsychology, by S. McLeod, 2017, Retrieved from https://www.simplypsychology.org/qualitative-quantitative.html. Copyright 1990 by Victor Minichiello et al.

Subjective Variables

Student outputs are not only fixed but can also be dynamic and influenced by a multitude of factors. Because of this, throughout the research there is no standard measurement to capture how well a student performs or their probability for academic success. Some researchers emphasize the importance of capturing the educational experience of students instead of solely focusing on fixed test scores. This includes accounting for other factors such as a student's attention in class, effort, willingness to learn, and a sense of belonging to the academic institution (Johnson, et al., 2001).

A student's experience is closely connected to educational outcomes, like completing high school and avoiding problematic behavior and delinquency if they feel like they are a part of their school. While not objective, level of attachment or engagement to the academic institution is important data that can inform ways to help minority students succeed academically (Johnson et al., 2001). Some of the questions asked of a student in Johnson et al. (2001) included whether in the past school year they felt close to people at their schools and were happy to be there. The answers helped determine levels of attachment. To gauge level of engagement, students self-reported on the number of times they skipped class, had difficulty paying attention in class, or completing their assignments.

Other studies focus on capturing the relationships established between teachers and students of the same or different race/ethnicity (Saft & Pianta, 2001) as a way of predicting academic achievement. Sample survey questions asked of teachers addressed levels of conflict (i.e. "Dealing with this child drains my energy"), as well as perceptions of dependency (i.e. "This child asks for my help when he/she really does not need help") (Saft & Pianta, 2001, p. 132). According to Saft & Pianta (2001) study, teacher perceptions and their relationships with students can play a key role in a student's academic and behavioral capabilities because it influences whether a classroom is optimal to help meet the student's needs and strengths.

Additional studies analyze teachers' educational expectations for their student's ultimate educational attainment (Gershenson, et al., 2016), such as estimating whether a student will graduate from high school or pursue a higher degree. Some of the research

focused on teachers' assessment of students' classroom performance and personal traits (Dee, 2005) by inquiring whether the teacher views the student as frequently disruptive or consistently inattentive. The assessment provides a way to learn about biases teachers might have towards students from different demographic backgrounds and the effects these biases have towards a student's academic achievement.

While these qualitative studies analyze the effects of teacher and student relationships and highlight the importance of acknowledging the student experience, policy makers are increasingly more interested in gauging teacher-value added by measuring contributions made to raising student test scores. Initiatives such as President Barack Obama's Race to the Top program underscored the use of quantifiable student outcomes (i.e. grades and test scores) to evaluate teacher performance and effectiveness (Harris, Ingle, & Rutledge, 2014). For example, states and school districts that were interested in receiving this federal funding had to assess and compensate teachers based on contributions made to student achievement, as opposed to engagement or attachment to school (or other qualitative measures).

Studies of Quantitative Dependent Variables

The methodological approach of quantitative research usually involves numerical analysis, such as statistical interpretations (McLeod, 2017) to support or reject a theory or hypothesis. In the case of my thesis question, this involves testing whether there is a positive relationship between a teacher's race/ethnicity and how a same-demographic student performs in standardized testing. Quantitative research aims for objectivity so that the results can exists separately from a researcher's interpretations and another

person can arrive to the same conclusion using the same methods. Quantifiable units of measurement can include objective variables such as student standardized test scores, attendance rates, graduation, college enrollment, and classroom grades. In the following paragraphs, I describe how some studies have measured student academic achievement using quantitative dependent variables.

Objective Variables

Of the academic studies that I found utilizing a quantitative method to measure the effects of teacher race/ethnicity on student academic performance, only three use test scores as the dependent variable. Two studies use state mandated standardized tests scores in reading or math. Dee (2004) uses Stanford Achievement Test scores from Tennessee's 1989 Project STAR public Access Data. The grade level of the student sample is kindergarten through third grade, which limits the implications of the study's findings has on students across all grade levels. A strength of the data is that it is at the class level, meaning the student was matched to the teacher, a mechanism lacking in other studies (Grissom, et al., 2017). Egalite, Kisida, & Winters (2015) also examine math and reading test scores from the Florida Comprehensive Assessment Test, which observes test scores for students in third to tenth grade. Both of these studies use data that are not nationally representative, and their findings are limited in reliability for nation-wide interpretation.

The third study did not use standardized testing and instead focused on test scores in economic courses as an alternative to measure the impact of teacher race/ethnicity. Evans (1992) analyzed the Test of Economic Literacy (TEL) from the Joint Council on

Economic Education's National Assessment of Economic Education (NAEE) Survey. The survey is from 1987 and no other studies have attempted to replicate the investigation to discover if the findings would still hold true. Evans' study is unique in that it only focused on African American and White students, limiting the implications on other race/ethnic student groups.

The two remaining studies I include in the literature review use quantitative dependent variables, but they are not test scores. Grissom, Rodrigues, & Kern (2017) investigate the relationship between a school's diverse teacher and principal population to the number of students enrolled in gifted programs. School educators can play a key role in the enrollment of students of color in gifted and talented programs because the process often first requires that the educator identify the student as potentially gifted and a referral for evaluation of the student. Teacher perceptions of students from different race/ethnicity background might influence whether a student is recommended to be in a gifted program and receive its services.

In another study, Lindsay & Hart (2017) investigate whether exposure to same-race/ethnicity teachers affects the rate at which African American students receive a disciplinary action, such as expulsion, in-school, or out-of-school suspensions. While disciplinary actions of students of color is not in itself a measurement of student academic achievement, it is a factor directly tied to academic success. The more time a student spends outside the classroom, the higher the deficiency in instructional time, which has a negative cyclical effect in a student's academic trajectory. Lindsay & Hart (2017) acknowledge the importance of studying student academic achievement through

conventional studies of dependent variables (i.e. test scores or grades), while emphasizing that alternative methods for studying the impacts of teacher race/ethnicity should encompass the totality of the student's experience, success, and performance.

Teacher Characteristics and Other Explanatory Variables

A critical component of conducting a regression analysis to understand the relationship between the independent and dependent variable is to control for as many explanatory variables as possible. This increases the ability to isolate the true effect the key explanatory variable has on the dependent variable by accounting for all other possible explanations. It is not easy to control for all of the factors that can influence student academic performance and achievement for several reasons. One has to do with the availability of data to create a robust set of potential explanatory variables. Another reason is that the factors that can impact student performs are multifaceted. For example, dynamics outside the school, such as their home environment and residential location, to what happens in the school or classroom (i.e. student population, availability of extracurricular activities, and teacher to student time due to class size) can play a role. Further, it is more complex to capture the many teacher characteristics that influence how same-demographic background students perform academically, such as teacher quality, years of experience, type of college degree and/or credential, and rigor of teacher credential program (Saft & Pianta, 2001; Dee, 2004). From all the academic studies I include in this literature review, I was able to create four categories of independent variables: school, teacher, student, and social explanatory factors.

School, Teacher, Student, and Social Explanatory Factors

Some of the studies have a strong set of independent variables and even create proxies for missing variables, while others omit explanatory factors. Assembling as many of these factors, increases the validity and reliability of the results. In studying the effect of teacher diversity on student math and reading scores, Egalite & Kisida (2018) examine several teacher, student, and social characteristics, such as: teacher gender, years of experience, and advance degree status; student grade level, gender, and race; and social factors like student free or reduced lunch status (a proxy for household income) and language proficiency, and enrollment in gifted programs or special education. The study did not include factors related to school characteristics. On the other hand, Egalite et al. (2015), accounted for school factors like race, poverty, and average school-level achievement. Across studies, the robustness of explanatory variables is not the same, especially when trying to account for teacher quality. Dee (2004) uses years of experience, education level, and merit pay status as a proxy for teacher quality, but does not include social factors (i.e. household income, parent education) and other relevant variables, such as student language proficiency, disability status, urban-city designation, and school size.

Besides teacher ethnicity or gender, half of the studies did not include any other teacher variables (Saft & Pianta, 2001; Johnson et al., 2001; Evans, 1992; Grissom et al., 2017; Lindsay & Hart, 2017). Evans (1992) uses less common explanatory variables, such as the percentage of high school graduates in a given school site and percentage of students who attend college. The study also controls for student Grade Point Average

(GPA), enrollment in college preparatory curriculum and number of hours spent doing homework for economics as well as maternal education. Besides teacher gender and race/ethnicity, no other factors are included. Overall, the most commonly observed variables are student race-ethnicity, gender, and age as well as parent education and subsidized lunch.

Summary of Findings

Findings of Qualitative Studies

One of the most commonly cited studies, Johnson et al. (2001), attempted to study whether African American, Hispanic, and White students had differences in their levels of attachment to school and academic engagement (as opposed to achievement) depending on the school's teacher and student racial-ethnic composition. Despite finding no statistical significance between teacher race/ethnicity and student attachment or engagement, this study has been cited in more than 700 articles related to school success and the importance of peer support (Google Scholar, n.d.). This is due to the statistical significance found in level of attachment for students who attend schools with a greater percentages of *students* of their own race/ethnicity. No statistical significance was found in engagement.

Another commonly cited qualitative study is Dee's (2005) investigation of 8th-grade students from nationally representative public and private schools using a 1988 longitudinal dataset. Utilizing teacher survey responses as the dependent variable, statistical significance indicates that the odds of a teacher seeing a student as disruptive was 36 percent greater when the teacher does not share the student's racial/ethnic

composition. The teacher was also at least 33 percent more likely to view the student as inattentive. Saft & Pianta (2001) found in researching teacher perceptions of their kindergarten students, when a child's and teacher's ethnicity are the same, the teacher is more likely to rate the child more positively. The positive correlation can be interpreted as a benefit for matching students and teachers by ethnicity or race, but can also be problematic if it hints towards having racially congruent schools (as opposed to integration of diverse students and teachers).

The findings of these qualitative studies do not directly tie into my study because not only are the dependent variables subjective, but they also do not directly measure student achievement or performance. Instead this area of research focuses on ways that teacher attitudes might be connected to how a student performs, but such assessment is open for interpretation. These studies appear to indirectly indicate that student attachment or teacher rating might be tied to actual student achievement, but research overall is limited in showing concrete evidence that a student who is more attached to their school or rated less disruptive by a teacher performs better academically.

Findings of Quantitative Studies

The final half of my literature review examines studies more closely tied to my research because the dependent variables are quantitative, although three of these six studies do not analyze standardized test scores (Grissom et al., 2017; Lindsay & Hart, 2017; Evans, 1992), which is the dependent variable I am using for my regression analysis. The two studies using test scores do not use national data to capture a more representative sample of students of color in the United States, but instead use data specific to their state, such as Tennessee standardized test scores from 1985 (Dee, 2004). Dee (2004) found that African American students paired with African American teachers were more likely to experience a four-percentage point increase math scores and a three percentage point increase in reading scores. The statistical significance was at the five percent level, indicating that we cannot reject the null hypothesis of no relationship between teacher race/ethnicity and student test scores at the conventional level of significance testing.

However, Dee omits several explanatory variables that could influence the reliability and validity of the results. A strong statistical regression analysis accounts for as many independent variables possible to isolate the effect of the key explanatory variable (in this case, teacher race/ethnicity). Dee's findings would be more reliable if the methodology of the study had controlled for other crucial factors that could explain the influence on student test scores. Another valid criticism is that such study does not capture current, modern forms of testing due to the year of the study and the evolution of new testing methods. Tennessee may also not reflective of all other states in the country.

Further, the population sample is only of White and African American elementary students in first to third grade, limiting the implications of the study's findings on students across all grade levels and of different ethnicities/races.

Egalite et al. (2015) use Florida-specific standard test scores from students in grades third to tenth. The findings were small but statistically significant positive effects and indicate that when students are matched to a teacher of their own race/ethnicity they are likely to have higher scores in reading and math. African American and White students have a statistically significant interaction effect size of .004 and .005 standard deviations (SD) respectively in reading, and .019 and .007 SD in math. The effects of matching a Hispanic student with a same/race teacher were negative in reading (-.011 SD) and math (-.007 SD). Pacific Islander students also demonstrated benefits in being paired with a teacher of the same demographic background, showing an significant interaction effect size of .039 SD in math.

The population sample of the Egalite et al. (2015) study is more reflective of students across all grade levels, but there are still limitations because Florida students and the education system there does not represent how students may perform nationally due to differences in education standards among states (Tampio, 2017). This means that students are evaluated differently depending upon which state they live. Proficient test scores in Florida may or may not be considered proficient in another state. Compared to Dee (2004), Egalite et al. (2015) controlled for more explanatory variables (see Table 1).

Conclusion

There are not enough studies that use a regression analysis model to examine the relationship between teacher race/ethnicity and same-demographic student test scores, hence there remains a need for a study like the one I designed. Out of the ten articles that I found, only three observe whether my explanatory variable (teacher race/ethnicity) influences the outcome of student test scores (see Table 1).

Dee (2004) and Egalite et al. (2015) both observe state standardized test scores, similar to the dependent variable I will examine. These studies found a positive correlation between teacher race/ethnicity and test scores of some same-race/ethnicity students. Evans (1992) used more narrow student achievement measures by looking at the economic literacy test scores of African American and White students specifically. No other academic peer reviewed studies have shown similar results on the positive effect of teacher race/ethnicity on student standardized test scores.

For my thesis, I will be researching California standardized test scores of African American, Hispanic/Latino, Asian, Pacific Islander, Filipino, and Native American high school students. The findings will focus on California's 2013 educational landscape and not be intended for national interpretation. I also attempt to control for as many explanatory variables possible, by including student race/ethnicity, percentage of students with disability, whether the school has a year round calendar designation, average class size, number of students enrolled on the first day of testing, percentage of teachers with full teaching credentials, among many other social inputs, such as parent education and enrollment in student service programs.

My sample size is representative of the average student in a California high school. I have eliminated schools that are too small in size, charter schools and continuation schools—these schools could skew results given their unique characteristics. I also account for the average household income in the school's region, capturing the influence of socio-economic background on a student's academic achievement. In the next chapter, I will explore this in more detail.

CHAPTER 3: RESEARCH METHODOLOGY

In chapter two, I reviewed past regression analysis based studies that have attempted to analyze the relationship between teacher race/ethnicity and student achievement, teacher and student perceptions, and teacher expectations. Most of the academic research utilized qualitative analyses to discover if it is important for students to be taught by a same-race/ethnicity teacher or attend a school where the majority of educators mirrors their race/ethnicity. My study attempts to add to the minimal quantitative body of research that explores the impacts of teacher race/ethnicity on same-demographic student academic achievement, specifically as it relates to the aggregate standardized test scores of six ethnic/race groups (Hispanic/Latino, African American, Asian, Filipino, Pacific Islander, and Native American) at a California high school.

Regression Analysis

I used multiple regression analysis to discover whether a positive relationship exists between the percentage of teachers of color in California high schools (key explanatory variable) and standardized test scores of same-race/ethnicity students (dependent variable). I aim to learn if a greater percentage of minority teachers leads to higher test scores for the six student categories mentioned earlier. Regression analysis is a quantitative approach that examines the influence that a main independent variable, also known as a key explanatory variable, has on the dependent variable. I conducted this analysis through STATA/IC 15.1, a statistical and data analysis software package. To conduct my analysis, I first gathered the data that provided the necessary variables to

create a robust model (set of factors). In the following sections I review the sources I used to obtain the data and describe the model specification to test my hypothesis.

Data Sources

Source for Dependent Variable

As a measure of student academic achievement, I used the California Academic Performance Index (API), an aggregated test score provided by the California Department of Education (CDEO) to measure performance of schools throughout the state's K-12 education system. The score ranged from a low of 200 to a high of 1000, with the interim statewide performance target for all schools being 800. For the average score per student race/ethnicity group, see Table 3.

The API was calculated using the results of the Standardized Testing and Reporting program and the California High School Exit Exam (CAHSEE), both standardized tests. The Public Schools Accountability Act requested that the API include other performance indicators, such as student graduation rates, but only when deemed reliable (Understanding the Academic Performance Index, 2013). There was no mechanism to know which API scores in my data included graduation rates. The dataset set also includes scores for all grade levels, but I only focused on the API scores of students in grades 9-12; it also provided other important information that I incorporated to my group of explanatory variables (i.e. student, school, and social factors).

It is important to mention that the API dataset was compiled yearly since 1999, but 2013 was the last year the CDEO produced an API report due to new accountability systems (Academic Performance Index, 2018). The CASEE is also a test that is no

longer required for students to take in order to graduate from California public schools (California High School Exit Examination, 2019). In spite of California's new accountability systems for student academic performance, the API scores could still provide insightful findings because they captured a snapshot of how the state evaluated student performance six years ago.

Table 3.
Average API Test Scores per Student Race/Ethnicity

Variable	Observations	Mean	Standard Deviation	Min	Max
AsianAPIScore	525	858	72	588	997
FilipinoAPIScore	423	848	51	667	989
NatAmeAPIScore	144	742	80	469	918
PacIslaAPIScore	118	741	81	488	946
LatinoAPIScore	752	732	67	488	979
AfriAmeAPIScore	514	719	90	436	998

Source for Key and Other Explanatory Variables

The API dataset provided the dependent variable information as well as most of the data needed to compile the explanatory variables. What the API data set did not provide was the race/ethnicity of teachers (the key explanatory variable I am studying) and other independent variables, such as medium household income in the school's region, metro designation (i.e. urban, rural, suburb, etc.), and percentage of population living below poverty level in the surrounding school site.

To gather teacher race/ethnicity I created a report through DataQuest, an online resource provided through the California Department of Education website (DataQuest, n.d.). It allows the public to find and access factual information about schools and

districts in California. To create and download the file, I first indicated the state, county, district, and then the subject of interest (i.e. school staffing, student demographics, etc.). I gathered teacher demographic information for the 755 school sites included in my sample. The other source I used to collect data was the American Fact Finder, a search engine provided by the United States Census Bureau that allows the public to find data on communities in the United States by providing city, county, town, state, or zip code (American Fact Finder, n.d.).

Model Specification

In this section I describe which regression model I chose to test my hypothesis. I also explain the reasoning for all of the variables included to isolate the effect of same-race/ethnicity teacher on the academic performance of students of color. I further justify why I did not include certain factors and the potential implications of this decision.

Log-Lin OLS Model

To test my hypothesis, I used two types of functional forms of the ordinary least squares (OLS) regression model. The OLS model is ideal given that the possible outcomes are continuous (i.e. test scores ranging from a low 200 to a high 1000). The first functional form I considered was Lin-Lin. Using that model I did not find statistically significant results for the key explanatory variable. Due to this, I did not use the Lin-Lin function as the final method to test my hypothesis. Instead, I used the Log-Lin functional form because it resulted in slightly more statistical significant results, most likely due to the fact that a log model is better designed to capture non-linear relationships between the dependent variable and main explanatory variable. In this case,

the dependent variable (Y) is logged, but the explanatory variables (X) are not. This natural logged (ln) model further eases the interpretation of the results because the coefficients reflect percentage changes, such as a percentage change in API test scores. The final step in creating the Log-Lin model consisted of creating interaction variables between the key explanatory variable and all dependent variables. I only added variable pairs in the final model that were statistically significant as an original term and when multiplied with the key explanatory variable.

Below, I present the Log-Lin functional form, which included the possible factors that can affect the API score (Y) of high school students of color throughout California. I utilized the same model but changed the dependent variable to study the API scores of the six race/ethnicity groups (Hispanic/Latino, African American, Asian, Filipino, Pacific Islander, and Native American:

Y = f (Student Inputs, School Inputs, Social Inputs),

where,

Student Inputs = f ({PrcntLatinoStudents, PrcntAfriAmeStudents, PrcntAsianStudents,

PrcntNatAmeStudents, PrcntFilipinoStudents, PrcntPacIslaStudents}—PrcntWhiteStudents

Excluded, PrcntStudentsDisability),

School Inputs = f ({PrcntLatinoStaff, PrcntAfriAmerStaff PrcntAsianStaff,

PrcntNativeAmerStaff, PrcntFilipinoStaff, PrcntPacificIslStaff}—PrcntWhiteStaff

Excluded, AverageClassSize, YearRoundCalendarDesignation, TestedEnrolled, EnrollmentNum1stDayOfTesting, PrcntTchrsFullCredntls),

Social Inputs = f (PrcntSubsidizedLunch, PrcntGiftedTalentedPrgm, PrcntMigrantEdPrgm, PrcntEnglishLearners, PrcntOfParentAnswerDocuments, {ParentPrcntWithHighSchoolEd, ParentPrcntWithCollegeEd, ParentPrcntWithGraduateEd}—ParentPrcntWithLessThanHighSchoolEd Excluded, MedHouseIncome, PrcntBelowPoverty, {MetroOver1Mill, MetroOver250k, MetroUnder250k, NearMetro20k, NotNearMetro20k, NearMetro2to19k, NotNearMetro2to19k}—CompletelyRural Excluded)

Table 4 includes a description of each of the explanatory variables I used in the model and the expected effect on the dependent variable. I excluded the percentage of White students and their API scores because I used this student population as my base to compare the API scores of student ethnic/race groups.

Table 4.
Description of Variables (Unit of measurement is by California High School)

Variable Name	Description	Expected Effect
LatinoAPIScore	2013 Hispanic or Latino Academic Performance Index	-
AfriAmeAPIScore	2013 African American or African American Academic Performance Index	-
AsianAPIScore	2013 Asian Academic Performance Index	-
NatAmeAPIScore	2013 American Indian or Alaska Native Academic Performance Index	-
FilipinoAPIScore	2013 Filipino Academic Performance Index	-
PacIslaAPIScore	2013 Native Hawaiian or Pacific Islander Academic Performance Index	-
PrcntLatinoStudents	Percentage Students Hispanic or Latino	+
PrcntAfriAmeStudents	Percentage Students African American or African American	+
PrcntAsianStudents	Percentage Students Asian American	+
PrcntNatAmeStudents	Percentage Students American Indian	+
PrcntFilipinoStudents	Percentage Students Filipino	+
PrcntPacIslaStudents	Percentage Students Pacific Islander	+
PrcntStudentsDisability	Percentage of Students with Disabilities	-
PrcntLatinoStaff	Percentage Hispanic or Latino Staff at School Site (i.e. teachers, administrators, counselors, guidance & welfare personnel, librarians, psychologists, etc.)	+
PrcntAfriAmerStaff	Percentage African American Staff at School Site	+
PrcntAsianStaff	Percentage Asian Staff at School Site	+
PrcntNativeAmerStaff	Percentage American Indian or Alaska Native Staff at School Site	+
PrcntFilipinoStaff	Percentage Filipino Staff at School Site	+
PrcntPacificIslStaff	Percentage Pacific Islander Staff at School Site	+
AverageClassSize	Average Class Size for a Number of Core Academic Courses	-
YearRoundCalendarDesignation	Multi-Track Year-Round School (YES= 1, NO= 0, .= NA)	+
PrcntTchrsFullCredntls	Percent Teachers at this School with Full Credentials	+
TestedEnrolled	Number of Students Tested	-
EnrollmentNum1stDayOfTesting	Number of Students Enrolled on the First Day of Testing for Grades 2-11	+
MetroOver1Mill	Metro - Counties in metro areas of 1 million population or more	-
MetroOver250k	Metro - Counties in metro areas of 250,000 to 1 million population (YES= 1, NO= 0)	-
MetroUnder250k	Metro - Counties in metro areas of fewer than 250,000 population (YES= 1, NO= 0)	+
NearMetro20k	Nonmetro - Urban population of 20,000 or more, adjacent to a metro area (YES= 1, NO=0)	+
NotNearMetro20k	Nonmetro - Urban population of 20,000 or more, not adjacent to a metro area (YES= 1, NO= 0)	-
NearMetro2to19k	Nonmetro - Urban population of 2,500 to 19,999, adjacent to a metro area (YES= 1, NO= 0)	-
NotNearMetro2to19k	Nonmetro - Urban population of 2,500 to 19,999, not adjacent to a metro area (YES= 1, NO= 0)	-
PrcntSubsidizedLunch	Percentage of Students That Are Eligible in The Free or Reduced Price Meal Program	-
PrcntGiftedTalentedPrgm	Percentage of Participants in Gifted and Talented Education Programs	+
PrcntMigrantEdPrgm	Percentage of Participants in Migrant Education Programs	-
PrcntEnglishLearners	Percentage of Participants Who Are Designated as English Learners	-
PrcntOfParentAnswerDocuments	Percentage of Student Answer Documents with Parent Education Level Information	+
ParentPrcntWithHighSchoolEd	Parent Ed Level: Percent High School Graduate	+
ParentPrcntWithCollegeEd	Parent Education Level: Percent College Graduate	+
ParentPrcntWithGraduateEd	Parent Education Level: Percent Graduate School	+
MedHouseIncome	Medium Household Income	+
PrcntBelowPoverty	Percentage of Individuals living below poverty level	-

To capture students' innate characteristics, which are inherent factors that may play a role in their learning environment, I controlled for race or ethnicity as well as whether they have a disability. As a proxy for school quality, I controlled for average class size, which can indicate over-crowdedness and a limited capacity for teachers to better teach students (Ed 100, n.d.). I also controlled for whether the school site is in a rural or urban location; whether it has a year-round calendar (as indicator of learning time available to students), and enrollment on the first day of testing to capture student participation and engagement and the school's emphasis on importance of attending class and standardized testing. Lastly, I used several variables to capture various societal circumstances facing students, such as poverty level, ability to understand the English language, home environment and stability (i.e. students whose parents work in agricultural jobs), as well as the type of education their parents may or may not have. Table 4 indicates the expected direction of effect for each of the specific causal factors (i.e. positive, negative, or uncertain).

Multicollinearity

To enhance the Log-Lin functional form I checked for multicollinearity, which is redundancy among the explanatory variables. To check for it, I ran the command "estat VIF", which stands for Variance Inflation Factor. The command provides a numerical result for each explanatory variable and if it is above five, it means the variable is very similar to another variable in the model (see Table 5). Such a similarity between factors can mask the effect of the key explanatory variable on the dependent variable. In some

cases, it is important to fix multicollinearity and remove the redundant variable(s) from the model and rerun the regression.

In the case of my regression model, I chose not to remove the variables with VIF scores higher than five. I did this because my key explanatory variable (teacher race/ethnicity) did not exhibit multicollinearity. Additionally, after removing the variables that exhibited multicollinearity from the model, the statistical significance of my key explanatory variable did not change. As a result, I decided to include all explanatory variables to have a more robust set of possible contributing factors to a student's API.

Table 5.
Variance Inflation Factor (VIF)

Variable	VIF	1/VIF
MetroOver1Mill	88.01	0.011362
MetroOver250k	66.26	0.015093
MetroUnder250k	21.47	0.046568
NearMetro20k	9.45	0.105779
NearMetro2to19k	8.13	0.123066
PrcntSubsidizedLunch	7.98	0.12536
MedHouseIncome	5.39	0.185654
ParentPrcntWithGraduateEd	4.7	0.21257
ParentPrcntWithCollegeEd	4.7	0.212857
ParentPrcntWithHighSchoolEd	4.25	0.235144
PrcntBelowPoverty	4.16	0.240175
NotNearMetro2to19k	4.11	0.243501
NotNearMetro20k	3.71	0.269714
PrcntAfriAmeStudents	2.95	0.338705
PrcntEnglishLearners	2.88	0.34684
PrcntAfriAmerStaff	2.68	0.373049
PrcntLatinoStaff	2.35	0.424962
PrcntAsianStudents	2.28	0.438277
PrcntNatAmeStudents	2.18	0.458245
PrcntAsianStaff	1.87	0.534408
AverageClassSize	1.77	0.565361
PrcntFilipinoStudents	1.72	0.58231
PrcntNativeAmerStaff	1.69	0.591005
EnrollmentNum1stDayOfTesting	1.65	0.604626
PrcntMigrantEdPrgm	1.58	0.634413
PrcntFilipinoStaff	1.44	0.695374
PrcntPacIslaStudents	1.43	0.700604
PrcntStudentsDisability	1.4	0.715553
PrcntOfParentAnswerDocuments	1.35	0.739654
PrcntGiftedTalentedPrgm	1.34	0.744117
PrcntTchrsFullCredntls	1.32	0.759131
PrcntPacificIslStaff	1.08	0.924802
YearRoundCalendarDesignation	1.02	0.982921

Note: Mean VIF = 8.13

Heteroskedasticity

The next step I took in addressing other potential statistical flaws in the Log-Lin model was to correct for heteroskedasticity. Unlike multicollinearity, which does not always have to be corrected, heteroskedasticity always has to be addressed. If not corrected, it can skew the statistical significance of the key explanatory variable by generating biased coefficients. To address this potential flaw in my regression model, I conducted a robust regression by adding the command "vce (robust)".

Descriptive Statistics

Table 6 provides a summary of the descriptive statistics for the dependent and explanatory variables, which includes the total number of observations, mean, standard deviation, and maximum and minimum values each variable can take. Dummy variables (binary terms), such as metro designation of the school site location and year-round calendars can only take on a zero or one value. All other variables are continuous, such as the average class size being composed of two students to as large as 35 students.

Table 6.
Descriptive Statistics of All Variables Used

Variable Name	Observations	Mean	Standard Deviation	Min	Max
LatinoAPIScore	752	732	67	488	979
AfriAmeAPIScore	514	719	90	436	998
AsianAPIScore	525	858	72	588	997
FilipinoAPIScore	423	848	51	667	989
PacIslaAPIScore	118	741	81	488	946
NatAmeAPIScore	144	742	80	469	918
PrcntLatinoStudents	755	50	28	2	100
PrcntAfriAmeStudents	755	5	8	0	86
PrcntAsianStudents	755	8	13	0	86
PrcntNatAmeStudents	755	1	4	0	79
PrcntFilipinoStudents	755	3	4	0	43
PrcntPacIslaStudents	755	0	1	0	7
PrcntStudentsDisability	755	10	3	0	23
PrcntLatinoStaff	755	17	14	0	87
PrcntAfriAmerStaff	755	4	7	0	71
PrcntAsianStaff	755	4	5	0	30
PrcntNativeAmerStaff	755	1	1	0	21
PrcntFilipinoStaff	755	1	2	0	19
PrcntPacificIslStaff	755	0	1	0	9
AverageClassSize	755	27	4	10	36
YearRoundCalendarDesignation	755	0	0	0	1
TestedEnrolled	755	99	2	80	100
EnrollmentNum1stDayOfTesting	755	1157	645	112	3749
PrcntTchrsFullCredntls	755	99	2	77	100
PrcntSubsidizedLunch	755	56	27	0	100
PrcntGiftedTalentedPrgm	755	12	11	0	77
PrcntMigrantEdPrgm	755	2	4	0	38
PrcntEnglishLearners	755	12	10	0	77
PrcntOfParentAnswerDocuments	755	84	19	0	100
ParentPrcntWithHighSchoolEd	755	23	10	0	69
ParentPrcntWithCollegeEd	755	19	12	0	100
ParentPrcntWithGraduateEd	755	13	13	0	100
MedHouseIncome	750	65931	26794	22485	174526
PrcntBelowPoverty	751	16	9	3	49
MetroOver1Mill	755	1	0	0	1
MetroOver250k	755	0	0	0	1
MetroUnder250k	755	0	0	0	1
NearMetro20k	755	0	0	0	1
NotNearMetro20k	755	0	0	0	1
NearMetro2to19k	755	0	0	0	1
NotNearMetro2to19k	755	0	0	0	1

Omitted Variable Bias & Data Limitation

Despite my attempt to capture the many explanatory variables that could potentially impact how a student performs academically, there were limitations to the data I used in this study. For example, the API dataset contained a limited number of variables that captured student, school, and social characteristics. In addition, there were other variables that I wanted to include, such as teachers' years of experience, their level of education, subject matter expertise, gender, and where they obtained their teaching credential (i.e. the California State University system or University of California system). However, such information was not readily available or did not have identifiable information that would allow me to associate the variable to a school site. I also did not account for whether the school offered college-level courses and whether students were in sports or any extra-curricular activities. This would have been an indicator of the rigor and quality of the school. Despite the lack of these other variables, the API dataset did provide a number of relevant variables for studying the impact of a teacher's or staff's race or ethnicity on a student's academic performance.

Hypothesis

As noted in Table 4, I hypothesized that having a teacher of the same race or ethnic background would exert a positive influence on a student's academic performance. Hence, my null hypothesis is that teacher race/ethnicity has zero influence, and the alternative hypothesis is that it has a negative influence on API scores. To determine if I could reject the null or alternative hypotheses, I looked for positive regression coefficients that are also statistically significant.

Conclusion

In this chapter I discussed the regression model I used to test whether there was a positive relationship between teacher race/ethnicity and students of the same demographic background. I discussed some of the weaknesses of the model and methods I attempted to strengthen the model specification. In the next chapter, I will be presenting and interpreting the results from these regression analyses.

CHAPTER 4: FINDINGS

In the previous chapter I discussed how I constructed the regression model to test the hypothesis that teacher race/ethnicity would influence the API scores of students from the same demographic background (the null hypothesis being that there would be no such statistical significant influence). In this chapter, I present the final regression results for each of the six races/ethnicities I researched (Hispanic/Latino, African American, Asian, Filipino, Pacific Islander, and Native American).

Log-Lin OLS Model without Interaction Variables

Based on the regression analysis I ran using the Log-Lin OLS model, I was unable to reject the null hypothesis in its entirety. The first column of Table 7 lists the key explanatory variable (teacher race/ethnicity for each of the separate race/ethnic groups), plus all other explanatory factors. The remaining columns show whether matched teacher race/ethnicity had a statistical significant impact on each of the six respective categories of API scores. The results indicated that the key explanatory variable, apart from African American staff, does not influence API scores of same-race/ethnicity students in California high schools. Furthermore, a greater percentage of African American teachers at California high schools in 2013-14 exerted a statistically significant influence on the API score among African Americans students, but the detected effect was negative and of small magnitude.

As illustrated in Table 7, for every one-percentage point increase in the value of this key explanatory variable, the regression coefficient (-0.0020) indicated that the African American API score fell by 0.2 percent. I converted the regression coefficient

into a percentage by multiplying it by 100. I then multiplied the percentage by the unit increase of the explanatory variable. So, for instance, if the percentage of African American teachers at school rose by 10 percent (unit increase by 10), test scores would fall by two percent.

Table 7.
Log-Lin OLS Regression Results for All Race/Ethnic Groups without any Interaction Variables

Explanatory Variable	LatinoAPIScore	AfriAmeAPIScore	AsianAPIScore	FilipinoAPIScore	PacIslaAPIScore	NatAmeAPIScore
PrcntLatinoStaff	-0.00018720 (0.00025840)	-0.00142100** (0.00062600)	-0.00060650 (0.00041830)	0.00016020 (0.00036980)	0.00022170 (0.00144770)	0.00124030 (0.00161920)
PrcntAfriAmerStaff	-0.00175120*** (0.00057350)	-0.00200270** (0.00087090)	-0.00030100 (0.00086780)	-0.00052390 (0.00077610)	-0.00439580** (0.00225400)	-0.00211910 (0.00550980)
PrcntAsianStaff	-0.00091990 (0.00061280)	-0.00043730 (0.00126530)	-0.00040030 (0.00081570)	-0.00059660 (0.00063180)	-0.00147810 (0.00204840)	-0.00892050** (0.00414740)
PrcntFilipinoStaff	-0.00192280 (0.00132100)	-0.00295210 (0.00220700)	-0.00283770 (0.00177520)	-0.00083320 (0.00145150)	-0.01262320*** (0.00425580)	-0.00269730 (0.00570470)
PrcntPacificIslStaff	0.00108730 (0.00196240)	0.00405070 (0.00507210)	-0.00007280 (0.00261200)	0.00247270 (0.00228350)	-0.00226050 (0.01186900)	-0.00443510 (0.01701000)
PrcntNativeAmerStaff	-0.00246380 (0.00181790)	0.00106490 (0.00395860)	-0.00343930 (0.00264650)	-0.00150380 (0.00259630)	-0.00409850 (0.01262440)	0.00260280 (0.00558460)
PrcntLatinoStudents	0.00039210* (0.00023760)	0.00191670*** (0.00053140)	0.00127970*** (0.00027570)	0.00044850* (0.00026290)	0.00066550 (0.00140560)	0.00144200 (0.00111780)
PrcntAfriAmeStudents	-0.00056930 (0.00054170)	-0.00068890 (0.00085560)	-0.00099070* (0.00056230)	-0.00001970 (0.00058680)	0.00060800 (0.00185620)	0.00088920 (0.00279930)
PrcntAsianStudents	-0.00007510 (0.00032220)	-0.00006910 (0.00065560)	0.00064990*** (0.00026430)	0.00011240 (0.00028420)	0.00077700 (0.00136600)	0.00122050 (0.00154990)
PrcntNatAmeStudents	-0.00129270 (0.00112910)	-0.00251440 (0.00371370)	-0.00529440* (0.00324000)	-0.00135690 (0.00234480)	-0.01355470* (0.00781140)	-0.00082960 (0.00176300)
PrcntFilipinoStudents	-0.00030790 (0.00070940)	-0.00075370 (0.00105280)	-0.00059370 (0.00064050)	-0.00143170*** (0.00049220)	0.00053780 (0.00145610)	0.00339270 (0.00434650)
PrcntPacIslaStudents	0.00143500 (0.00294770)	0.00332950 (0.00508520)	0.00656710** (0.00339290)	0.00022550 (0.00301390)	0.01593600* (0.00938230)	-0.00962480 (0.01979220)
PrcntStudentsDisability	-0.00702960*** (0.00083290)	-0.00644100*** (0.00158640)	-0.00408180*** (0.00111270)	-0.00481370*** (0.00106320)	-0.00623620 (0.00424940)	-0.00579250** (0.00301790)
AverageClassSize	-0.00049920 (0.00059290)	0.00193500 (0.00122850)	0.00005240 (0.00084160)	0.00069770 (0.00077460)	0.00316540 (0.00295500)	-0.00194010 (0.00248230)
YearRoundCalendarDesignation	-0.02364940 (0.02924690)	0.02256440 (0.02761620)	0.03240780 (0.04835680)	-0.02659420 (0.01816630)	(omitted)	(omitted)
TestedEnrolled	0.00660110*** (0.00173000)	0.00423690 (0.00461990)	0.00598780*** (0.00238700)	0.00787750*** (0.00304080)	0.01767160** (0.00834810)	-0.00622870 (0.00769500)
EnrollmentNum1stDayOfTesting	0.00002080*** (0.00000401)	0.00001850** (0.00000775)	0.00002000*** (0.00000543)	0.00001780*** (0.00000436)	0.00003820** (0.00001760)	0.00003840** (0.00001930)
PrcntTchrsFullCredntls	0.00247980* (0.00149830)	0.00552820 (0.00344780)	0.00689460** (0.00311870)	0.00983750*** (0.00362650)	0.00839390** (0.00390200)	-0.00054510 (0.00846560)

PrcntSubsidizedLunch	0.00028260 (0.00024980)	-0.00022260 (0.00044130)	-0.00058720** (0.00029480)	-0.00016420 (0.00030570)	-0.00116330 (0.00108880)	-0.00114020 (0.00133240)
PrcntGiftedTalentedPrgm	0.00087130*** (0.00021740)	0.00067150 (0.00047680)	0.00028750 (0.00024100)	0.00051310** (0.00023010)	0.00155760* (0.00087880)	0.00018360 (0.00111590)
PrcntMigrantEdPrgm	0.00128640** (0.00061070)	0.00179740 (0.00239770)	-0.00156220 (0.00177880)	-0.00198850 (0.00174920)	0.00793710** (0.00402600)	-0.00085230 (0.00404220)
PrcntEnglishLearners	-0.00356010*** (0.00047540)	-0.00400480*** (0.00094810	-0.00261310*** (0.00056330)	-0.00172710*** (0.00056780)	-0.00352310** (0.00153020)	-0.00639890*** (0.00246940)
PrcntOfParentAnswerDocuments	0.00020290 (0.00013270)	0.00005640 (0.00023010)	-0.00007230 (0.00013900)	0.00014290 (0.00014340)	-0.00034040 (0.00038360)	-0.00123920*** (0.00046750)
ParentPrcntWithHighSchoolEd	-0.00010270 (0.00050580)	-0.00115550 (0.00104470)	-0.00014530 (0.00063260)	-0.00087110 (0.00072010)	-0.00147270 (0.00167640)	0.00088200 (0.00166450)
ParentPrcntWithCollegeEd	0.00183670*** (0.00039020)	0.00246400*** (0.00077720)	0.00111380*** (0.00041460)	0.00047980 (0.00035800)	0.00048630 (0.00075670)	0.00184180** (0.00087050
ParentPrcntWithGraduateEd	0.00097230*** (0.00034790)	0.00159440*** (0.00060820)	0.00130140*** (0.00040940)	0.00033940 (0.00034760)	-0.00226620 (0.00164770)	0.00231360*** (0.00080620)
MedHouseIncome	-0.00000035** (0.00000017)	-0.00000127*** (0.00000033)	-0.00000023 (0.00000018)	0.00000004 (0.00000018)	-0.00000021 (0.00000072)	-0.00000201 (0.00000133)
PrcntBelowPoverty	-0.00076620** (0.00043210)	-0.00370770*** (0.00086000)	-0.00184050*** (0.00063370)	0.00122510*** (0.00058020)	-0.00020040 (0.00228790)	-0.00262780 (0.00248600)
MetroOver1Mill	-0.06671730 (0.05074660)	-0.10215650*** (0.03046490)	0.04220740 (0.03493090)	-0.00435080 (0.02597280)	-0.02518500 (0.03309280)	0.07558390* (0.04585670)
MetroOver250k	-0.07657730 (0.05057510)	-0.11743070*** (0.03026310)	0.01656620 (0.03355790)	-0.00540970 (0.02584940)	0.01327080 (0.03361540)	0.04474430 (0.05089390)
MetroUnder250k	-0.07731110 (0.05076450)	-0.12196540*** (0.02999670)	0.00127900 (0.03367730)	(omitted)	(omitted)	0.07369480** (0.03443200)
NearMetro20k	-0.09359600** (0.05136990)	-0.01742780 (0.04577830)	-0.07800970** (0.03302340)	(omitted)	(omitted)	0.02244670 (0.03730170
NotNearMetro20k	-0.07597680 (0.05449140)	(omitted)	(omitted)	(omitted)	(omitted)	0.07479240* (0.04213280)
NearMetro2to19k	-0.09011390* (0.05313960)	(omitted)	-0.14092520*** (0.02976660)	(omitted)	(omitted)	0.03898180 (0.03123720)
NotNearMetro2to19k	-0.05066690 (0.05286030)	(omitted)	(omitted)	(omitted)	(omitted)	0.01399960 (0.05021980)
Total Statistically Significant Coefficients	14	13	15	9	10	10

Notes: [1] Confidence Percentage Levels: * = 90% to 94% [p<.10]; ** = 95% to 98% [p<.05]; *** = 99% [p<.01]
[2] Robust standard errors in parenthesis.

Other Findings: Metropolitan Designation, Percentage of Students with Disabilities, and English Learners

I controlled for a total of 35 explanatory variables, of which less than half yielded statistically significant coefficients for each of the six dependent variables. Factors related to metropolitan (metro) and nonmetropolitan (nonmetro) designations appear to have the most impact on student API scores. For example, the API score of African American students attending a California high school in a metro area of fewer than 250,000 population (MetroUnder250k) decreased by 12 percent. This was statistically significant at a 99-percentage confidence level, rendering it a substantial effect. The effect was the opposite for the API score of Native American students. The API score increased by up to seven percent for Native American students attending high schools in counties with a population under 250,000. However, the confidence level was smaller (at a 95-percentage level).

The percentage of students with disabilities and English learners also yielded statistically significant results for five of the six race/ethnic categories. A one-unit increase (one percent) of students with disabilities decreased the Hispanic/Latino API score by 0.7 percent. Hence, if the percentage of students with disabilities increased by 10 percent, the test scores of Hispanic/Latino students fell by seven percent. The decrease in API scores ranged from 0.4 and 0.7 percent for Asian (-0.004), Filipino (-0.004), Native American (-0.005), African American (-0.006), and Hispanic/Latino (-0.007) students.

The percentage of English learners in California high schools also had a negative impact across all the API scores of the six demographic categories I studied. The API scores of Native American students yielded the greatest statistically significant coefficient, indicating that a 1-unit increase in percentage of English learners at California high schools in 2013 would result in a 0.6 percent decrease of the dependent variable. Overall, there were other statistically significant coefficients, but the magnitudes were not substantially relevant. For example, attendance on the first day of testing showed an increase across API scores for all race/ethnic groups, but the greatest magnitude resulted in a 0.00382 percent increase for Native American students.

Log-Lin OLS Model with Interaction Variables

I previously presented the results of a modified version of the Log-Lin OLS model, which incorporated interaction variables. This modification allowed the regression model to capture the influence that other variables had on the key explanatory variable. To ensure reliable results, I only included interaction variables in the model that were statistically significant as original individual factors and when multiplied with the key explanatory variable. After adding the interaction variables, the Log-Lin regression yielded a statistically significant coefficient for the key explanatory variable among Hispanic/Latino, African American, Asian, and Filipino staff (none yielded for Pacific Islander and Native American). Hence, I was able to reject the null hypothesis for the aforementioned race/ethnic groups, but only under certain circumstances.

Results for Hispanic/*Latino API Scores*

Interaction variables depict scenarios where the key explanatory variable interacts with another explanatory variable, changing its effect on the dependent variable. For example, when I accounted for the interaction between the percentage of Hispanic/Latino staff and the percentage of teachers fully credentialed, I discovered that Hispanic/Latino staff does have a statistically significant impact in Hispanic/Latino API scores. For instance, I found that if a California high school did not have teachers with full credentials, a one-percentage point increase in Hispanic/Latino teachers resulted in a 1.41 percent increase in API test scores for Hispanic/Latino students (see Table 8). However, a one-percentage point increase in teachers with full credentials, diminished this positive effect by -0.01 percent. Hence, after a high school reached 98 percent of credentialed teachers, increasing the presence of Hispanic/Latino staff stopped exerting a positive influence in the test scores of Hispanic/Latino students. Utilizing the minimum value of credentialed teachers in my sample, which was 77 percent (see Table 9), I found that the greatest actual effect of adding another one-percentage point increase in Hispanic/Latino teachers in that school site would have resulted in a 0.31 percent increase in Hispanic/Latino test scores. This was a positive effect but it was inelastic because the result was under a one-percentage point increase. This finding suggests that teacher ethnicity makes a difference in how Hispanic/Latino students perform, but only when there are not many highly skilled teachers (as measured by not being fully credentialed).

Table 8.
Hispanic/Latino Teacher Interaction Results
(Teachers with Full Credentials Interaction Variable)

Explanatory Variables in Regression Using Hispanic/Latino API Score as Dependent Variable to Calculate Interaction Effect	**Regression Coefficient (Standard Error)**
PrcntLatinoStaff	0.0141032** (0.0058926)
PrcntLatinoStaff_TchrCredntls++	-0.0001442** (0.0000597)

Notes: ++ = interaction variable
* = 90% to 94% [p<.10]; ** = 95% to 98% [p<.05]; and *** = 99% [p<.01]

Table 9.
Descriptive Statistics of All Variables Used to Measure Interaction Effects

Variable Name	Observations	Mean	Standard Deviation	Minimum	Maximum
PrcntAfriAmeStudents	755	5	8	0	86
PrcntTchrsFullCredntls	755	99	2	77	100
PrcntEnglishLearners	755	12	10	0	77
PrcntOfParentAnswerDocuments	755	84	19	0	100
ParentPrcntWithCollegeEd	755	19	12	0	100

The percentage of parent response documents submitted to the high school (see Table 10) was another explanatory variable that showed a statistically significant interaction with Hispanic/Latino staff. These results indicated that if a high school had a zero percent of parent response documents, a one-percentage point increase in Hispanic/Latino Staff would decrease the API test scores of Hispanic/Latino students by -0.28 percent. However, for every one-percentage point increase of parent answered documents, this influence of Hispanic/Latino staff increased by 0.0036 percent. Hence, after a school reached a 78 percent level of completed parent response documents,

increasing the percent of Hispanic/Latino staff turned into a positive effect for the Hispanic/Latino API score.

I obtained from my sample the maximum value of the percentage of parent response documents (100 percent) and concluded that the effect of adding another percent of Hispanic/Latino staff in a high school with significant parent engagement, resulted in a 0.08 percent rise in Hispanic/Latino test scores. Albeit having an inelastic effect, the results indicated that ethnicity congruence can positively impact the test scores of Hispanic/Latino students when combined with high levels of parent engagement (as measured by the percentage of parent response documents submitted to the high school). This finding aligns with previous research that finds that parental involvement correlates with higher student test scores (Griffith, 1996).

Table 10.
Hispanic/Latino Teacher Interaction Results
(Parent Response Interaction Variable)

Explanatory Variables in Regression Using Hispanic/Latino API Score as Dependent Variable to Calculate Interaction Effect	**LatinoAPIScore**
PrcntLatinoStaff	-0.002799*** (0.000699)
PrcntLatinoStaff_ParResp^{++}	0.0000357*** (0.00000833)

Notes: ++ = interaction variable
* = 90% to 94% [p<.10]; ** = 95% to 98% [p<.05]; and *** = 99% [p<.01]

Results for African American API Scores

The percentage of African American staff in a high school site also demonstrated an interaction effect with the percentage of African American students (see Table 11). These results indicated that if the high school had a zero percent of African American

students, a one-percentage point increase in African American staff would result in a -0.17 percent decrease in the API test scores for African American students. However, this negative effect stopped after the high school population consisted of at least 48 percent African American students. The highest percent of African American students in my sample was 86 percent , so the effect of adding another percent of African American staff in that school resulted in a 0.14 percent rise in African American test scores (an inelastic, positive effect). The results indicated that the African American API depends not only on the percentage of African American staff, but also the percentage of African American students, suggesting that this student group potentially reaps benefits from a congruent student body.

Table 11.
African American Teacher Interaction Results
(African American Students Interaction Variable)

Explanatory Variables in Regression Using African American API Score as Dependent Variable to Calculate Interaction Effect	**AfriAmeAPIScore**
PrcntAfriAmerStaff	-0.0017254*** (0.0009287)
PrcntAfriAmerStaff_AfAmStuds++	0.0000573*** (0.0000237)

Notes: ++ = interaction variable
* = 90% to 94% [p<.10]; ** = 95% to 98% [p<.05]; and *** = 99% [p<.01]

The percentage of parents with a college education was the fourth explanatory variable that when interacted with the percentage of African American staff resulted in a statistically significant influence (see Table 12). For example, if zero percent of parents had a college education in a given California high school, a one-percentage point increase in African American Staff would result in a -0.31 percent decrease in API test scores of African American students.

However, as parents with a college education increased by one-percentage point, then the influence of African American teachers increased by 0.015 percent. Hence, if more than 21 percent of parents had a college education, adding additional African American staff turned into a positive influence in the African American API. For instance, the highest percent of parents with a college education in my sample was 100 percent. The effect of increasing African American staff in that high school site would result in a 1.20 percent rise in African American test scores. This was a slightly high elastic and positive effect because the African American API would increase by over one-percentage point. These findings demonstrate that increasing the presence of African American staff can have a positive effect on African American student performance, but only when a certain percent of parents possess a college education. This makes sense because parental education attainment is proven to contribute positively to the academic outcomes of students (Alexander, Entwisle, & Bedinger, 1994).

Table 12.
African American Teacher Interaction Results
(Parents with College Education Interaction Variable)

Explanatory Variables in Regression Using African American API Score as Dependent Variable to Calculate Interaction Effect	**AfriAmeAPIScore**
PrcntAfriAmerStaff	-0.00309*** (0.0010319)
PrcntAfriAmerStaff_ParCollEd^{++}	0.0001511** (0.0000667)

Notes: ++ = interaction variable
* = 90% to 94% [p<.10]; ** = 95% to 98% [p<.05]; and *** = 99% [p<.01]

Results for Filipino API Scores

Filipino staff, like the Hispanic/Latino staff effect on Hispanic/Latino API test scores, also interacted with the percentage of teachers with full credentials to yield higher Filipino test scores (see Table 13). In this interaction, the results indicated that if a high school site had no teachers with full credentials, a one-percentage point increase in Filipino staff resulted in a 25 percent increase in the API test scores of Filipino students. The positive effect of adding Filipino Staff only continued up until there were 99 percent of credentialed teachers. In my sample of California high schools there was not a school site that had zero percent of teachers with full credentials. The lowest percent of credentialed teachers in the data was 77 percent, so the effect of adding another percent of Filipino staff in that high school would have resulted in a 6 percent rise in Filipino test scores.

This was a positive and substantially significant increase, demonstrating that for the API scores of certain race/ethnic groups (i.e. Filipino and Hispanic/Latino), the effect of teacher ethnicity depends on teacher quality. It is not clear why teacher ethnicity had a statistically significant interaction with the percentage of fully credentialled teachers for

only these two race/ethnic groups, and not the other demographic categories. Nevertheless, this finding indicates that attending a school with a high percentage of same-race/ethnicity educators does not uniformly impact the academic performance of all students of color.

Table 13.
Filipino Teacher Interaction Results
(Teachers with Full Credentials Interaction Variable)

Explanatory Variables in Regression Using Filipino API Score as Dependent Variable to Calculate Interaction Effect	**FilipinoAPIScore**
PrcntFilipinoStaff	0.2524093** (0.1238311)
PrcntFilipinoStaff_TchrCredntls^{++}	-0.0025435** (0.0012436)

Notes: ++ = interaction variable
* = 90% to 94% [p<.10]; ** = 95% to 98% [p<.05]; and *** = 99% [p<.01]

The last interaction that revealed statistically significant findings was between Filipino staff and the percent of English Learners in a high school site (see Table 14). Such findings indicated that if a school had no English Learners, a one-percentage point increase in Filipino staff would result in a -0.46 percent decrease in API test scores for Filipino students. However, for every one-percentage point increase in English Learner students, this influence increased by 0.021 percent. Hence, the negative effect of adding Filipino staff in a California high school stopped after there were at least 22 percent English Learner students. The highest percent of English Learner students in my sample was 77 percent, so the effect of adding another percent of Filipino staff in that high school site resulted in a 1.15 percent rise in Filipino API test scores (a slightly elastic effect). It is not clear why the positive effect of Filipino educators on the Filipino API

depends on the percentage of English Learners. Perhaps, the findings suggest that teacher ethnicity impacts mostly Filipino students attending schools with diverse student populations.

Table 14.
Filipino Teacher Interaction Results
(English Learners Interaction Variable)

Explanatory Variables in Regression Using Filipino API Score as Dependent Variable to Calculate Interaction Effect	**FilipinoAPIScore**
PrcntFilipinoStaff	-0.0045578** (0.0024068)
PrcntFilipinoStaff_ESLStuds^{++}	0.000209** (0.0001149)

Notes: ++ = interaction variable
* = 90% to 94% [p<.10]; ** = 95% to 98% [p<.05]; and *** = 99% [p<.01]

Conclusion

In this chapter I presented the findings from the regression model. I was only able to reject the null hypothesis (i.e. that there is a lack of a relationship between teacher ethnicity and API scores for ethnically matched students) for African American using a Log-Lin OLS regression model, without accounting for the effect of interaction variables. Adding interaction variables, I was able to find a significant relationship between teacher ethnicity and ethnically matched student scores under some but by no means all circumstances. In the final chapter of this thesis, I discuss possible explanations as to why I was unable to reject the null hypothesis in its entirety and policy lessons learned from these results.

CHAPTER 5: CONCLUSION

The lack of racial diversity in the teacher workforce across the United States is a prevalent, salient topic of discussion for policy makers, educators, and advocates who are concerned that teachers generally do not reflect the race/ethnicity of students in their classrooms (Geiger, 2018; Miller, 2018). This disproportion is true in California, where White teachers dominate the profession (Freedberg, 2018), accounting for over half of the teacher population, while nearly 75 percent of students are students of color. Stakeholders view the demographic disproportion as a possible contributing factor to the academic disparities, or achievement gap, between White students and students of color.

To better understand the impact of teacher ethnic diversity on the academic performance of students of color, I conducted a quantitative analysis of California secondary data. More specifically, I used high school level 2013 data from the California Department of Education to construct a statistical model to research whether teacher race/ethnicity had a statistically significant effect in the aggregate Academic Performance Index (API) scores of Hispanic/Latino, Asian, Pacific Islander, Filipino, or Native American students at traditional public high schools.

This thesis presented three major findings. First, with only one exception, I did not find evidence to support the general statement that teacher and staff race/ethnicity exerts a statistically significant effect on the API scores of students of the same race/ethnicity. The exception was for African American, where the correlation is negative. My second overall finding was that under special circumstances, educator race/ethnicity does exert both positive and negative impacts on the test scores of students

of the same race/ethnicity. My third major finding in this analysis was that other factors, aside from teacher and staff race/ethnicity, exert statistically significant influences on the aggregated standard test scores of students at a California high school. In the remainder of this concluding chapter, I discuss and analyze its findings and policy implications and recommendations for policy makers, educators, and stakeholders interested in finding ways to help increase the academic performance of students of color in California. Finally, I also discuss the limitations of my thesis and provide recommendations for future research.

Discussion

Limited Statistical Significance

Using regression analysis, I was unable to consistently find that teacher and staff race/ethnicity has a statistically significant influence on demographically matched API scores across each of the six race/ethnic groups I studied. The African American API score was the only category influenced by the percentage of African American staff. Results revealed that a one percentage-point increase in African American educators in a California high school in 2013 correlated with the African American API score decreasing by 0.2 percent. Though the response was inelastic (meaning that a one-percentage point increase in an explanatory variable resulted in less than a one-percentage change in the dependent variable), it was still statistically significant. These results were surprising for two reasons. One reason is that African Americans were the only group for which I found a statistically significant regression coefficient. I had hypothesized that all six race/ethnic groups would show statistically significant results.

Moreover, the relationship between African American staff and performance of matched students was in fact negative. This not only contradicted my hypothesis but also two of the studies I discussed in my literature review. Dee (2004) and Egalite et al. (2015) found that African American students paired with same-race/ethnicity teachers correlated with higher test scores. However, the regression model in Dee's (2004) study did not account for other possible contributing factors to student test score outcomes, such as parental education, parental engagement in school, medium household income, percentage of students with a disability, English Learner status, school region location, district size, total days of instruction in a year, and availability of after school or summer school student support programs. Egalite et al. (2015) not only did not incorporate many of these same variables, but also did not indicate whether any statistical flaws, such as heteroskedasticity, were fixed to ensure reliable results of the regression model.

Not finding a statistically significant correlation between teacher race/ethnicity and the API score for five of the six race/ethnic categories was not what I had hypothesized. However, the findings did generally align with the literature review I conducted. The amount of literature focusing on the effect of teacher race/ethnicity on same race/ethnicity student test scores was limited to three studies (Dee, 2004; Egalite, et al., 2015; Evans, 1992). Most academic studies I found related to this topic focused on qualitative dependent variables, such as student sense of belonging and teacher bias towards students of color. Those studies that did utilize test scores as a dependent variable ultimately showed limited evidence that teacher race/ethnicity unequivocally contributes to higher test scores of all demographically matched students. Also, these

studies involved individual outcomes and not the aggregate high school outcomes used in this thesis.

Statistical Significance Only Under Special Circumstances

The main regression analysis I ran did not account for the interaction effect that educator race/ethnicity could have at different values on other explanatory variables. Without including such an interaction variable between two explanatory variables (i.e. teacher race/ethnicity and another variable), a regression coefficient only indicates the influence of a single explanatory variable on the dependent variable, holding all else constant. To uncover the possibility of statistically significant interaction effects, I conducted other explanatory regressions that included interaction variables. The results indicated that, depending on other factors, educator race/ethnicity can positively influence student API scores.

For example, consider the main finding that a greater percentage of Hispanic/Latino or Filipino teachers exerts no overall effect on same race/ethnicity API scores. But the effect changes as the percentage of teachers with full credential changes. When the majority of a school is composed of teachers with full credentials, Hispanic/Latino and Filipino teachers demonstrate a correlation with higher API scores for same race/ethnicity students. This makes sense because credentialed teachers are more qualified and skilled in their profession, which would contribute to higher gains in student achievement and learning outcomes (Darling-Hammond, 2004). Highly skilled educators, combined with the positive influence of the role model effect that teacher of colors can have on students of the same background (Ingersoll, May & Collins, 2011;

Villegas, Strom, & Lucas, 2012) suggests that the quality of school educators is critical in determining student performance. Without accounting for interaction variables, a standard multiple regression analysis cannot fully answer the question of whether teacher race/ethnicity affects same race/ethnicity student API scores.

It not clear why the influence of the interaction between educator race/ethnicity and teacher credentials was only detected for Hispanic/Latino and Filipino, but not the other demographic groups (i.e. African American, Asian, Native American, and Pacific Islander). It is possible that I had insufficient data, or there was too small of a population among some of these race/ethnic categories for the regression analysis to capture significant correlations. It is also possible cultural differences and nuances among these groups differently impact student achievement process. For instance, Asians are largely portrayed and perceived as one of the most successful minority groups in America (Miranda & Lindgren, 2006). As a result, these views could impact how Asian students perform. Asian students may be treated more favorably by staff (DeCastro-Ambrosetti & Cho, 2011) and the students themselves may have internalized model minority behaviors (Kim & Lee, 2014) to compensate for the lack of same-race/ethnicity and well-qualified teachers.

Testing for other interaction variables, I found that in combination with educator race/ethnicity, parents also play a key role in determining API score outcomes. For instance, Hispanic/Latino API scores increased when there was a high percentage of parent engagement in school matters (as demonstrated by the proxy variable that captured the number of submitted parent surveys regarding their education background). This

aligns with research that has demonstrated the link between parental involvement in school-related activities to positive academic achievement (Wilder, 2014).

Additionally, the percentage of African American teachers was correlated with higher test scores when there was a greater percentage of parents with a college education. This finding resonates with past studies that have found parental education attainment is correlated with a higher likelihood of academic success and grade-point average for minority students (Gooding, 2001). For African American students, the level of parent education has shown to contribute significantly to literacy achievement (Davis-Kean, 2005). Overall, my findings indicate that the influence of school factors (teacher and staff race/ethnicity) on Hispanic/Latino and African American API scores depends on family factors like parent engagement and education.

Other Factors that Impact Student API Scores

The purpose of this thesis was to research whether teacher and staff race/ethnicity had an impact on the API scores of same-race/ethnicity students. However, through this research I found there are also other variables (i.e. metro designation, percentage of students with disabilities, and percentage of English Learners) that significantly impact the API scores of certain race/ethnic groups. First, the API score of African American students attending a high school in a county in a metro area of fewer than 250,000 population dropped by 12 percent, while the Native American API increased by seven percent. The eight counties with this metro designation in my sample included Butte, Imperial, Kings, Madera, Napa, Shasta, Sutter, and Yuba. The Rural County Representatives of California organization designates these counties as rural, apart from Kings (RCRC, n.d.). However, the California Communities Program of University of California explains there are differences among rural counties. Some counties are entirely rural while others are predominantly rural (Quick Facts about Rural California, n.d.). I do not have the percentage level rural for each of the eight counties in my data.

Rural districts generally tend to face greater financial distress than urban districts due to inadequate funding, often a result of state funding formulas (Jimerson, 2005), which negatively impacts student outcomes (Peske & Haycock, 2006). This could potentially help explain the negative impact on African American student test scores, but not the increase in test scores for Native American students. For instance, a study researching the educational aspirations of African American males in rural high schools found a correlation between rural settings and lower academic aspirations (Strayhorn,

2009). The findings are limited to males and do not fully explain my own thesis findings, but it does corroborate the negative influence rural communities can potentially have on students of color.

The composition of the student body also had a statistically significant impact on the API scores of certain race/ethnic groups. An increase in the percentage of students with disabilities resulted in inelastic lower API scores (under 1 percent) for Hispanic/Latino, Asian, Filipino, African American, and Native American students. An increase in the percentage of English Learners also decreased the API among Hispanic/Latino, Asian, Filipino, African American, Native American, and Pacific Islander.

These findings were not surprising because English Learners are more likely to attend schools with lower standardized test scores (Fry, 2008); further, English Learners are more likely to be concentrated in schools with insufficient and less experienced teachers. My regression analysis might be capturing these realities and not necessarily mean that English Learning attribute to lower test scores. It is also not surprising that the percentage of students with disabilities would be associated with lower API scores for the six minority groups I studied. Students of color are more likely to be overidentified as having a disability (Artiles, Harry, Reschly, & Chinn, 2002), possibly explaining the close correlation between percentage of students with disabilities and lower API scores for all six minority groups.

Policy Implications and Recommendations

Diversity and Quality Must Go Hand in Hand

California has the largest teacher diversity gap in the United States. There are far more students of color than there are teachers reflecting that diversity. Policy makers, educators, and other interested stakeholders wanting to close this gap must implement approaches that address not only the quantity and representation of teachers of color, but also the quality of this teacher pool. Most empirical evidence, including the evidence presented in this thesis, has overwhelmingly shown that teacher and staff race/ethnicity alone does not explicitly determine the test scores of students of the same background.

Teacher and staff race/ethnicity do, however, have an impact when it is combined with a higher percentage of fully credentialed teachers. This indicates that policies seeking to diversify the California teacher workforce should equally focus in preparing, attracting, and retaining prospective teachers into programs that help qualify them to meet the needs of a diverse population. Too often, teachers who are under-prepared are concentrated in schools with larger populations of minority students. These schools do not merely need more teachers who reflect the race or ethnicity of their students. These high schools need teachers with expertise, who have received training, education, and appropriate certification to teach on various assignments while working with diverse student groups.

No "Cookie Cutter Solutions"

I studied six different minority groups to research the impact of teacher race/ethnicity on their test scores. All the results had one thing in common: the impacts are different among the various types of minority groups accounted for in this thesis. Hispanic/Latino and Filipino showed greater API scores when there was a high percentage of fully credentialled, same-race/ethnicity teachers. For the Filipino API, if a high school had no fully credentialled teachers, adding a one-percentage point increase in Filipino teachers correlated with a 25 percent increase in Filipino API. For the Hispanic/Latino API doing the same with Hispanic/Latino teachers, correlated with a 1.41 percent increase in the Hispanic/Latino API. Even among these two demographic groups, the magnitude is greater for one, further suggesting not all groups are impacted the same. The other race/ethnic groups did not exhibit any statistical significance correlations in this area.

Additionally, Native Americans in rural counties had a higher API when there was a high percentage of Native American educators. African American students attending high schools in rural counties on the other hand reflected the opposite when there was an increase in African American teachers. What this indicates is the need to reach a greater understanding of the unique needs of California's diverse racial/ethnic student population. This warrants local research because of the range in student diversity that exists across the state.

The way California currently funds K-12 appears to acknowledge the need to move away from "cookie cutter" solutions because certain student groups have different

needs than others. For instance, the Local Control Funding Formula (LCFF) provides additional funding for school districts with high numbers and a concentration of English Learners, foster youth, and students from low-income backgrounds. The funding is intended for services and supports that will meet the unique needs of these student groups. Perhaps the LCFF can also include in a similar fashion additional funding for students with disabilities. For instance, this thesis found that a high percentage of students with disabilities is correlated with lower API scores for almost all minority groups. Ultimately, my analysis indicates that not all students of color are impacted in the same way by attending high school with higher percentage of teachers and staff of the same race/ethnicity. Since students are impacted differently, policy solutions should reflect approaches informed by these differences.

Limitations

In chapter three, I discussed limitations with my research. For instance, while I controlled for major explanatory variables, such as student social economic status and teacher credentials, there were still other omitted variables. Due to limited availability of data, I was not able to account for a teacher's years of experience, level of education, subject matter expertise, gender, and the institution where they obtained their credential, as well as other indicators of school quality and rigor (i.e. student to teacher ratio, availability of college-level courses, and after school programs). These omitted variables can limit the regression analysis to unequivocally capture the individual effect of educator race/ethnicity.

There was also a limitation with the dependent variable, the Academic Performance Index (API), because it was composed of outdated academic state standards to measure students' knowledge (Fensterwald, 2014). The API was discontinued in 2013 and in 2017 was replaced with a new accountability system, the California School Dashboard (California Department of Education, n.d.). The new accountability system takes into account other measures of student success and outcomes by including suspension rates, graduation rates, college/career preparation, and English Learner progress—and as such, expands the focus beyond test scores. New updated data on these new accountability factors could offer a different approach to research the influence of teachers of color on same-race/ethnicity student success.

Another limitation with my research was that I did not have classroom-level data to know which students were matched to teachers of the same race/ethnicity, nor did I have teacher-only data. Data that tracks a student to their classroom teacher is not readily available. The California Longitudinal Pupil Achievement Data System (CALPADS) tracks individual student-level data over time, but you must be an authorized local education agency user to access the information (CALPADS System Documentation, n.d.). Further, my sample data included the percentage of teachers and staff of color. Hence, my results incorporate not only teachers, but administrators, counselors, and other educators in California high schools. So, I was not able to study exclusively the influence of teachers. Disaggregated data that only accounted for teachers was not available in public files provided by DataQuest from the California Department of Education.

Lastly, the findings of my study focused on traditional California high schools, which excluded charter schools, continuation schools, and other non-traditional schools. Future research could focus on non-traditional schools to study the effects of teacher race/ethnicity on students attending these school categories. Ideally, future research would also include national samples of secondary institutions. The findings of this thesis are not intended to be representative of the United States, and instead provide a local glimpse of California's secondary education landscape.

Recommendations for Future Research

To say that teachers of color do not influence the academic trajectory of students of the same race/ethnicity in California would be incorrect. While my study had limitations, it did suggest that under certain circumstances and for certain demographic groups, educators of the same background can make a difference in student test scores. Future research in this topic could strengthen the findings of my thesis and increase the limited amount of empirical evidence surrounding the topic. This could be accomplished by: 1) narrowing the sample data of the explanatory variable to include only teacher percentage; 2) including more explanatory variables to better control for teacher influence; and 3) replacing the dependent variable with a different measure of student success, such as graduation rates or suspension rates. These variables could perhaps offer a more appropriate approach to measure the value teachers of color impart on same race/ethnicity students.

Gathering new variables would require working with the California Department of Education to obtain all the necessary data, as well as researching alternative data bases

to obtain information not collected or provided by the Department. If none of my recommendations are possible, a last recommendation would be to use the same data used for this thesis, and divide the sample of high schools into two categories (i.e. one with a higher and lower medium household income) to better study the impact of teacher race/ethnicity on students attending high schools in higher- and lower-income neighborhoods.

It is evident that an achievement gap exists between students of color and White students in California. Policy makers, educators, and stakeholders want to address this gap. Conventional wisdom and limited research hint that diversifying the teacher workforce will help close this gap. However, unequivocal evidence that this is the case did not surface in the findings of this thesis.

This thesis revealed that the factors that contribute to student success are multifaceted and simply increasing teachers of color would not provide the solution. Furthermore, while there are benefits to increasing teacher diversity to reflect the student population, such as the role model effect that teachers of color can impart on minority student groups, more research is needed to formulate informed policy decisions. Policy decisions that are based on research can help ensure that California makes strides to close the achievement gap for students of color. These policy decisions should maintain at the forefront the need to increase the pool of qualified teachers, who are prepared to meet the diverse needs of students across the state, while recognizing that a “cookie-cutter” approach will not help close the achievement gap for all students of color.

APPENDIX A
REGRESSION STUDIES SUMMARY TABLE

Author & Title	Sample Characteristics	Research/ Regression Model	Research Focus	Key & Other Explanatory Variables	Dependent Variable (Related to Minority Student Success)	Research Findings
Johnson, Crosnoe, & Elder (2001) Students' attachment & academic engagement: The role of race & ethnicity.	**Sample Size:** 90-minute in-home interviews of 8,104 students from 109 middles schools & high schools from 80 different communities. **Data Type:** Cross sectional. **Data Source(s):** National Longitudinal Study of Adolescent Health (AddHealth). **Supplemental AddHealth Data Sets:** Parent Data Set, School Administrator Data Set, & aggregated responses from students on the in-school questionnaire.	Hierarchical linear models	**Students' educational experience:** Study whether White, African American, & Hispanic students differ in their levels of attachment to school & academic engagement depending on the % of same-race/ethnicity students & teachers.	**Key Explanatory Variable(s):** School racial-ethnic composition (% of White teaches & same-race/ethnicity students). **Other Variables:** School: region, urbancity status, school type (private or public), schools' grade point average, & size. Teacher: NA. Student: gender & age. Social: number of parents at home & parents' education & educational expectations.	Minority students' academic attachment & engagement (versus achievement). **Attachment** (psychological) defined by whether in the past school year, students felt close to people at their schools, felt like they belonged, & were happy to be there. **Engagement** (behavioral) students' self-report on the number of times they skipped school, had difficulty in paying attention in class, & had trouble completing homework.	**Teacher race/ethnicity:** no statistical significance (SS) in attachment or engagement. Note: study did not have same-race/ethnicity teacher data, only estimated %of White teachers. **Same race/ethnicity student:** no SS in engagement for students who attend schools with greater % of students of their own race/ethnicity. SS in attachment; stronger for middle school students [.09 standardized coefficient; ($p < .001$)] than high school students [.04 standardized coefficient; ($p < .001$)].
Saft & Pianta (2001) Teachers' perceptions of their relationships with students: Effects of child age, gender,	**Sample Size:** 197 teachers rated 840 students in preschool & kindergarten (average age: 4 years & 7 months).	Ordinary Least-Squares (OLS)	Examine the relation between African American, White, & Hispanic teachers' perceptions of their relationships with	**Key Explanatory Variable(s):** Teacher race/ethnicity. **Other Variables:** School: NA.	STRS Total score (combined scores of teacher's perceptions on levels of closeness, conflict, & dependency with students).	**Overall Teacher's Rating of Child:** When a child & teacher's ethnicity were the same, the teacher was likely to

& ethnicity of teachers & children.	**Teacher ethnicity:** 71.1% White, 14.2% African American, 10.2% Hispanic. **Data Type:** Teacher report questionnaire measuring perceptions of relationships with students (closeness, conflict, & dependency scores). **Data Source(s):** Student-Teacher Relationship Scale (STRS) from AZ, CA, CT, CO, NV, & VA.		students & (a) teacher ethnicity, (b) child age, ethnicity, & gender, & c) the ethnic match between teacher & child.	Teacher: NA. Student: age, ethnicity, & gender. Social: maternal education, family income (Note: nonuniform data).	Note: Student achievement is not defined or directly measured in this study. Instead, the dependent variable is the teachers' ratings of student conduct & academic achievement (STRS scores). STRS is shown to be correlated with student academic performance outcomes.	rate the child more positively (t-value 4.04, $p < .001$). This was particularly true for Hispanic children. The total model accounted for only 4.5% of explained variance with interaction terms & ethnic match variables accounting for the majority (3.1%).
Egalite & Kisida (2018) The effects of teacher match on students' academic perceptions & attitudes.	**Sample Size:** 93,386 student observations, 1,591 teachers, 284 participating schools from 6 school districts across the United States, ranging from 4th grade to middle school. **Teacher Ethnicity:** 57% White,37% African American, & 6% Hispanic. **Data Type:** Student surveys over 2009–2010 & 2010–2011 school years, from the following states: NC, TX, CO, FL, TN, & NY. **Data Source:** Gates Foundation's Measures	OLS	Estimate how assignment to a demographically similar teacher (African American, White, or Hispanic) affects students' academic perceptions & attitudes (APA) & assessment of classroom environment by utilizing student surveys that are directly tied to their classroom teachers.	**Key Explanatory Variable(s):** Teacher race/ethnicity mismatch. **Other Variables:** School: NA. Teacher: gender, years of experience, & advanced degree. Student: gender, race/ethnicity, grade level. Social: free reduced lunch, English learner, enrollment in gifted programs or special education.	Students' self-reported academic perceptions & attitudes of classroom environment, captured through 9 measurements/scales indicating if:1) a student feels cared for by his or her teacher, 2) student interest & enjoyment of classwork, 3) the quality of teacher–student communication, 4) clarity in teaching style & methods, 5) students' self-assessment of their teachers' influence on their own effort & motivation, 6) classroom management, 7) students reporting if they feel pushed by their teachers, 8)	Students who do not share their teacher's race/ethnicity, report having more negative perceptions across the dimension of Care, Clarify, & Control than students in the same classroom who do share their teacher's race/ethnicity (range from −0.03 to −0.04 SD, $p < .05$). No SS shows for the other scale dimensions pertaining to race.

	of Effective Teaching (MET) project.				students' happiness in class, & 9) a measure of students' college aspirations.	
Gershenson, Holt, & Papageorge (2016) Who believes in me? The effect of student–teacher demographic match on teacher expectations.	**Sample Size:** 16,810 student–teacher dyads, each containing exactly two teacher expectations per student, part of a nationally representative cohort of U.S. 10th grade students. **Data Type:** Report of math & reading teachers' educational expectations of their students. **Data Source(s):** Educational Longitudinal Study of 2002 (ELS) conducted by the National Center for Education Statistics (NCES).	Linear Probability Model	Investigate whether student–teacher demographic mismatch affects high school teachers' expectations for students' educational attainment.	**Key Explanatory Variable(s):** Teacher race/ethnicity mismatch. **Other Variables:** School: NA Teacher: experience, graduate degree, & major in subject taught. Student: 9th grade GPA, & math/reading scores. Social: Maternal education & household income.	Teachers' educational expectations for each student's ultimate educational attainment.	Teachers are 3 percentage points more likely to expect low levels of educational attainment for students of different racial backgrounds than they are for students of the same race. The effect is positive, small in magnitude, & only marginally SS ($p < 0.10$). **Non-African American Teachers (mostly White):** 12 percentage points more likely to have lower expectations of African American students [($p < 0.01$)]. **African American teachers:** 8 percentage points more likely to report higher expectations for African American students than White teachers ($p < 0.10$).
Dee (2005) A teacher like me: Does race, ethnicity, or gender matter?	**Sample Size:** 21,324 8th-grade student from 1,052 public & private schools. **Data Type:** Teacher surveys; longitudinal	Logit Model	Evaluate whether assignment to a demographically similar teacher influences the teacher's subjective evaluations	**Key Explanatory Variable(s):** Teacher gender & race/ethnicity. **Other Variables:**	Teacher's assessment of students' classroom performance/personal traits defined by whether the student was seen as frequently disruptive, consistently	The odds of a student being seen as disruptive by a teacher are 1.36 times as large when the teacher does not share the student's racial/ethnic

	study. **Data Source(s):** National Education Longitudinal Study of 1988 (NELS:88), a nationally representative, longitudinal study that began in 1988.		of student behavior & performance.	School: class size & region location. Teacher: education level & experience. Student: gender & race/ethnicity. Social: socio-economic status.	inattentive, or rarely completed homework.	designation (SS at the 1-percent level). Having a teacher who does not share a student's racial/ethnic designation increases the odds of the student being seen as inattentive by at least 33% (SS at the 1% level) & the odds of rarely completing homework by at least 22% (SS at the 5% level).
Dee (2004) Teachers, race, & student achievement in a randomized experiment.	**Sample Size:** 11,600 elementary students from 79 participating Tennessee schools (inner-city, suburban, rural, & urban). **Data Type:** A 4-year study that began with kindergarten students in fall of 1985 (included information on class size & test score data).**Observations:** 23,883 on the math test & 23,544 on the reading test.**Data Source(s):** Tennessee's Project STAR (Student Teacher Achievement Ratio) Public Access Data.	OLS & 2SLS Estimates	Study the relationship between teacher race/ethnicity & student achievement. Controlled for school, student, & social variables. *Original Focus of Data Source:* the Tennessee STAR was designed to determine the effect of smaller class size in the earliest grades on short-term & long-term pupil performance.	**Key Explanatory Variable(s):** Teacher gender & race/ethnicity. **Other Variables:** School: class size. Teacher: experience, merit pay status, & education level. Student: race, gender, & age. Social: free-lunch status.	Scaled math & reading scores from the Stanford Achievement Tests (SAT) (part of Tennessee's Project START).	Assignment to own-race teacher significantly increased math & reading scores of African American & White students. **White Students** Math Scores: 4% point increase (SS at 1% level for males & 5% level for females) Reading Scores: 4% point increase (SS at 5% level for males only. No SS for females) **African American Students** Math Scores: 4% point increase (SS at 5% level for females & males) Reading Scores: 3% point increase (SS at 1% level for males & 5% level for females.

Egalite, Kisida, & Winters (2015) Representation in the classroom: The effect of own-race teachers on student achievement.	**Sample Size:** Approximately 3 million students (grades 3 to 10) linked to 92,000 teachers from Florida public schools. **Data Type:** Florida Comprehensive Assessment Test (FCAT) student test scores (2001–2002 through 2008–2009) & administrative data. **Data Source(s):** Florida Department of Education.	OLS with Log-Lin form	Study the relationship between student/teacher race-matching & student achievement.	**Key Explanatory Variable(s):** teacher race/ethnicity (African American, White, Hispanic, & API). **Other Variables:** School: Race level, poverty level, average school-level achievement. Teacher: gender, experience, & quality. Student: teacher assigned to, course subject, gender, race, prior year test scores, & grade. Social: free-lunch status & language proficiency.	Math & reading test scores of the Florida's mandated standardized exam.	Small but significant positive effects when students are matched to a teacher of their own race/ethnicity: **Reading Scores** African American & White students: .004–.005 standard deviations, $p < 0.01$. **Math Scores** African American: (.019), White: (.007), & Asian/Pacific Island (.039) at $p < 0.01$. *For Hispanic students, overall effects negative: (-.011 SD in reading) & (-.007 SD in math).
Evans (1992) An estimate of race & gender role-model effects in teaching high school.	**Sample Size:** 2,440 high school students. **Data Type:** Cross-sectional. **Data Source(s):** Test of Economic Literacy (TEL) from the Joint Council on Economic Education's National Assessment of Economic Education (NAEE) Survey, 1987.	OLS	Estimate race & gender role-model effects in high school economics courses (African American & White only).	**Key Explanatory Variable(s):** teacher race/ethnicity & gender. **Other Variables:** School: % of high school graduates, percent of students who attend college. Teacher: NA. Student: GPA, enrollment in college preparatory classes, & hours spent on economics homework. Social: Maternal education.	Score on the Test of Economic Literacy (TEL) for African American & White students.	There was a significant role-model effect for African-Americans, who scored 2.25 points higher on the TEL with a African American role model in the classroom. This implies a 14.5% absolute improvement. In relative terms, the average score increased from the 29th to the 38th percentile.

Grissom, Rodriguez, & Kern (2017) Teacher & principal diversity & the representation of students of color in gifted programs.	**Sample Size:** 2,170 public elementaryschools with gifted programs.**Data Type:** nationally representative student & educator data 2004, 2012.**Data Source(s):** Schools & Staffing Survey (SASS), survey data collected by the Office for Civil Rights(OCR), & Common Core of Data(CCD).	OLS	Investigate whether representation of students of color in gifted programs is higher in schoolswith racially/ethnically diverse teachers & principals. (Hispanic, African American, or White).	**Key Explanatory Variable(s):** Teacher & principal race/ethnicity. **Other Variables:** School: size, district size, & locale type. Teacher: NA. Student: race/ethnicity. Social: free or reduced-price lunch.	% of students from different racial & ethnic backgrounds in gifted programs.	The % of teachers or principals that are Hispanic or African American is positively associated with the % of gifted students who are Hispanic or African American, respectively. A 10% increase in Hispanic teachers is associated with a 3.1% increase in Hispanic gifted students ($p < 0.01$). This increase is meaningful, given that the sample average of gifted students who are Hispanic is just 10%. A 10% increase in the % of African American teachers in a school is associated with an increase in the representation of African American students in gifted programs of about 3.2% ($p < 0.01$).
Lindsay & Hart (2017) Exposure to same-race teachers & student disciplinary outcomes for African American students in North Carolina.	**Sample Size:** Elementary, middle, & high school (1st grade–12th grade students attending North Carolina public schools from 2007–2008 to 2012–2013. **Observations:** 2,236,678 for African American students. **Data Type:** Student-	OLS	Explore whether exposure to same-race teachers affects the rate at which African American students receive exclusionary discipline, such as out-of-school suspensions, in-school suspensions, & expulsion.	**Key Explanatory Variable(s):** Teacher race/ethnicity. **Other Variables:** School: urbanicity, enrollment, pupil-to-teacher ratios, demographic composition of the school, share of students using subsidized lunch,	The extent to which middle & high school African American students are exposed to exclusionary disciplinary consequences (i.e. in-school suspensions, out-of-school suspensions, or expulsion).	Exposure to same-race teachers is associated with reduced rates of exclusionary discipline for African American students. This relationship holds for elementary, middle, & high school grade ranges: A 25 percentage-point

	level administrative data. Data allowed them to identify which teachers are matched to each student for each class during this time period, as well as the race of teachers serving as instructors for those classes. **Data Source(s):** North Carolina			school average standardized achievement scores, & charter/magnet status. Teacher: NA. Student: race & sex. Social: special education status, family income subsidized lunch, & limited English proficiency indicators.		increase in a student's share of teachers who are African American is associated with a decrease in disciplinary referrals ranging from 0.027 (for elementary grade students) to 0.048 (for high school students) [$p < 0.01$]. While these reductions are relatively modest in magnitude, declines of this magnitude would represent a 4% decline in the number of referrals at the high school level & a decline of 6% in the number of referrals at the elementary level.

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