

THE ROLE OF TEACHER IMPLICIT BIAS IN THE RACIAL ACHIEVEMENT GAP

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By

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ABSTRACT

The black-white academic achievement gap in the American education system persists, despite decades-long efforts to close it. Several theories have been posited to explain this achievement gap between students of different races with the same socioeconomic status, including a predominantly white teacher population contrasted against an increasingly racially diverse student body, a lower esteem for education in black families, and oppositional culture theory, which holds that black culture rejects the normative values that lead to educational achievement.

My research explores an alternative theory, that the implicit racial bias of teachers accounts for the racial achievement gap not explained by socioeconomic factors. I examine whether implicit racial bias is a statistically significant predictor of student achievement levels, irrespective of a teacher's race. Using the National Center for Education Statistics' nationally representative 2002 Educational Longitudinal Study, I conduct a series of OLS multivariate analyses to test for correlations between student achievement and teacher attitudes and student race and teacher attitudes. I use students' 12th grade standardized math test scores as a measurement of student achievement. To examine teachers' assessments of student ability and engagement, I use factor analysis to develop a composite variable of base year teacher survey responses specific to individual students, and I create an interaction variable to test the relationship between teacher assessments of students and student race.

The results of my analysis support the hypothesis that part of the racial achievement gap not explained by socioeconomic factors can be attributed to a proxy measure for teacher implicit racial bias. In order to one day close the racial achievement gap, we must first understand all of its causes. Empirical studies such as this one, demonstrating the role of teacher implicit racial bias in the achievement gap, will enable policymakers to develop tailored policies through which to address teacher implicit racial bias.

The research and writing of this thesis is dedicated to
Fondé, for his efforts to fight bias and inequality
in the classroom through Healthy Words.

Many thanks,
Breah C. Mortenson

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INTRODUCTION

The black-white academic achievement gap in the American education system persists, despite decades-long efforts to close it.¹ Several theories have been posited to explain this achievement gap between students of different races with the same socioeconomic status, including a predominantly white teacher population contrasted against an increasingly racially diverse student body², a lower esteem for education in black families³, and oppositional culture theory⁴, which holds that black culture rejects the normative values that lead to educational achievement.

My research explores an alternative theory, that the implicit racial bias of teachers accounts for the racial achievement gap not explained by socioeconomic factors. Some research has already been conducted on the role of implicit bias in the educational racial achievement gap, using small sample sizes wherein Implicit Association Tests were administered to teachers,⁵ but few studies have applied regression models to broad cross-sections of the country in order to measure teacher implicit racial bias. Instead, much of the existing research focuses on a teacher's race and concludes that students tend to perform better when taught by teachers of the same race as the student.

¹ Jencks, Christopher and Meredith Phillips. *The Black-White Test Score Gap*. Brookings Institution Press, 1998.

² See, e.g., Egalite, Anna J., Brian Kisida, and Marcus A. Winters. "Representation in the classroom: The effect of own-race teachers on student achievement." *Economics of Education Review*, vol. 45, April 2015, pp. 44-52.

³ Puchner, Laurel and Linda Markowitz. "Do Black Families Value Education? White Teachers, Institutional Cultural Narratives, & Beliefs about African Americans." *Multicultural Education; San Francisco*, vol. 23, no. 1, September 2015, pp. 9-16.

⁴ Phelan Kozlowski, Karen. "Culture or Teacher Bias? Racial and Ethnic Variation in Student-Teacher Effort Assessment Match/Mismatch." *Race and Social Problems*, vol. 7, no. 1, March 2015, pp. 43-59.

⁵ See, e.g., Clark, Patricia and Eva Zygmunt. "A Close Encounter with Personal Bias: Pedagogical Implications for Teacher Education." *The Journal of Negro Education; Washington*, vol. 83, no. 2, Spring 2014, pp. 147-161.

In contrast, I examine whether implicit racial bias is statistically significant in student achievement levels, irrespective of a teacher's race. Using the National Center for Education Statistics' nationally representative 2002 Educational Longitudinal Study, I conduct a series of OLS multivariate analyses to test for correlations between student achievement and teacher attitudes and student race and teacher attitudes. I use students' 12th grade standardized math test scores as a measurement of student achievement. To examine teachers' assessments of student ability and engagement, I use factor analysis to develop a composite variable of base year teacher survey responses specific to individual students, including the teacher's perception of how challenging the material is for the student, whether the student works hard for good grades, and how far the teacher expects the student to go in school. I create an interaction variable to test the relationship between teacher assessments of students and student race. In addition, I include the explanatory variables socioeconomic status, parent aspirations, student gender, student attitude, teacher experience levels, base year standardized math test scores, a learning environment scale, and a school safety index as control variables.

In order to one day close the racial achievement gap, we must first understand all of its causes. Empirical evidence demonstrating the role of teacher implicit racial bias in the achievement gap will enable policymakers to better understand how teacher implicit racial bias impacts black and white student achievement levels differently and thereby develop tailored policies through which to address teacher implicit racial bias.

REVIEW OF LITERATURE

The racial achievement gap in the United States education system is only one symptom of the racial oppression that has plagued this country since its inception. Despite *Brown v. Board of Education*, an academic achievement gap persists between black and white students in American schools, appearing before a child enters kindergarten and surviving the entire educational process into adulthood. While the racial achievement gap shrank through the second half of the twentieth century, the advent of the new millennium brought with it the first increase in the racial achievement gap since the passage of the Civil Rights Act. The achievement gap is back on the decline today, but continues to manifest at levels that ensure it will remain for at least another generation.

Much of the existing research on the role of the teacher in the racial achievement gap centers around the teacher's race. For example, a study using state-level data from Tennessee finds that having an own-race teacher substantially improves the performance of both black and white students.⁶ In a similar study, researchers compile data from the state of Florida to measure the effect of having an own-race teacher on public school student performance and finds a statistically significant correlation between a student having an own-race teacher and improvements in the student's test scores, especially for previously underperforming students when matched with an own-race teacher.⁷

⁶ Dee, Thomas S. "Teachers, Race, and Student Achievement in a Randomized Experiment." *Review of Economics and Statistics*, vol. 86, February 2004, pp. 195-210.

⁷ Egalite, Anna J., Brian Kisida, and Marcus A. Winters. "Representation in the classroom: The effect of own-race teachers on student achievement." *Economics of Education Review*, vol. 45, April 2015, pp. 44-52.

Others have examined the effect of a teacher's race specifically on minority students.⁸ For example, Fairlie's 2008 study examines the effect of having an underrepresented minority instructor on the dropout rates and grades of underrepresented minority students in a community college. Fairlie finds that taking courses with minority instructors improves the performance of minority students in the short-term by decreasing the achievement gap by 20-50%, and in the long-term, improving course selection, retention, and graduation rates among underrepresented minority students.

Quantitative analysis of nationally representative data shows that teachers tend to underestimate black students significantly more than their white peers.⁹ Cherng's findings show that teachers tend to underestimate black and Hispanic high school students more often than white students, and that a teacher's underestimation of a student has a statistically significant negative impact on that student's performance, as measured by the student's sophomore year GPA and senior year expectations.¹⁰

Teachers must exhibit unconditional race neutrality in order to be unbiased, according to Ronald Ferguson's 2003 study.¹¹ In order to achieve unconditional race neutrality, all relevant factors, beliefs, and attitudes must be entirely uncorrelated with race. Citing a collection of small sample studies as well as analysis of data from the NELS:1988, Ferguson concludes that

⁸ Fairlie, Robert W., Florian Hoffmann, and Philip Oreopoulos. "A Community College Instructor Like Me: Race and Ethnicity Interactions in the Classroom." *American Economic Review*, vol. 104, August 2008, pp. 2567-2591.

⁹ Cherng, Hua-Yu Sebastian. "If they think I can: Teacher bias and youth of color expectations and achievement." *Social Science Research*, vol. 66, August 2017, pp. 170-186.

¹⁰ Id.

¹¹ Ferguson, Ronald F. "Teachers' Perceptions and Expectations and The Black-White Test Score Gap." *Urban Education*, vol. 38, no. 4, July 2003, pp. 460-507.

teachers' perceptions and expectations of students are statistically significantly different for black students than their white peers.

Gershenson conducts a similar research analysis, measuring the variances in black and white teacher expectations on black students. Using a fixed effects model, Gershenson analyzes expectations of two teachers for each student and finds that, after controlling for socioeconomic status and prior student performance measures, white teachers hold statistically significantly lower expectations for black students than do black teachers.¹²

Studies on racism and ethnic bias in other countries provide substantial insight to American scholars focused on the black-white achievement gap. One Indian study of educational disparities in education provides supplemental material to American studies such as Cherng's and Gershenson's. Selecting and interviewing 35 teachers to interview and observe, the scholars in India conclude that the majority of teachers studied perceive minority students more negatively than the majority population and consequently have substantially lower expectations for them.¹³

Peterson, et al. conducted a study in New Zealand using a small sample size of 38 teacher, to whom they administered explicit bias and implicit bias tests with respect to the different ethnicities of children in their classrooms.¹⁴ The study found that a student performed significantly better when her teacher's biases favored her ethnicity.

¹² Gershenson, Seth, Stephen B. Holt, and Nicholas W. Papageorge. "Who believes in me? The effect of student-teacher demographic match on teacher expectations." *Economics of Education Review*, vol. 52, June 2016, pp. 209-224.

¹³ Namrata. "Teachers' beliefs and expectations towards marginalized children in classroom setting: a qualitative analysis." *Procedia Social and Behavioral Sciences*, vol. 15, 2011, pp. 850-853.

¹⁴ Peterson, E.R., C. Rubie-Davies, D. Osborne, and C. Sibley. "Teachers' explicit expectations and implicit prejudiced attitudes to educational achievement: Relations with student achievement and the ethnic achievement gap." *Learning and Instruction*, vol. 42, February 2016, pp. 123-140.

Similar to black students in the United States, ethnic minority students in the Netherlands have a higher risk of academic failure. Dutch scholars conducted a study in which 41 elementary school teachers completed an Implicit Association Test and a survey for self-reporting of ethnic prejudice.¹⁵ Comparing the results to performance measures of the teachers' students, researchers found no correlation between self-reported prejudice and student outcome disparities; however, they found a statistically significant correlation between the implicit prejudice results and ethnic disparities in student performance in a teacher's classroom.

One German study, wherein ethnic bias was examined through a simulation model yielded different results than tests administered to teachers in real world classrooms.¹⁶ Kaiser tests teacher bias through the use of simulated classrooms with controlled, simulated enrollment and found that teachers are typically more accurate in their judgement of students whose ethnicity comprised a minority of their classroom population, regardless of whether that ethnicity was minority in the population overall.

A 2008 study of 1,872 American students reached similar conclusions to Kaiser's simulated study.¹⁷ The research concluded that a teacher's bias toward racial minority students in the classroom tends to increase as the proportion of racial minority students in the classroom increases. Essentially, any teacher bias is less likely to affect a class that is predominantly one ethnic group than in a classroom wherein the students are members of a wide and diverse number

¹⁵ Van den Bergh, Linda, Eddie Denessen, Lisette Hornstra, Marinus Voeten, and Rob W. Holland. "The Implicit Prejudiced Attitudes of Teachers: Relations to Teacher Expectations and the Ethnic Achievement Gap." *American Educational Research Journal*, vol. 47, no. 2, June 2010, pp. 497-527.

¹⁶ Kaiser, Johanna. "The effects of student characteristics on teachers' judgment accuracy: Disentangling ethnicity, minority status, and achievement." *Journal of Educational Psychology*, vol. 109, no. 6, August 2017, pp. 871-888.

¹⁷ McKown, Clark and Rhona S. Weinstein. "Teacher expectations, classroom context, and the achievement gap." *Journal of School Psychology*, vol. 46, no. 3, June 2008, pp. 235-261.

of ethnic groups. In addition, the study found a statistically significant correlation between the racial achievement gap among elementary school students with both the level of racial diversity in the classroom and the level of differential teacher treatment between high and low achieving students. The study further indicates that teachers who treat high-achieving students significantly differently than low achieving-students tend to demonstrate implicit negative bias against racial minorities.

A student's degree of self-confidence plays an important role in her level of academic achievement. Cohen examines the role of student self-confidence in academic performance as it relates specifically to minority students.¹⁸ In his 2006 study of 119 black students and 124 white students, Cohen finds that the completion of a single, simple exercise designed to improve a student's confidence level reduced the racial achievement gap in the sample by a statistically significant 40%.

The Implicit Association Test has been utilized by scholars to document teacher racial bias. In one such study, two Implicit Association Tests were administered to 302 elementary school teachers, and individual reactions of teachers to their implicit bias scores were recorded.¹⁹ The results of the Implicit Association Tests indicated that 96% of the teachers in the study preferred white students to their black peers. In addition, more than half of the teachers studied expressed disregard or disbelief at their results, refusing to acknowledge that they may possess a degree of implicit bias.

¹⁸ Cohen, Geoffrey L., Julia Garcia, Nancy Apfel, and Allison Master. "Reducing the Racial Achievement Gap: A Social-Psychological Intervention." *Science*, vol. 313, September 2006, pp. 1307-1310.

¹⁹ Clark, Patricia; and Eva Zygmunt. "A Close Encounter with Personal Bias: Pedagogical Implications for Teacher Education." *The Journal of Negro Education; Washington*, vol. 83, no. 2, Spring 2014, pp. 147-161.

Various theories have been put forth to explain the black-white academic achievement gap, including the cultural capital mismatch theory, the oppositional culture theory, and teacher bias. Cultural capital mismatch theory posits that the racial achievement gap persists because teachers and black students have different understandings and definitions for what is required to achieve. Oppositional culture theory posits that the achievement gap persists because black culture is inherently antithetical to achievement. Teacher bias posits that teachers have a biased set of values and expectations that favors white students over black students.²⁰ Karen Phelan undertakes a study to test all three theories using the nationally representative ELS:2002 dataset. After accounting for key control variables like socioeconomic status, Phelan's study finds no statistically significant evidence supporting cultural capital mismatch theory or oppositional culture theory; however, the study finds statistically significant evidence that white and Asian students are unfairly advantaged by potential teacher bias, because they are more likely than black and Hispanic students to positive effort assessments from their teachers when they admit that they are not working hard.²¹

An alternative theory, Critical Race Theory, initially developed in the legal field, has taken hold in the field of education as a way to explain and address the roles of systemic racism and counternarratives in the continued existence of the racial achievement gap. One scholar employs a qualitative case study approach to examine the presence of systemic racism, implicit racial bias, and individual racism in the classroom setting.²² The study concludes in identifying

²⁰ Phelan Kozlowski, Karen. "Culture or Teacher Bias? Racial and Ethnic Variation in Student-Teacher Effort Assessment Match/Mismatch." *Race and Social Problems*, vol. 7, no. 1, March 2015, pp. 43-59.

²¹ Id.

²² Young, Evelyn Y. "The Four Personae of Racism: Educators' (Mis)Understanding of Individual vs. Systemic Racism." *Urban Education*, vol. 46, no. 6, November 2011, pp. 1433-1460.

four different types of racism that manifests in teacher's instructional practices: (1) the conscious perpetrators, (2) the unconscious perpetrators, (3) the deceived perpetrators/activists, and (4) the enlightened perpetrators/activists. Despite racial training and extensive efforts by teachers to create racially equal learning environments, Young's results indicate that all of the teachers in her study were perpetuating a form of racial inequality in their classrooms.

Another concept, known as Social Equity Theory, seeks to explain achievement gaps entirely through a combination of "direct" and "signal" influences.²³ Social Equity Theory defines direct influences as equal opportunity social processes designed to encourage academic achievement equally for children of all races and ethnic groups. Conversely, signal influences are social processes that do not encourage academic achievement equally, instead signaling to minority groups of children that they are devalued solely because of their membership in their racial or ethnic group. According to Social Equity Theory, both direct and signal influences contribute to the racial achievement gap.

Direct influences increase the racial achievement gap when they are distributed disproportionately to dominant groups over minority groups of children. In contrast, signal influences increase the racial achievement gap even when they are distributed equally to all racial and ethnic groups. The category of signal influences is quite broad, from overt racism to unintentional racial signals, and are typically not even perceived by the majority group. For example, standardized tests can be viewed differently depending on a child's race. For a white child, he will likely perceive the test as a measure of his innate ability compared to his peers,

²³ McKown, Clark. "Social Equity Theory and Racial-Ethnic Achievement Gaps." *Child Development*, vol. 84, no. 4, July/August 2013, pp. 1120-1136.

which is just what standardized tests are designed to do. Conversely, a black child—who is a member of a group traditionally stereotyped as inferior—may interpret a standardized test as yet one more way in which she and her race can be devalued, or worse—as a burden on her shoulders to disprove the stereotype. Both potential interpretations by a black child can cause stress, anxiety, and self-doubt, hindering performance and thereby contributing to the documented achievement gap.

DATA AND METHODS

Data and Analysis Sample

To determine whether an implicit racial bias of teachers plays a statistically significant role in the achievement gap between black and white students in American schools, I utilize a dataset compiled by the National Center for Education Statistics called the Education Longitudinal Study of 2002 (“ELS:2002”). The ELS:2002 is a nationally representative, longitudinal study of American high school sophomores in 2002 focused on student trajectories from early high school through higher education and into the workforce. The ELS:2002 follows up with study participants in 2004 – their senior year of high school, and again in 2005, 2006, 2012, and 2013.

The study sampled 16,197 10th grade students in the 2002 spring term from 750 different schools. The schools were selected first, with a higher number of nonpublic high schools selected to enable a large enough sample for comparison to public schools. Students were then randomly selected from the 750 schools, with the exception that Asian students were selected at an intentionally higher rate to ensure sufficient data to draw comparisons between different racial groups. In the base year of 2002, the study administered surveys to students, their parents, school administrators, librarians, and one math teacher and one English teacher per student. Student assessments, standardized test scores, and transcripts supplemented the data collected via survey. Follow-up surveys were conducted in 2004, 2006, and 2012.

I drew variables from the base year of 2002 and the first follow-up in 2004. In the base year of 2002, I obtained variables from the surveys administered to students, math teachers,

parents, and administrators. In addition, I utilized standardized math scores from tests administered in the base year and the first follow-up year.

Dependent Variable

The dependent variable for this study is the *12th grade standardized math test score*, serving as an approximation of student achievement. The 12th grade standardized math test score was collected during the first follow-up phase of the ELS:2002, and is a specific version of the standardized test score known as the “T score,” which is derived from the raw test score measuring number of questions right in order to create a better tool for comparing students’ achievement to their peers. The T score is structured to have a mean score of 50 and standard deviation of 10. The original variable, used in my multivariate regression analyses, is measured on a continuous scale, with scores ranging from 19.82 to 79.85. For the purpose of bivariate comparison, I recode the variable into four quartiles, the 1st quartile being the lowest 25% scoring students and the 4th quartile being the highest 25th scoring students. The cutoff points for each quartile in ascending order are scores of 43.42, 50.85, and 58.06.

Key Explanatory Variables

The key explanatory variable in this study is a measure of *teacher’s assessment of student ability and engagement*, a composite variable derived from three separate variables taken from base year math teacher survey responses, “student usually works hard for good grades,” which was answered yes or no; “difficulty of class for student,” which was ranked on a 1-3 scale from too difficult to not challenging enough; and “how far teacher expects student to get in school,”

which offered 7 levels of educational attainment from which respondents could choose, from failing to finish high school to earning a PhD or advanced professional degree, coded 1-7. Using principal-component factor analysis, one factor had a significantly high Eigen value of 1.7 and Cronbach's alpha of 0.82. The new factor variable was recoded to have a mean of 0 and standard deviation of 1 for use in multivariate models.

To test for the effect of teacher assessments of ability and engagement on black students specifically, I construct an interaction variable by multiplying the teacher assessment composite variable with the binary variable indicating whether a student is black.

Additional Explanatory Variables and Controls

Student Household Characteristics:

Household Socioeconomic Status: This is a composite variable developed by NCES and derived from five separate variables derived from parent survey responses, "father's education," "mother's education," "family income," "father's occupation," and "mother's occupation." The resulting composite variable is continuous, with a mean of 0.05 and range of -2.11 to 1.82.

How Far in School Parent(s) want Student to Go: In the base year of the survey, parents were asked how far they desired their children to go in school. NCES then created a composite variable in order to take into account responses from more than one parent. The ELS:2002 variable is categorical, with scores ranging from 1 for will not finish high school to 7 for obtaining a professional or doctoral degree. I condensed the ELS:2002 scale slightly and recoded the variable such that a score of 0 means belief that the student will fail to graduate from high

school, a score of 1 a desire for the student to finish high school, a score of 2 a desire that the student will attend some college but not obtain a four-year degree, a score of 3 a desire for the student to earn her four-year degree, and a score of 4 equals a desire for the student to obtain a graduate degree, including masters, professional, and doctoral degrees.

Student Characteristics:

Student's Race: I created three categorical binary variables for White, Black, and Other Race, where a score of 0 equals not the identified race and a score of 1 equals the identified race. White is the reference group in every model.

Student's Gender = Female: This descriptive binary variable is coded 0 for male and 1 for female. Male is the reference group in every model.

10th Grade Standardized Math Test Score: This variable serves as a proxy for a student's level of knowledge at the time of the base year survey. I include this variable to create a level playing field for students who may have received inferior education up to 10th grade, in order to better measure any impact of other variables on student achievement as measured in the dependent variable, measured when the student is in 12th grade. Like the dependent variable, the 10th grade standardized math score is converted into a "T score" in order to make peer-to-peer comparisons, with a mean of 50 and standard deviation of 10. The variable is continuous, with a range from the lowest to highest test score achieved, from 19.38 to 86.68.

Student believes education is important to get a job later: This variable is created from a student response to a base year survey question. Measured from 0 to 3, with 0 equal to strongly disagree and 3 equal to strongly agree.

Getting a good education is important to student: This variable is created from a student response to a base year survey question. Measured from 0 to 2, with 0 equal to not important and 2 equal to very important.

How far in school student believes s/he will get: This variable is derived from the base year student survey and measures how far a student believes s/he will get in school. I condensed the survey responses slightly and recoded the variable such that a score of 0 indicates a student believes she will fail to graduate from high school, a score of 1 that she will only finish high school, a score of 2 that she will attend some college but not obtain a four-year degree, a score of 3 that she will earn her four-year degree, and a score of 4 reflects that the student believes she will obtain a graduate degree, including masters, professional, or doctoral degree.

Student attitude to learning: This is a composite variable of three variables derived from base year student survey responses, “student believes education is important to get a job later,” “getting a good education is important to student,” and “how far in school student believes s/he will get,” all of which are defined above. Using principle-component factor analysis, one factor had a significantly high Eigen value of 1.9 and Cronbach’s alpha of 0.85. The new factor variable coded for use in multivariate models with a mean of 0 and standard deviation of 1.

School Characteristics:

Whether student feels safe at school: This is a base year school safety index composite variable developed by the ELS:2002 using measurements of student perceptions of school safety levels. The Cronbach's alpha is 0.62, and the variable is standardized to a mean of 0 and standard deviation of 1. The variable is continuous with higher values representing higher perceptions of school safety.

Whether school environment is conducive to learning: This is a composite variable developed by ELS:2002 from base year administrator survey responses to measure the academic climate of a school. Principal-component factor analysis was performed on five separate variables, "student morale is high," "teachers press students to achieve," "teacher morale is high," "learning is high priority for students," and "students are expected to do homework," all of which were ranked on a 1-5 scale from not at all accurate to very accurate, and one factor was selected with a Cronbach's alpha of 0.86. The composite variable was coded to a mean of 0 and standard deviation of 1.

Teacher Characteristics:

Highest Degree Earned by Teacher: This categorical variable identifies the highest level of education achieved by the teacher and is scored from 0 to 3. A score of 0 means the teacher never obtained a bachelor's degree; a score of 1 indicates the teacher did obtain her bachelor

degree; a score of 2 indicates the teacher earned a specialized certificate or master's degree; and a score of 3 indicates the teacher holds a doctoral or professional degree.

Years of Experience Teaching: This variable measures the total years of experience a teacher has teaching students; it is a continuous variable that measures years of experience in number of whole years, with a range from 0 to 40 years.

Teacher's Level of Experience: This is a composite variable developed using principle-component factor analysis of two separate variables derived from base year teacher survey responses, "highest degree earned by teacher" and "total years teaching." One factor had a high Eigen value of 1.3 and was standardized to a mean of 0 and standard deviation of 1.

Teacher's Assessment of Student:

Believes student works hard for good grades: This is a binary variable derived from the base year math teacher survey, coded 0 for no and 1 for yes.

Student's mastery of class material: This variable is renamed from a base year teacher survey question measuring the perceived difficulty of the class for the student, measured from 0 to 2, with a score of 0 indicating the class to be very difficult and a score of 2 indicating the class not to be difficult at all.

How far in school teacher expects student to go: On the base year teacher survey administered in 2002, math teachers were asked to predict the highest level of education each of their students would achieve. I condensed the variable slightly and recoded it such that a score of 0 equals a prediction that the student will fail to graduate from high school, a score of 1 that the student will only finish high school, a score of 2 that the student will attend some college but not obtain a four-year degree, a score of 3 that the student will earn her four-year degree, and a score of 4 predicts the student will obtain a graduate degree, including master's, professional, and doctoral degrees.

Table 1 presents means, standard deviations, and ranges for all of the variables used in this analysis.

Data Limitations

An ideal way to measure implicit bias would be to have every member of the study complete an implicit association test. Unfortunately, in large, longitudinal survey datasets such as ELS:2002, surveyors would be hard pressed to achieve a substantial enough response rate to such a test to be of statistical usefulness. Alternatively, it would have been helpful to have a section of the teacher survey dedicated to explicit racially biased beliefs, but such responses would have been of limited value, given the likelihood for cultural acceptance bias affecting teacher's responses. Thus, the best option available is to use survey questions regarding teacher's attitudes toward individual students and comparing those attitudes with other available explanatory variables to look for a correlation between a teacher's attitude toward a specific student and that student's race.

Implicit association tests are designed to expose the unintentional racial bias that a person exhibits in response to racial cues. I chose questions from the base year math teacher survey that asked about topics typically muddled by cultural racial stereotypes and included control variables to account for nonracial reasons for teacher responses. However, the available data do not include exhaustive reasons for why a teacher might assess a student a certain way and the teacher survey questions were not designed to uncover or estimate implicit bias. In addition, to definitively measure implicit racial bias, teachers would need to be presented with and asked to evaluate identical students whose only difference is their race. Since the ELS:2002 is a representative sample of the population, such identical comparisons are impossible. A lab-conducted experiment would enable such an evaluation, but lab experiments do not yield results that are representative of the population.

Another limitation of the ELS:2002 dataset is that a large portion of the information is restricted, and I did not have access to such restricted-use data. As a result, I was particularly limited in my choices for a dependent variable that would serve as a measure for student achievement, which is how I settled on 12th grade standardized math test scores. If I had access to the restricted-use data, I would have explored 12th grade GPAs, high school transcripts, college entrance exam scores, or college admission rates as alternative dependent variables.

Finally, incomplete data and missing values due to unanswered survey questions and attrition between the base year of the study and follow-up years can lead to biased or skewed results. Of the 16,197 10th graders surveyed in the spring of 2002, 12th grade standardized math test scores were obtained for 13,648 of them, a response rate of 84%. I would have preferred to use variables with response rates at least as high as the 12th grade scores to assess teacher bias,

but the best proxies were base year teacher survey questions a student's work ethic, a student's ability, and predictions of a student's future achievements, with response rates of only 77%, 78% and 74% respectively.

To address the possible bias and inaccuracy that can result from missing survey answers and attrition rates from the base year, the ELS:2002 employs a balanced repeated replication weighting system using probabilities for fit of missing data that are then applied inversely as weights of existing data. In order to utilize the ELS:2002 weighting system in my analyses, I incorporated the balance repeated replication weights into each of my regression models.

Methodology

In setting out to measure whether teacher implicit racial bias plays a statistically significant role in the racial achievement gap, represented here as 12th grade standardized math test scores, I must first establish whether there is a relationship between a student's race and a teacher's assessment of that student, and if so, assess whether there is an association between the teacher's assessment of that student's ability and engagement and the student's 12th grade standardized math test score.

Hypothesis I: A student's race has a statistically significant effect on a teacher's assessment of a student's ability and engagement.

To measure the impact of a student's race on a teacher's assessment of a student, I estimate an OLS multivariate regression model with the composite variable – teacher's assessment of student ability and engagement – as the dependent variable.

Empirical Models:

Model 1

Teacher's attitude toward student = $\beta_0 + \beta_1 * \text{female} + \beta_2 * \text{black} + \beta_3 * \text{other race} + \beta_4 * \text{teacher's experience level} + \beta_5 * \text{student's socioeconomic status} + \beta_6 * \text{parents' aspirations for student} + \beta_7 * \text{student's attitude toward school} + \beta_8 * \text{safe at school} + \beta_9 * \text{learning environment} + e$

Model 2

Teacher's attitude toward student = $\beta_0 + \beta_1 * \text{female} + \beta_2 * \text{black} + \beta_3 * \text{other race} + \beta_4 * \text{teacher's experience level} + \beta_5 * \text{student's socioeconomic status} + \beta_6 * \text{parents' aspirations for student} + \beta_7 * \text{student's attitude toward school} + \beta_8 * \text{safe at school} + \beta_9 * \text{learning environment} + \beta_{10} * 10^{\text{th}} \text{ grade standardized math test score} + e$

To measure the effect of a teacher's assessment of a student's ability and engagement on a proxy measure for student achievement, I estimate two OLS multivariate regression models with 12th grade standardized math test scores as the dependent variable.

Hypothesis II: A teacher's assessment of a student has a statistically significant effect on a student's 12th grade standardized math test score.

Empirical Models:

Model 3

12th grade standardized math test score = $\beta_0 + \beta_1 * \text{female} + \beta_2 * \text{black} + \beta_3 * \text{other race} + \beta_4 * \text{teacher's experience level} + \beta_5 * \text{teacher's attitude toward student} + \beta_6 * \text{student's socioeconomic status} + \beta_7 * \text{parents' aspirations for student} + \beta_8 * \text{student's attitude toward school} + \beta_9 * \text{safe at school} + \beta_{10} * \text{learning environment} + \beta_{11} * \text{teacher's attitude toward student} * \text{black} + e$

Model 4

12th grade standardized math test score = $\beta_0 + \beta_1 * \text{female} + \beta_2 * \text{black} + \beta_3 * \text{other race} + \beta_4 * \text{teacher's experience level} + \beta_5 * \text{teacher's attitude toward student} + \beta_6 * \text{student's socioeconomic status} + \beta_7 * \text{parents' aspirations for student} + \beta_8 * \text{student's attitude toward school} + \beta_9 * \text{safe at school} + \beta_{10} * \text{learning environment} + \beta_{11} * \text{teacher's attitude toward student} * \text{black} + \beta_{12} * 10^{\text{th}} \text{ grade standardized math test score} + e$

Prior to performing multivariate analyses, I examine relationships between my selected variables, focusing primarily on student race, standardized math test scores, and math teacher assessments of their students' ability and engagement. First, I compare the mean values of the descriptive variables across three different levels of a teacher's assessment of a student's engagement, from low to high, with a medium level assessment defined as the mean teacher assessment of 0 plus or minus one-half of a standard deviation, and low and high as all values below and above the medium group, respectively. I then test for a relationship between a student's race and standardized math test scores and between a student's race and a teacher's assessment of a student's ability and engagement. I compare mean values across differing

teacher expectations and assessments of students and between above and below average scoring students on the 12th grade standardized math test.

Methodological Limitations

While I structured my methodological approach to minimize potential errors and biases, one or more of my models may be negatively affected by omitted variable bias or multicollinearity. Even though the full OLS regression model with math scores as the dependent variable has a high R-squared value of 0.82, the model could likely be improved by addition of other key explanatory variables that I did not select from the ELS:2002 data. However, because the model's F-test statistic is enormous at 2,450, the risk of substantial bias is low.

Conversely, the full OLS regression model with teacher assessments as the dependent variable only achieves an R-squared of 0.31, the risk of omitted variable bias is higher. However, the F-test statistic is still large, at 366. Thus, while the risk of omitted variable bias is higher for the teacher assessment OLS model, the risk is still relatively low.

In addition, because several of the explanatory variables are related to one another, my multivariate models are at risk of suffering from multicollinearity; however, I tested the correlation levels between the independent variable in each model, and none of the variables were significantly correlated with any others. The highest degree of correlation in both models is between a student's socioeconomic status and 10th grade standardized math test score, with a 30% correlation in the teacher assessment model and a 44% correlation in the 12th grade standardized math test score model.

RESULTS

Differences in Student Standardized Math Test Scores by Student Race

First, I examine whether mean test scores vary by student race. Black students score, on average, lower than white students on both the 10th and 12th grade standardized math tests, with statistically significant differences in score means at the $p < .001$ level, as shown in Table 2. The racial disparities in average standardized math test scores remain essentially unchanged between 10th and 12th grade, as reflected in Figure 1. The average score for a black student is 44.31 in 10th grade and 44.35 in 12th grade and 52.77 in 10th grade and 53.06 in 12th grade for a white student. These results support the existence of a racial achievement gap – and as prior research demonstrates.

Effects of Student's Race on a Teacher's Perceptions of Student

Next, I determine whether there is a relationship between a teacher's assessment of a student's ability and engagement and the student's race. Recall that the composite teacher assessment variable was created from math teachers' responses to three questions asking them to assess the focal student: whether the student works hard for grades, the degree to which he/she has mastered class material, and how far the teacher expects a student to go in school. Table 3 provides, separately by race, percentage distributions for responses to each question, as well as means on the overall composite. There are clear disparities in teacher ratings according to the race of the student.

Beginning with teachers' ratings of student effort, only 57% of black students have math teachers who report that they work hard for good grades, compared to 71% of white students.

Turning to assessments of the student's mastery of class material teachers were given three response options— too difficult, the appropriate level, or not challenging enough. While white students (84%) are only slightly more likely than black students (77%) to be rated as having an appropriate mastery of class material than their black students, their teachers are almost half as likely to believe that the material is too difficult for them (9% versus 17%).

Table 3 also reveals differences by race in teachers' expectations for how far students' will go in school. Teachers are three times more likely to predict that black students (4%) will fail to graduate from high school than white students (1%), and roughly half as likely to predict that a black student (5%) will obtain a master's degree than a white student (13%). In addition, the teachers of black students are twice as likely to predict he/she will obtain no education past a high school diploma than a white student's teacher (28% versus 14%). Teacher expectations for college graduation is 30% among black students and 44% among their white counterparts. Seven percent of black students are expected by their teachers to obtain a graduate-level education compared with 16% of white students.

The final row of Table 3 reports mean values on the composite measure. Here we see an almost one-half standard deviation disparity between teachers' mean overall assessments of white and black students ($p < 0.001$), with black students 0.37 points below the standardized mean of 0 and white students 0.10 points above the mean.

Teacher's Perceptions of Student by Race and Standardized Math Test Score

Thus far, we have established that black students receive markedly less favorable assessments by their math teachers than white students. To determine whether these

discrepancies in ratings can be explained by lower math test performance, I divided black and white students into two groups based on whether they scored above or below the mean score of the 12th grade standardized math test. In Table 4, I examine how teachers' expectations for how far a black or white student will go in school compare to a student's mathematic achievement level. Regardless of whether the student scores above or below the mean, the teachers of black students are still about three times as likely to predict that the student will fail to graduate from high school than the teachers of white students (4.1% versus 3.1% for below average scoring students and 0.3% versus 0.1% for above average scoring students).

After taking into account whether a student scores above or below average, the teachers of 30.7% of below-average-scoring white students expect they will graduate from a four-year college, but the comparable figure for black students is only 25.5%, which is consistent with the racial disparities in teacher expectations without accounting for how a student scores. However, the racial gap actually closes completely for above-average-scoring students who teachers predict will graduate from a four-year college. Among students with above average scores, an equal percentage of teachers (57.1%) of white and black students expect that they will earn their four-year degrees.²⁴

The racial disparity in teacher expectations actually reverses at the level of PhD and professional degrees. After taking into account a student's test score, the teachers of black students are more likely to predict that the student will obtain a professional or doctoral degree than their white peer, regardless of whether both students score above or below the mean. In fact,

²⁴ This variation may be the result of other characteristics common to higher scoring black students, such as socioeconomic status or other household traits, but such analysis is outside the scope of this study.

among below-average-scoring black students, teachers are twice as likely to predict that students will earn a PhD or professional degree than among below-average-scoring white students.²⁵

Table 5 is constructed in the same way as Table 4, but looks at patterns across the composite teacher assessment measure. To facilitate comparison, I divided the continuous measure into low, medium, and high categories, with medium equal to the mean of 0 plus or minus one-half standard deviation, and low and high including the value that fall outside of the medium level. Among above-average-performing students (on 12th grade math test), there is a 5 percentage point difference between black (15%) and white (10%) in the share whose teachers' assessments of their ability and engagement fall well below the mean. Forty-three percent of black students with below average math scores are given assessments in the "low" category compared with 37% of below-average-scoring white students.

However, the disparities in assessments shrink considerably for black and white students who teachers assess as having a high level of ability and engagement. For below-average-scoring students, teachers are only 10% less likely to assess a black student's ability and engagement than a white student's (26% versus 29%). For above-average-scoring students, the disparity nearly disappears. Teachers are only 3% less likely to assess an above-average-scoring black student as having a high level of ability and engagement than an above-average-scoring white student (71% versus 73%).

²⁵ This reversal in trend could reflect an increased level of importance teachers attribute to a black student's work ethic; that is, because teachers are overall less likely to predict achievement levels from their black students equal to their white students, if a black student displays characteristics sufficient to bridge the gap in teacher expectations, the characteristics are interpreted so strongly as to lead a teacher to believe that the student will achieve the highest level degree. This difference in the effect of race on a teacher's prediction that a student earns a PhD or professional degree versus any other level of education merits further inspection and should be the topic of future studies; however, the difference falls outside the scope of this paper.

The wide variation in the racial disparities between students whom teachers assess as having high levels of ability and engagement versus students whom they assess as having low levels of ability and engagement suggests that a teacher may be less likely to have her opinion affected by a student's race when she perceives the student as high-achieving. Similar to the shifts in racial disparities for teacher assessments of student ability and engagement, the racial gap in teacher expectations of students also diminishes as the teacher's expectations rise, and – in the case of predicted PhDs and professional degrees – actually reverses.

Having established bivariate relationships between teacher assessments of student ability and engagement and students' race, which cannot be fully explained by differences in math scores, we now examine whether these racial disparities can be explained by controlling for additional explanatory variables.

Multivariate Results

Does a student's race have a statistically significant effect on a teacher's assessment of a student's ability and engagement?

Using the composite measure of teacher's assessment of a student's ability and engagement as the dependent variable and a student's race as the key explanatory variable, I estimate two models (Table 6). The first model controls for student's gender, the teacher's level of experience, the student's socioeconomic status, parental aspirations for the student, the student's attitude toward school, whether the student feels safe at school, and whether the school environment is conducive to learning as control variables. The second model adds the 10th grade

standardized math test scores as a control for the student's achievement prior to engaging with the 12th grade math teacher.

The results for Model 1 reveal a statistically significant effect of student's race on the teacher's assessment of student ability and engagement. Specifically, being a black student is associated with a 0.45 standard deviation lower score ($p < 0.01$) on the teacher's assessment composite, on average, compared to a white student, net of controls for socioeconomic status, parental aspirations, the student's attitude toward school, feels safe at school, and whether the school environment is conducive to learning. After taking into account 10th grade standardized math test scores in the second model, the coefficient on black is notably reduced in magnitude ($\beta = 0.16$; $p < 0.001$), but remains highly statistically significant.

The results from Model 2 also indicate that being female ($\beta = 0.19$; $p < 0.001$) and having a higher socioeconomic status ($\beta = 0.10$; $p < 0.001$) are associated with higher teacher assessments, as is the student's math score ($\beta = 0.04$; $p < 0.001$). Not surprisingly, parents' educational expectations for the student and students' own favorable attitudes toward school are positively associated with teachers' assessments.

Does a teacher's assessment of a student have a statistically significant effect on a student's 12th grade standardized math test score?

Having established that there is a statistically significant effect of race (black=1) on teachers' assessments of student ability and engagement, the next step is to test my second hypothesis. To accomplish this, I conduct an OLS multivariate regression analysis with the student's 12th grade standardized math test score as the dependent variable and a teacher's

assessment of the student's ability and engagement, a dummy variable for black, plus a variable measuring the interaction between the teacher assessment composite and black. The model includes controls for the student's gender, other race, teacher's experience level, teacher's assessment of the student's ability and engagement, the student's socioeconomic status, parental aspirations for the student, the student's attitude toward school, whether the student feels safe at school, and whether the school environment is conducive to learning as the control variables. The results are presented in Table 7.

The results from Model 1 show that the coefficient for the variable identifying whether a student is black, all else equal, indicates that her score will be 4.87 points lower than her white peer. This correlation strongly supports the existence of the racial achievement gap.

A teacher's assessment of a student's ability and engagement predicts an increase in the student's 12th grade standardized math test score of 3.92 points for each one standard deviation increase in a teacher's assessment of that student's ability and engagement. This correlation supports the hypothesis that, all else equal, a positive teacher's assessment of a student will result in a higher score, and a negative teacher's assessment will result in a lower score.

While of a smaller magnitude, the coefficient on the interaction variable for teacher assessments of student ability and engagement and whether a student is black is statistically significant and predicts a reduction of .74 points on a student's score from the interaction effect. The statistically significant negative interaction effect supports my hypothesis that differences in teachers' assessments of students because of their race account for a portion of the racial achievement gap.

Taken together, the coefficients on whether a student is black, teacher's assessment of a student's ability and engagement, and the interaction effect of the variables combined result in a predicted 1.69 reduction in a student's 12th grade standardized math test score.

A student's score on the 12th grade math test is also influenced by whether a student is female ($\beta=-2.52$; $p<0.001$), whether a student is black ($\beta=-4.87$; $p<0.001$), teacher's experience level ($\beta=0.82$; $p<0.001$), teacher's assessment of the student's ability and engagement ($\beta=3.92$; $p<0.001$), the student's socioeconomic status ($\beta=2.95$; $p<0.001$), parental aspirations for the student ($\beta=1.62$; $p<0.001$), whether the student feels safe at school ($\beta=0.83$; $p<0.001$), whether the school environment is conducive to learning ($\beta=4.07$; $p<0.001$), and the student's attitude toward school ($\beta=0.26$; $p<0.05$). The effects of each explanatory variable on 12th grade standardized math test scores match predictions.

As before, I introduce a control for 10th grade standardized math test scores in Model 2 to account for the student's achievement prior to engaging with the 12th grade math teacher. Not surprisingly given the high pairwise correlation between the two math scores ($r=.89$), the 10th grade math score explains a sizable share of the variance in the 12th grade score. Given that any race-related factors that are shown to be associated with the current scores were presumably operational at the time of the prior scores, it is not surprising that the coefficient for whether a student is black and the interaction effect of whether a student is black and a teacher's assessment of a student's ability and engagement cease to be statistically significant. Indeed, bias in a previous teacher's assessment of the student may be captured in the 10th grade score.

It is notable that the main effect of a teacher's assessment of a student's ability and engagement remains a statistically significant predictor of 12th grade standardized math test

scores at the 0.001 level. While the size of the coefficient is dramatically reduced (from 3.92 to 0.98), how a teacher assesses a student's ability and engagement continues to have a statistically significant effect on 12th grade standardized math test scores, even after controlling for 10th grade standardized math test scores.

CONCLUSIONS

This study sought to determine whether teacher implicit racial bias can explain any aspect of the black-white racial achievement gap. Using the ELS:2002 dataset, which surveyed a broad nationally representative sample of 10th graders, I developed multivariate models to address two hypotheses: (1) a student's race has a statistically significant effect on a teacher's assessment of a student's ability and engagement; and (2) a teacher's assessment of a student has a statistically significant effect on a student's 12th grade standardized math test score.

To test my first hypothesis, I used an OLS multivariate regression model with a composite variable measuring teacher's assessment of a student's ability and engagement as the dependent variable and whether a student is black as the key explanatory variable. I constructed the composite variable through factor analysis using three questions asked of math teachers on the base year survey – whether a teacher believes that a specific student works hard for good grades, a teacher's perception of that student's mastery of class material, and how far a teacher expects that student to go in school.

I included student gender, student socioeconomic status, parental aspirations for the student, the student's attitude toward school, the teacher's experience level, whether the student feels safe at school, and whether the school environment is conducive to learning as control variables. In addition, I included 10th grade standardized math test scores in a second running of the OLS regression model to control for student achievement levels as of the base year.

Regardless of whether I included 10th grade standardized math test scores to control for a student's prior achievement level, whether a student was black remained a statistically significant predictor of a teacher's assessment of that student's ability and engagement, with a

coefficient of $-.45$ ($p < 0.001$) excluding 10th grade math scores, and a coefficient of $-.16$ ($p < 0.001$) after including them. These results support my first hypothesis and indicate that even after controlling for all other relevant factors – including a student’s prior achievement level – a student’s race has statistically significant effect on a teacher’s assessment of that student’s ability and engagement.

To test my second hypothesis, I constructed an OLS multivariate regression model with a student’s 12th grade standardized math test score as the dependent variable. I used the composite variable measuring a teacher’s assessment of student ability and engagement, a dummy variable for whether a student is black, and an interaction variable measuring the interaction effect of both the composite and dummy variable as my primary explanatory variables.

I added student gender, student socioeconomic status, parental aspirations for the student, the student’s attitude toward school, the teacher’s experience level, whether the student feels safe at school, and whether the school environment is conducive to learning as my control variables. In addition, just as I did in testing my first hypothesis, I run the regression model twice, including 10th grade standardized math test scores as a control variable for prior student achievement in the second model.

The results demonstrated that a teacher’s assessment of a student’s ability and engagement is a substantial, positive, and statistically significant predictor of 12th grade standardized math test scores, even after controlling for other explanatory variables ($\beta = 3.92$, $p < 0.001$). In addition, after including 10th grade standardized math test scores in the model, a teacher’s assessment of a student’s ability and engagement remained statistically significant ($\beta = 0.98$, $p < 0.001$). These results – especially the 0.001 level of statistical significance across

both versions of the model – support my second hypothesis and suggest that teacher assessments of students’ ability and engagement levels affect student achievement irrespective of a student’s prior achievement levels.

In contrast, without taking into account 10th grade standardized math test scores, whether a student is black has a statistically significant, substantial, and negative coefficient ($\beta=-4.87$, $p<0.001$). In fact, the results indicate that a black student’s score will be 4.87 points lower than an otherwise identical white student. However, after including 10th grade standardized math test scores, the coefficient on whether a student is black ceases to be statistically significant, which suggests that factors contributing to the racial disparities in 12th grade standardized math test scores may also be reflected in the racial disparities in 10th grade standardized math test scores.

Similarly, the coefficient measuring the interaction effect of teacher assessment and whether a student is black on 12th grade math scores is statistically significant and negative in the model excluding 10th grade scores ($\beta=-0.74$, $p<0.01$), but is no longer statistically significant after taking 10th grade math scores into account. These results also suggest that factors associated with racial disparities in 12th grade standardized math test scores also exist in 10th grade or are similar to the factors that result in the racially disparate 10th grade standardized math test scores. In addition, because the interaction effect loses statistical significance once 10th grade standardized math test scores are included in the models, the results suggest that some of the factors that explain racial disparities in teachers’ assessments of students are also present prior to 10th grade.

Because evidence of the racial achievement gap manifests prior to a child even entering kindergarten²⁶, we would need to conduct a far more in-depth investigation into how a student's race affects teachers' assessments of that student in every year of that student's education in order to determine with any degree of confidence the precise role of teacher racial bias in a student's standardized math test scores and whether that bias stays consistent or varies in kind and effect over the years. Such trends are beyond the data available in the ELS:2002 survey and outside the scope of this paper. The quantitative analysis of a longitudinal study that begins collecting data on students when they first begin school would provide the appropriate data to assess how a student's race affects a teacher's perception of that student over time.

In addition, future research should seek to employ data collection methods that directly measure teachers' implicit racial biases. While this paper sought to deduct a teacher's racial bias from math teacher responses to a handful of race neutral survey questions, the direct measurement of bias would be far more beneficial and compelling to the field of academic racial equality. Further, while this paper's research defined teacher assessments of students as racially neutral on their face – that is, because race was not mentioned in the survey questions, the questions did not measure intentional, explicit racial bias – the possibility remains that the statistically significant impact of a student's race on a teacher's assessment of that student could reflect explicit racial bias as well implicit racial bias. Thus, a more direct method of measuring teacher implicit racial bias would be of enormous benefit to furthering the understanding of the

²⁶ Valentino, Rachel. "Will Public Pre-K Really Close Achievement Gaps? Gaps in Prekindergarten Quality Between Students and Across States." *American Educational Research Journal*, vol. 55, no. 1, February 2018, p. 79.

role of implicit bias in the racial achievement gap. The administration of Implicit Association Tests to a nationally representative sample of teachers may be one way to collect such data.

In addition, my research focused solely on the black-white racial achievement gap, classifying all other races into one category that was included in the results for control purposes, but not evaluated. I would expect that statistically significant differences can be demonstrated in teacher assessments of white versus Hispanic and Asian students as well; understanding these differences would further the broader subject of racial and ethnic disparities and provide more information that can be leveraged to address the disparities.

Based on the results of the analysis, demonstrating that whether a student is black has a statistically significant, negative impact on a teacher's perception of that student's ability and engagement, policymakers should examine methods by which to reduce the discrepancies in a teacher's assessments of otherwise identical black and white students. The employment of racial awareness training for teachers is one method by which the Department of Education might seek to address the effects of implicit racial bias. Creating awareness of one's own bias can help to reduce that bias going forward; however, many individuals refuse to confront their own bias, even when presented with solid evidence.²⁷ Thus, policymakers should test ways to present teachers with the racial disparities in their perceptions of students in such a way that will cause them to both accept their bias and inspire them to address it.

Another approach to address teacher racial bias may be to instead focus on the affected students rather than the teachers. For example, in "Reducing the Racial Achievement Gap: A

²⁷ Clark, Patricia; and Eva Zygmunt. "A Close Encounter with Personal Bias: Pedagogical Implications for Teacher Education." *The Journal of Negro Education; Washington*, vol. 83 no. 2, Spring 2014, pp. 147-161.

Social-Psychological Intervention,” Geoffrey L. Cohen, Julia Garcia, Nancy Apfel, and Allison Master demonstrate that a simple writing exercise can have a profound and statistically significant impact on closing the racial achievement gap between black and white students.²⁸ If one confidence-boosting exercise can have such a substantial impact on the achievement gap in the sample classroom, equalizing treatment of blacks and whites by all teachers could lead to a major reduction in the national racial achievement gap. The mandatory addition of similar exercises to public school curricula could help to reduce the black-white achievement gap, but further research should be conducted first.

In addition, future research should examine available data through a Social Equity Theory lens.²⁹ As McKown explains, the racial achievement gap in education is the result of a combination of direct and signal influences. Direct influences lead to disparities in student performance because of unequal access to resources and opportunities and are often the result of the persistent economic and socioeconomic racial disparities that exist in the United States. Policies developed to address such social disparities should also provide more equal exposure for black and white students to various direct influences in their education.

The greater challenge for policymakers will be determining how to address signal influences. Signal influences are distributed equally to black and white students but affect them differently because they are perceived differently depending on a student’s race. Often, harmful signal influences are not even perceived by the majority group – white students – even though

²⁸ Cohen, Geoffrey L., Julia Garcia, Nancy Apfel, and Allison Master. “Reducing the Racial Achievement Gap: A Social-Psychological Intervention.” *Science*, vol. 313, September 2006, pp. 1307-1310.

²⁹ McKown, Clark. “Social Equity Theory and Racial-Ethnic Achievement Gaps.” *Child Development*, vol. 84, no. 4, July/August 2013, pp. 1120-1136.

they cause real and measurable harm to the minority group – black students. Greater understanding of teachers’ signal influences and their effects on students through studies designed using Social Equity Theory would help policymakers design programs tailored to address specific manifestations of teacher implicit racial bias and its harmful effects on black students.

Education policy experts should continue to explore both teacher-centric and student-centric approaches to addressing the effects of teacher implicit racial bias and their role in the black-white racial achievement gap. In addition, more national-scale longitudinal education surveys should focus on measuring and understanding the effects of implicit racial bias so that we can determine how to successfully address the role of teacher implicit racial bias in contributing to the racial academic achievement gap in order to one day close the gap completely.

APPENDIX: FIGURES

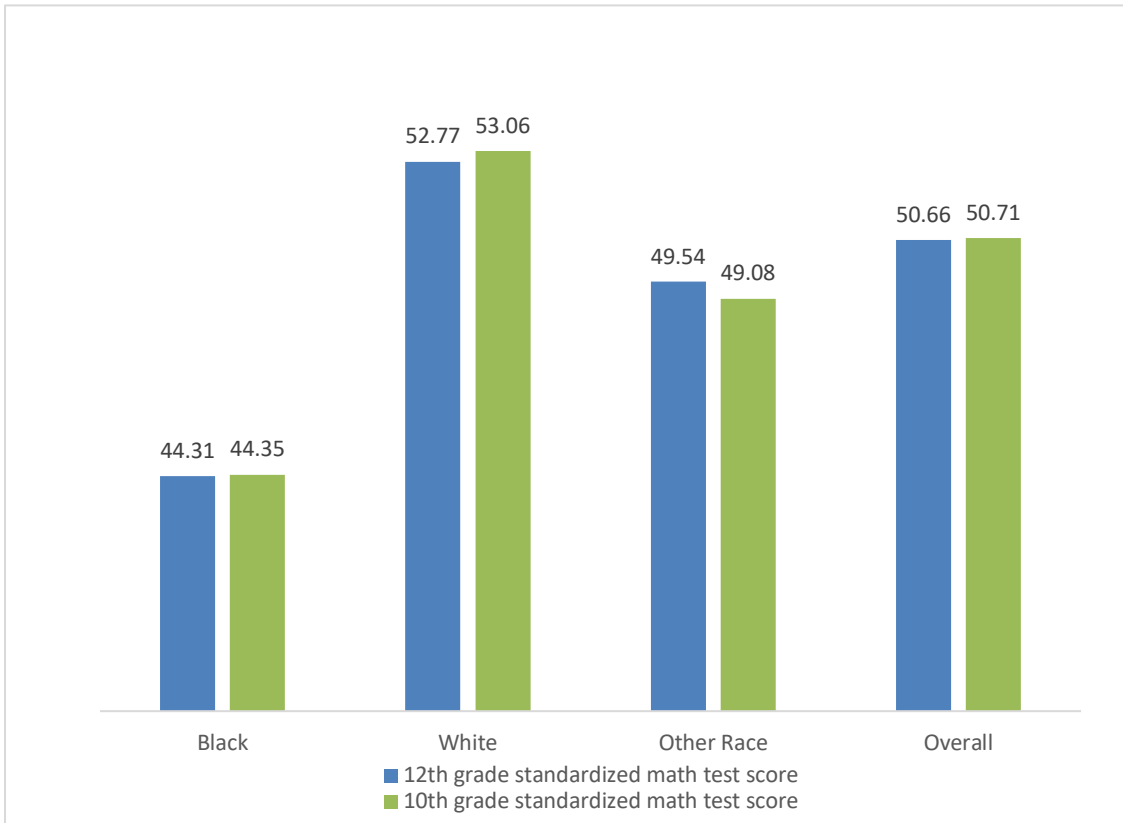


Figure 1 – Mean Standardized Math Test Score, by Student’s Race

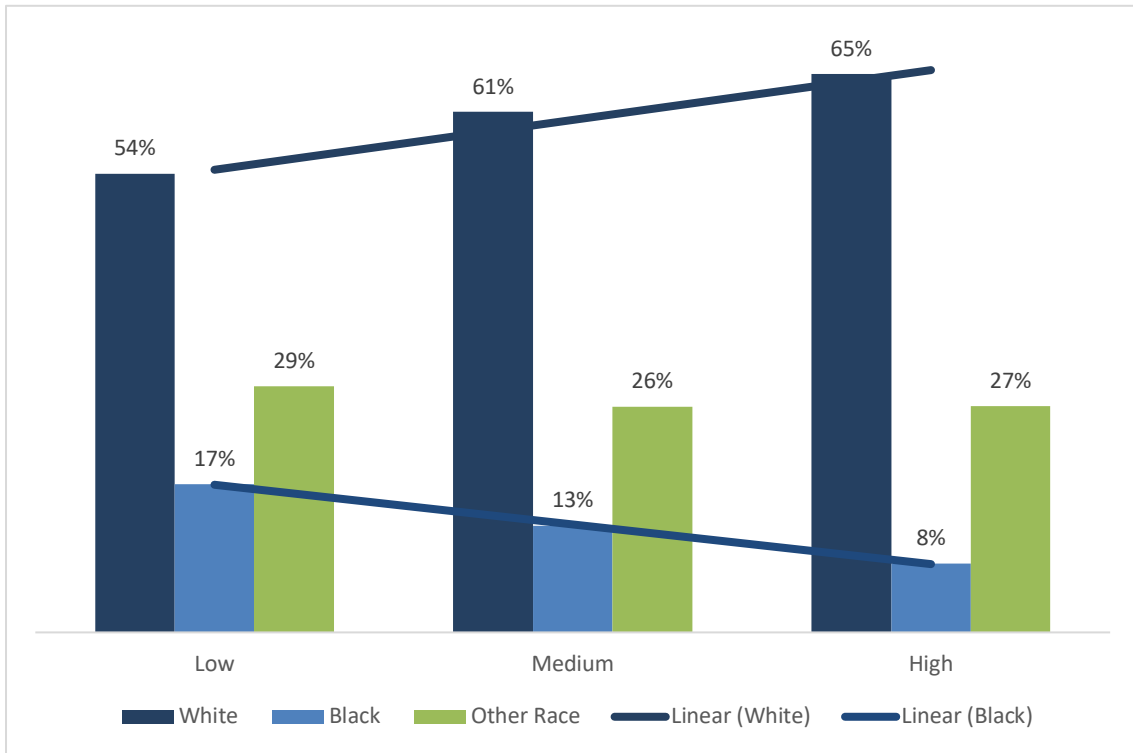


Figure 2 – Teacher’s Assessments of Student Ability and Engagement (Low, Medium, or High), by Student’s Race (%)

APPENDIX: TABLES

Table 1 – Descriptive Statistics for Variables Used in Analyses and Models

<i>Dependent Variables</i>	Mean/Proportion	Standard Deviation	Range	
			Min	Max
12th grade standardized math test score	50.67	10.11	19.82	79.85
Teacher's overall assessment of student	0.00	1.00	-2.75	1.94
<i>Student Household Characteristics</i>				
Socioeconomic status	0.05	0.74	-2.11	1.82
How far in school parent(s) want student to go*	3.27	0.77	0.00	4.00
<i>Student Characteristics</i>				
White	56.95%		0.00	1.00
Black	13.25%		0.00	1.00
Other Race	29.80%		0.00	1.00
Female	50.20%		0.00	1.00
10th grade standardized math test score	50.71	9.91	19.38	86.68
Student believes education is important to get a job later	2.58	0.59	0.00	3.00
Good grades are important to student	2.38	0.74	0.00	3.00
Getting a good education is important to student	1.82	0.41	0.00	2.00
Student attitude to learning	0	1	-5.08	0.83
<i>School Characteristics</i>				
Whether student feels safe at school	0.14	1.01	-3.04	1.56
Whether school environment is conducive to learning	0.01	0.16	-0.63	0.27
<i>Teacher Characteristics</i>				
Highest degree earned*	1.52	0.53	0.00	3.00
Years of experience teaching	14.9	10.71	0.00	40.00
Teacher expertise	0	1	-2.62	3.24
<i>Teacher's Assessment of Student</i>				
Believes student works hard for good grades	0.68	0.47	0.00	3.00
Student's mastery of class material	0.96	0.42	0.00	2.00
How far in school teacher expects student to go*	2.49	1	0.00	4.00
Teacher's overall assessment of student	0	1	-2.75	1.94

*Range from less than high school to doctoral/professional degree

Table 2 – Mean Standardized Math Test Score, by Student's Race

	Black	White	Other Race	Overall
12th grade standardized math test score	44.31	52.77	49.54	50.66
10th grade standardized math test score	44.35	53.06	49.08	50.71

***All means are significant at $p < .001$

Note: Based on race-specific and overall mean comparison t-tests

Table 3 – Teachers' Perceptions of Students, by Student's Race

Teacher's Opinion of Whether a Student Works Hard for Good Grades, by Student's Race

	Black	White	Other Race	Overall
No, Student Does Not Work Hard for Good Grades	43%***	29%***	34%**	32%
Yes, Student Does Work Hard for Good Grades	57%***	71%***	66%**	68%

***p < 0.001, **p < 0.01, *p < 0.05

Note: Based on race-specific and overall mean comparison t-tests

Teacher's Opinion of a Student's Mastery of Class Material, by Student's Race

	Black	White	Other Race	Overall
Too Difficult	17.00%***	8.88%***	12.53%**	10.90%
Appropriate Level	77.44%***	83.69%***	80.41%*	82.00%
Not Challenging Enough	5.49%***	7.43%***	7.10%	7.10%

***p < 0.001, **p < 0.01, *p < 0.05

Note: Based on race-specific and overall mean comparison t-tests

How Far in School Teacher Expects Student to Go, by Student's Race

	Black	White	Other Race	Overall
Less than high school	4%	1%	3%	2%
High school degree or GED	28%	14%	19%	17%
Attend or complete 2-year college/school	22%	17%	16%	18%
Attend college, 4-year degree incomplete	8%	8%	8%	8%
Graduate from college	30%	44%	40%	41%
Obtain Master's degree	5%	13%	10%	11%
Obtain PhD or professional degree	2%	3%	4%	3%

Mean Teacher's Assessment of Student, by Student's Race

	Black	White	Other Race	Overall
Teacher's overall assessment of student	-0.37***	0.10***	-0.05***	0.00***

***p < 0.001, **p < 0.01, *p < 0.05

Note: Based on race-specific and overall mean comparison t-tests

Table 4 – How Far in School Teacher Expects Student to Go, by Race and 12th Grade Standardized Math Test Scores

	Scored at or below average on 12th grade standardized math test				Scored above average on 12th grade standardized math test			
	Black	White	Other Race	Overall	Black	White	Other Race	Overall
Less than high school	4.1%	1.3%	2.7%	2.2%	0.3%	0.1%	0.0%	0.1%
High school degree or GED	30.9%	23.6%	26.6%	25.8%	3.8%	2.9%	3.1%	3.0%
Attend or complete 2-year college/school	26.5%	31.0%	24.1%	28.2%	7.6%	7.4%	6.2%	7.1%
Attend college, 4-year degree incomplete	10.0%	10.0%	10.2%	10.0%	8.3%	6.8%	5.3%	6.5%
Graduate from college	25.5%	30.7%	33.6%	30.7%	57.1%	57.1%	54.6%	56.5%
Obtain Master's degree	2.2%	2.9%	2.2%	2.6%	17.0%	20.8%	21.8%	20.8%
Obtain PhD or professional degree	0.8%	0.4%	0.6%	0.6%	5.9%	4.8%	9.0%	5.9%

Table 5 – Teacher’s Assessment of Student's Ability and Engagement, by Race and 12th Grade Standardized Math Test Scores

	Scored at or below average on 12th grade standardized math test				Scored above average on 12th grade standardized math test			
	Black	White	Other Race	Overall	Black	White	Other Race	Overall
Low (Below Mean - ½ St. Dev.)	43%	37%	37%	38%	15%	10%	10%	10%
Medium (Mean +/- ½ St. Dev.)	30%	34%	31%	32%	14%	17%	15%	16%
High (Above Mean + ½ St. Dev.)	26%	29%	32%	30%	71%	73%	75%	73%

Table 6 – OLS Coefficients (Standard Errors) for Models Predicting Math Teacher's Attitude Toward Student

	(1) Excluding 10th Grade Standardized Math Test Performance	(2) Including 10th Grade Standardized Math Test Performance
Female	0.11*** (0.02)	0.19*** (0.02)
Black	-0.45*** (0.04)	-0.16*** (0.04)
Other Race	-0.09** (0.03)	-0.01 (0.02)
Teacher's Level of Experience	0.01 (0.01)	-0.02* (0.01)
Student's Socioeconomic Status	0.25*** (0.02)	0.10*** (0.02)
Parents' Aspirations for Student	0.22*** (0.02)	0.12*** (0.01)
Student's Attitude Toward School	0.22*** (0.01)	0.18*** (0.01)
Whether Student Feels Safe at School	0.05*** (0.01)	0.01 (0.01)
Whether School Environment is Conducive to Learning	0.27*** (0.07)	0.10 (0.06)
10th Grade Standardized Math Test Score		0.04*** (0.00)
Constant	-0.73*** (0.05)	-2.59*** (0.07)
R ²	0.20	0.31
N	8,589	8,589

***p < 0.001, **p < 0.01, *p < 0.05

Table 7 – OLS Coefficients (Standard Errors) for Models Predicting Student Performance on 12th Grade Standardized Math Test

	(1) excluding 10th grade standardized math test performance	(2) including 10th grade standardized math test performance
Female	-2.52*** (0.18)	-0.61*** (0.10)
Black	-4.87*** (0.31)	-0.31 (0.18)
Other Race	-0.70** (0.23)	0.46*** (0.13)
Teacher's Level of Experience	0.82*** (0.09)	0.21*** (0.05)
Teacher's Assessment of Student	3.92*** (0.11)	0.98*** (0.71)
Student's Socioeconomic Status	2.95*** (0.15)	0.78*** (0.08)
Parents' Aspirations for Student	1.62*** (0.14)	0.22** (0.08)
Student's Attitude Toward School	0.26* (0.11)	0.15** (0.06)
Whether Student Feels Safe at School	0.83*** (0.10)	0.19** (0.06)
Whether School Environment is Conducive to Learning	4.07*** (0.61)	1.23*** (0.33)
Interaction Variable – Teacher's Assessment and Race	-0.74** (0.27)	-0.18 (0.16)
10th Grade Standardized Math Test Score		0.83*** (0.01)
Constant	47.19*** (0.48)	7.39*** (0.47)
R ²	0.42	0.82
N	7,445	7,445

***p < 0.001, **p < 0.01, p < 0.05

Table 8 – Means on Explanatory Variables, by Teachers’ Assessments of Student Ability and Engagement

<i>Dependent Variable</i>	Low	Medium	High
	Below Mean - ½ St. Dev.	Mean +/- ½ St. Dev.	Above Mean + ½ St. Dev.
12th grade standardized math test score	44.8	47.41	56.1
<i>Student Household Characteristics</i>			
Socioeconomic status	-0.15	-0.07	0.31
How far in school parents want student to go	3.03	3.15	3.49
<i>Student Characteristics</i>			
White	53.8%	61.0%	65.4%
Black	17.4%	12.5%	8.1%
Other Race	28.9%	26.5%	26.5%
Female	41.5%	47.9%	56.2%
10th grade standardized math test score	45.68	48.40	56.24
Student believes education is important to get a job later	2.46	2.55	2.68
Good grades are important to student	2.08	2.28	2.62
Getting a good education is important to student	1.71	1.80	1.90
Student attitude to learning	-0.4	-0.12	0.28
<i>School Characteristics</i>			
Whether student feels safe at school	-0.03	0.12	0.36
Whether school environment is conducive to learning	-0.01	0.00	0.04
<i>Teacher Characteristics</i>			
Earned a Bachelor’s Degree or lower	51.7%	50.0%	46.9%
Earned a Master’s Degree or higher	48.3%	50.0%	53.1%
Years of experience teaching	14.91	14.58	15.17
Teacher expertise	-0.03	-0.03	-0.04

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