The Effects of Teacher Match on Academic Perceptions and Attitudes

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Abstract:
Research has demonstrated positive benefits for students assigned to demographically similar teachers. Because teachers are more likely to be white and female than their students, however, demographic mismatches may contribute to racial and gender achievement gaps. Using data from six U.S. school districts collected by the Measures of Effective Teaching (MET) project and a teacher fixed effects approach, we estimate how assignment to a demographically-similar teacher affects student reports of personal effort, happiness in class, feeling cared for, student-teacher communication, post-secondary motivation, and academic engagement, as well as student achievement. Because students were randomly assigned to teachers in the second year of the MET project, we can also test the robustness of our findings in light of concerns about nonrandom sorting of students to teachers. Our results show that students assigned to a demographically congruent teacher experience important benefits in terms of academic perceptions and attitudes. The largest benefits are demonstrated by black male students assigned to black male teachers and by black female students assigned to black female teachers. We find little convincing evidence of test score impacts associated with student/teacher demographic pairings.

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A considerable body of evidence points to large, persistent achievement gaps between minority and white students that have only modestly improved since the 1960s (Clotfelter, Ladd, & Vigdor, 2009; Hanushek, Ingram, & Kenyon, 2014). Additional gaps exist across gender lines, with female students often outperforming male students in reading, and male students often outperforming females in science and math (Dee, 2005; Robinson & Lubienski, 2011). One line of research suggests that the underrepresentation of minority and male teachers may contribute to these gaps (e.g. Dee, 2007; Egalite, Kisida, & Winters, 2015). While teachers are overwhelmingly female and white, students are roughly evenly split across gender lines, and a majority of students now belong to an ethnic minority group. If, as evidence suggests, there are positive benefits for students who experience a demographically similar teacher, the so-called teacher diversity gap and the teacher gender gap may contribute to student achievement gaps. Such conclusions bolster arguments and policy directives aimed at diversifying the teacher labor force (Goldhaber, Theobald, & Tien, 2015).

Commonly proposed theories about student-teacher demographic interactions tend to focus on the psychological and social effects that may occur when students are better able to view their teachers as role models (Boser, 2011; Evans, 1992), or when negatively-biasing stereotypes of student-teacher interactions are abated (Ferguson, 1998). Because of the social and emotional aspects of these theories, student achievement as measured through test scores is likely too narrow to sufficiently evaluate the dynamics of race/ethnicity and gender interactions between teachers and students. Fortunately, additional measures of student success are increasingly being collected, which have varyingly been referred to as non-cognitive outcomes (Heckman & Rubinstein, 2001), social emotional skills (Merrell & Gueldner, 2010) and academic behaviors and mindsets (Blazar & Kraft, 2015). A growing body of evidence finds that

teachers have measurable impacts on these types of outcomes (Blazar & Kraft, 2015; Gershenson, 2016; Holt & Gershenson, 2015; Jackson, 2012). By and large, however, these measures have not been sufficiently examined within the context of student-teacher demographic interactions (Grissom, Kern, & Rodriguez, 2015).

We address this gap in the literature by examining student self-reports of academic perceptions and attitudes that are directly tied to their classroom teachers. Using data from student surveys administered to more than 80,000 students as part of the Gates Foundation's Measures of Effective Teaching (MET) project, we are able to evaluate how race/ethnicity and gender interactions affect students' perceptions of academic characteristics related to their teachers and classrooms. Seven of the measures collected are taken from TRIPOD surveys administered to students in grades 4-8 (Ferguson, 2008). The TRIPOD measures include scales indicating if a student feels cared for by his/her teacher (Care), student interest and enjoyment of classwork (Captivate), the quality of teacher-student communication (Confer), clarity in teaching style and methods (Clarify and Consolidate), students' self-assessment of their teachers' influence on their own effort and motivation (Effort), classroom management (Control), and students reporting if they feel pushed by their teachers (Challenge). Two additional outcomes and attitudinal scales are constructed from ancillary items collected by the MET researchers. These include a measure of students' happiness in class (Happy) and a measure of students' college aspirations (College).

We estimate race/ethnicity and gender interactions for these outcomes by exploiting the fact that each teacher is assigned ratings on these measures by multiple students. In previous studies, researchers have used homologous student fixed-effects strategies to isolate the effect of student-teacher demographic interactions when students received multiple contemporaneous

subjective ratings from different teachers (e.g., Dee, 2005; Gershenson, 2015). In this case, because individual teachers are receiving ratings from multiple students, we reverse this intuition and use a teacher fixed-effects approach to isolate the effects of demographically similar teachers on student perceptions and academic attitudes. Moreover, because a sub-sample of students in the MET project were randomly assigned to teachers, we are able to further test if our estimation strategy is producing valid estimates that are free of potential bias that could result from the non-random assignment of students to teachers. We also take advantage of this random assignment component to examine how student-teacher demographic interactions affect math and reading achievement scores. This is particularly important as it allows us to directly compare estimates of attitudinal effects, relative to achievement effects.

Our results suggest there are important benefits for students' academic perceptions and attitudes when they are assigned to a demographically congruent teacher. The largest benefits are demonstrated by black male students assigned to black male teachers and by black female students assigned to black female teachers. We find little convincing evidence of impacts on students' math or reading test scores.

Literature Review

Theoretical Framework

The potential for demographically congruent teachers to influence educational outcomes tends to be framed as psychologically- or socially-based. From a psychological perspective, the influence of having a similar teacher may affect students if they view their teachers as role models (Adair, 1984; Graham, 1987; Hess & Leal, 1997; Stewart et al., 1989). In such instances, students may raise their academic motivations and aspirations when exposed to a demographically similar person in a position of authority (King, 1993; Villegas & Clewell, 1998;

Villegas & Lucas, 2004). Another psychological influence may be stereotype threat (Steele, 1997; Steele & Aronson, 1995), which occurs in situations where students feel pressure from a negative stereotype that inhibits their performance. This threat may be abated when teachers share their racial/ethnic or gender identity. Evidence from a recent field experiment demonstrates that affirmation exercises and supportive classroom environments lead to significant improvements in academic performance for minority students (Dee, 2015)

Alternatively, demographically similar teachers may serve to encourage students by adopting a mentoring role or advocating for students they identify with or who share backgrounds similar to their own (Adair, 1984; Graham, 1987; King, 1993; Ladson-Billings, 1992; Nixon & Robinson, 1999; Pitts, 2007; Stewart, Meier, & England, 1989). Moreover, cultural differences between teachers and students of different backgrounds may affect instructional techniques that could put some students at a disadvantage. Some researchers have also argued that minority teachers in particular may tend to hold higher expectations for minority students (Beady & Hansell, 1981; Ferguson, 2003; Gershenson, Holt, & Papageorge, 2016). Finally, intentional or unintentional biases related to negative stereotypes may alter the ways that teachers interact with students who have different demographic characteristics (e.g., Ferguson, 1998), especially if they hold stereotypes related to perceived academic ability (Rosenthal & Jacobson, 1968). Related research has shown that disciplinary actions taken in response to students' behavior may sometimes be biased along racial or gender characteristics (Downey & Pribesh, 2004; Gregory, Skiba, & Noguera, 2010; McCarthy & Hoge, 1987).

Studies Examining Achievement Effects

A number of studies have attempted to document student achievement benefits resulting from student-teacher pairings along race/ethnicity and gender lines. For example, an early study

of own-race teacher matches using a nationally representative dataset found no link between test score gains and same-race teachers (Ehrenberg, Goldhaber, & Brewer, 1995). In an analysis of data from Tennessee's Project STAR class-size experiment, Dee (2004) found that third-grade black and white students randomly assigned to racially similar teachers saw improved test scores. Dee found the largest effects when black students were assigned to black teachers. Additional studies have found similar, though often smaller effects using quasi-experimental approaches. For instance, Clotfelter et al. (2007) and Goldhaber and Hansen (2010), both use longitudinal data from North Carolina to document student achievement effects from racially congruent teachers. Goldhaber and Hansen find that in particular, black students with black teachers experienced the largest gains. Similarly, employing a student fixed-effects analysis with eight years of data from the state of Florida, Egalite, Kisida and Winters (2015) find some evidence of student-teacher matching effects, with the strongest effects demonstrated by black students in elementary grades.

Student achievement effects as a result of gender matches between teachers and students are less conclusive. Examining data from the National Education Longitudinal Study of 1988, Ehrenberg et al. (1995) find no evidence of achievement effects from student-teacher gender congruence. Winters, Haight, Swaim, and Pickering (2013) analyze an administrative panel dataset from Florida, also finding no significant relationship from student-teacher gender interaction. Rather, they conclude that both male and female students benefit from being assigned to a female teacher.

Effects on Non-Tested Academic Outcomes

Research has also examined student-teacher demographic congruence on subjective or "non-tested" measures. Using data from the National Education Longitudinal Study of 1988,

which includes contemporaneous ratings of students by different teachers, Dee (2007) finds that assignment to a same-gender teacher improves teacher perceptions of student engagement and performance. Ehrenberg et al. (1995) reach similar conclusions using these same data. Ouazad (2014) also finds that students are rated stronger in terms of academic performance by same-race teachers. Similar to Dee (2007), Gershenson, Holt and Papageorge (2016) exploit contemporaneous ratings by multiple teachers per student as an identification strategy. They find that non-black teachers have lower expectations for the educational attainment of black students. Gershenson and colleagues find no effects from student-teacher gender interactions.

The Importance of Combining Research on Non-Tested Academic Outcomes and Teacher Effectiveness

We also draw on the broader literature on teacher quality and its measurement. Of all the educational inputs within a school's control, none have been demonstrated to be as important as teachers (Hanushek, 2011; Winters, 2011). Based on measures of student achievement, having a higher quality teacher improves college attendance, leads to higher salaries, and lowers teen pregnancy rates (Chetty, Freidman, & Rockoff, 2014). Though the measurement of teacher quality has made significant progress, a narrow reliance on test score growth poorly measures what constitutes an effective teacher in non-tested outcomes (Blazar & Kraft, 2015; Gershenson, 2016; Grissom, Loeb, & Doss, 2015; Jackson, 2016). The federal endorsement of broader measures of teacher quality in the recently adopted *Every Student Succeeds Act* is a particularly telling manifestation of the growing reluctance to rely on narrowly-defined measures of teacher and school effectiveness (ESSA, 2015), though some researchers are skeptical that newly adopted approaches have been thoroughly vetted (Duckworth & Yeager, 2015). The literature to date that attempts to demonstrate teachers' impact on students' non-cognitive outcomes is

nascent (Jennings & DiPrete, 2010; Kraft & Grace, 2016; Ruzek, Domina, Conley, Duncan, & Karabenick, 2015). Our examination of these types of measures within the context of student-teacher demographic interactions adds to this emerging area of research.

Data and Measures

Our data are drawn from the Measures of Effective Teaching (MET) project, which tracked approximately 3,000 teachers in six school districts across the United States over the 2009-10 and 2010-11 school years. Those districts are Charlotte-Mecklenburg Schools (NC), the Dallas Independent School District (TX), Denver Public Schools (CO), Hillsborough County Public Schools (FL), Memphis City Schools (TN), and the New York City Department of Education (NY).

MET researchers collected a variety of measures of teaching practice, including students' achievement on standardized tests, surveys of students' perceptions of their teacher and classroom environment, and videos of classroom practice. In the second year of the study, teachers were randomly assigned to classrooms, a design feature we exploit to test if the statistical controls we apply to the full set of data are sufficient to ensure our estimates are free of selection bias that could result from the non-random sorting of students to teachers.

Table 1 presents a descriptive overview of the sample. We focus on students in grades three through eight—those grades in which students took the state standardized assessment. Twenty-five percent of students in our sample are white, 35 percent are Black, and 32 percent are Hispanic. More than half of students (57 percent) qualify for the federal free and reduced price lunch program. Fourteen percent of students are classified as English Language Learners, 10 percent are gifted, and 8 percent are identified as having special educational needs. Table 1 also presents summary statistics describing teacher characteristics, which reflect the teacher racial

diversity and teacher gender gaps seen nationwide. Just 18 percent of teachers are male, 57 percent are white, 37 percent are Black, and 6 percent are Hispanic. Finally, Table 1 also presents summary statistics of the ten dependent variables, whose values range from one to five.

≪ TABLE ONE ABOUT HERE ≫

The full list of items included in each scale and the associated Cronbach's Alphas are listed in Appendix A. Further, Appendix Table B1 provides the mean values for each of the ten dependent variables broken out by various student characteristics and Appendix Table B2 presents a matrix of correlation coefficients, describing the strength and direction of the relationships between these various scales. The strongest observed relationship is between the Clarify and Care scales (r = .71). Similarly, Confer and Care are strongly related (r = .70). Conversely, the weakest observed relationship is between the Control and College scales (r = .29).

Our independent variables include "Same Race" and "Same Sex." We also include other possible combinations (i.e., Same Race *and* Same Sex; Same Race *and* Other Sex; etc.). Table 2 provides a detailed breakdown of these independent variables by various student characteristics. Forty-eight percent of students are matched to a teacher of the same race, but this overall statistic masks important heterogeneity by race. White students are most likely to be matched to a same-race teacher at 80%, compared to just 9% of Hispanic students. The corresponding statistic for black students is 59%. At 50%, the aggregate statistic for assignment to a same-sex teacher also masks important heterogeneity by subgroups. Only 18% of male students are assigned to a male teacher, whereas 83% of female students are assigned to a female teacher.

≪ TABLE TWO ABOUT HERE ≫

Identification Strategy

The primary identification strategy builds upon that presented by Dee (2005) and Gershenson, Holt, and Papageorge (2016), which leverages contemporaneous subjective evaluations of students by teachers with various demographic characteristics. Because multiple students in our sample evaluate the same classroom teacher, we reverse this analytic to exploit the within-teacher variation from multiple students' evaluations. Formally, the measure of academic perceptions and attitudes (*APA*) for student *i*, at time *t* is measured as

$$APA_{it} = \alpha_j + \beta_1 \mathbf{X}_i + \beta_2 \mathbf{Y}_{t-2} + \beta_3 \mathbf{Z}_c + \eta_g + \beta_4 \boldsymbol{Other}_{it} + \epsilon_{it} \quad (1)$$

where α is a teacher fixed effect that controls for unobserved, time-invariant teacher characteristics that might influence students' evaluations (for instance, the ability to motivate students); **X** is a vector of observed student characteristics (e.g., gender, race, FRL, ELL, special education status, and gifted status); **Y** is a vector of math and reading test scores from 2009, prior to the start of the MET data collection period; **Z** is a vector of observed classroom characteristics (i.e., class size, percent male, percent of each race/ethnicity, percent FRL, percent ELL, percent special education, and percent gifted); and η is a grade fixed effect. ***Other*** is a vector of variables that measure demographic mismatch between teacher and student; and ϵ is a stochastic error term clustered at the school level. β_4 is the coefficient of interest. Following Dee (2005), the ***Other*** vector in the baseline model contains two variables: *Other Race* and *Other Sex.* However, to test for multiplicative effects of assignment to a teacher who falls into both the *Other Race* and *Other Sex* categories, we follow Gershenson, Holt and Papageorge (2016) and consider a specification in which ***Other*** is composed of four mutually exclusive categories of demographic mismatch: *Same Race and Other Sex*, *Other Race and Same Sex*, *Other Race and Other Sex*, and *Same Race and Same Sex,* with the latter variable omitted as the reference category.

We also estimate the effects of demographic similarities between teachers and students on math and English Language Arts (ELA) achievement outcomes. Formally, the achievement measure (*A*) for student *i*, at time *t* is measured as

$$A_{it} = \delta_1 \mathbf{X}_i + \delta_2 \mathbf{Y}_{t-2} + \delta_3 \mathbf{Z}_c + \eta_g + \zeta_t + \delta_4 \boldsymbol{Other}_{it} + \epsilon_{it} \quad (2)$$

where **X** is a vector of observed student characteristics (i.e., gender, race, FRL, ELL, special education status, and gifted status); **Y** is a vector of math and reading test scores from 2009, prior to the start of the MET data collection period; **Z** is a vector of observed classroom characteristics (e.g., class size, percent male, percent of each race, percent FRL, percent ELL, percent special education, percent gifted, and a teacher value-added score based on students' average growth on standardized math or ELA test scores); η is a grade fixed effect. As before, ***Other*** is a vector of variables that measure demographic mismatch between teacher and student and ϵ is a stochastic error term clustered at the school level. We examine achievement outcomes for 2010-11, controlling for two years of prior test scores.

Results

For our initial examination of the effect of teacher/ student demographic match on students' academic perceptions and attitudes, we estimate race and gender interactions separately by including indicator variables for *Other Sex* and *Other Race* (Table 3). We define the analysis sample in three different ways to ensure our findings are not influenced by sample characteristics. In columns 1 and 2, our estimates are generated using all available observations. Using this specification, we observe a consistent, statistically significant pattern of negative coefficients associated with the *Other Sex* variable for all of the scales examined. On average, students report having more favorable perceptions when their teacher is the same gender as them relative to when their teacher is a different gender. Similarly, we observe statistically significant

negative coefficients for the *Other Race* variable for Care, Happy, Clarify, Control, and Consolidate. On average, students have more favorable perceptions on these measures when they share their teacher's race/ethnicity.

≪ TABLE THREE ABOUT HERE ≫

Columns 3 and 4 add controls for math and ELA test scores in 2009, which is the year prior to the start of the MET project. This restriction limits the analysis sample to those students in grades five and above only. Using this restricted sample, the results are nearly identical.

Finally, Columns 5 and 6 report results from the second year of the MET study only, in which teachers were randomly assigned to class sections. This randomization allows us to be confident that any inferences we draw about the relationship between teacher/student racial congruence and the various outcomes examined are not driven by the nonrandom sorting of students to teachers. With this additional sample restriction, the direction of the effects is consistent with what we have observed thus far, and in some cases the magnitude of the effects grows larger. In a few instances, however, the effects fall shy of statistical significance. Given the consistency of the direction and magnitude of the effects, the lack of significance on some items is likely related to a reduction in study power when using this smaller sample.

Across all three specifications, the largest and most consistently significant effects are observed for Care, Captivate, Confer, Challenge, and Consolidate. In general, the effects are largest among gender matches.

In Table 4 we report estimates from a more finely specified version of the analytical model in which the *Other* vector is specified as a set of four mutually exclusive categories that describe the specific nature of the demographic match between students and teachers: *Same Race and Other Sex*, *Other Race and Same Sex*, and *Other Race and Other Sex*. Typically, the effects

in columns 1, 4, and 7 are larger than columns 2, 5, and 8, confirming the patterns from Table 3. That is, the negative effects of gender mismatches are generally of higher magnitude than race/ethnicity mismatches. Interestingly, the largest negative coefficients are observed in columns 3, 6, and 9, which are instances when a student experiences both a racial and gender mismatch. Again, the results from the randomized sample are well aligned with the results that rely on teacher fixed-effects to control for selection.

≪ TABLE FOUR ABOUT HERE ≫

Thus far, we have restricted the effect of a demographic mismatch to be constant across all students, but this approach may mask important differences by race or gender. Table 5 reports results when the sample is restricted to white male teachers, white female teachers, black male teachers, and black female teachers. In order to provide the most reliable estimates, all estimates in Table 5 are based on the sample of teachers randomly assigned to classrooms, except in the case of College, which was only asked in the first year. Although we also generated estimates for Hispanic teachers, we found no significant effects from demographic mismatches; thus, we exclude those results from the table for ease of presentation.

≪ TABLE FIVE ABOUT HERE ≫

The results in table 5 more precisely illustrate the source of our results. First, white female students rate white teachers higher compared to white male students and nonwhite male students. In other words, for white female teachers, the significant effects are driven by gender matches. White female teachers are rated higher by white female students than by white male students in terms of Captivate, Happy, Effort, and College (column 4). Similarly, white female teachers are rated higher by white female students than by nonwhite male students in terms of Care, Happy, and Effort (column 6).

There is also evidence of specific effects for black male students matched with black male teachers. In particular, there is evidence of a race-matching effect as black male teachers are rated higher by black male students than they are rated by white male students in terms of Care, Confer, Effort, Control, and Consolidate (column 8). Black male teachers are also rated higher by black male students compared to white female students on the measures of Care, Confer, Control, and Consolidate (column 9). The fact that there are no significant differences in column 7 implies that black male teachers receive similar ratings from both male and female black students.

Finally, we observe the largest results for black female students' ratings of black female teachers. Across multiple domains, black female teachers are rated much higher by black female students than they are rated by black male students, nonblack female students, and nonblack male students. First, black female teachers are rated higher by black female students than they are rated by black male students in terms of Care, Confer, College, Clarify, and Challenge (column 10). Black female teachers are also rated higher by black female students than they are rated by nonblack female students in terms of Confer, College, Clarify, Challenge, and Consolidate (column 11). Finally, black female teachers are rated higher by black female students than they are rated by nonblack male students in terms of Care, Captivate, Confer, Effort, College, Clarify, Challenge, and Consolidate (column 12). Moreover, the sizes of the effects in column 12 are the largest in magnitude in every instance. Thus, matches between black *and* female students and teachers generate the most robust evidence of the effects of demographic congruence on students' academic perceptions and attitudes.

Turning next to math and ELA achievement outcomes, Table 6 presents the results of the student achievement analysis described in model (2). Examining test score outcomes in 2010-11,

we find no effects associated with any of the various demographic matching variables in either ELA or Math. We find similar results in our subgroup analysis of ELA and math achievement effects. None of the subgroups we examine reveal a statistically significant relationship between demographic matching variables and student achievement in ELA or math at $p < .05$ or lower. There is some limited evidence of an effect in ELA for female students paired with female teachers, and an effect in math for white students paired with white teachers. There is also suggestive evidence that white male students paired with white male teachers are doing better in math. Overall, however, the evidence of achievement effects is limited.

≪ TABLE SIX ABOUT HERE ≫

Discussion

Our findings demonstrate the influence of teacher/student demographic similarity on students' academic perceptions and attitudes about their teachers and classrooms. Across a number of different specifications, students who share racial and/or gender characteristics with their teachers tend to report higher levels of personal effort, happiness in class, feeling cared for, student-teacher communication, post-secondary motivation, and academic engagement. Previous studies have hypothesized that demographically similar teachers may be more likely to encourage students or serve as mentors to students with whom they share similar backgrounds (King, 1993). Related empirical evidence has demonstrated that demographically congruent teachers hold higher expectations for students (Fox, 2015; Gershenson, Holt, & Papageorge, 2016; Ouazad, 2014). Additionally, demographically similar teachers may employ targeted instructional approaches (King, 1993), serve as cultural translators (Irvine, 2000; King, 1993), and employ "culturally relevant pedagogy" (Ladson-Billings, 1994, 1995). Against this backdrop, our findings on students' academic perceptions and attitudes make intuitive sense.

We observe the largest and most consistent effects when examining female students paired with female teachers. These effects are particularly strong for black female students paired with black female teachers, where we observe significant effects for eight out of ten items. The largest results emerge in the Care, Confer, Effort, College, Clarify, Challenge, and Consolidate scales. The Care scale includes items such as "I like the way my teacher treats me when I need help," and "My teacher in this class makes me feel that he/she really cares about me." The Effort scale, Challenge scale, and College scale include items such as "I have pushed myself hard to understand my lessons in this class," "My teacher doesn't let people give up when the work gets hard," and "My teacher makes me want to go to college," respectively. And finally, the Confer scale and the Consolidate scale include items such as "My teacher asks questions to make sure we understand what he/she is teaching us" and "We get helpful comments to let us know what we did wrong on assignments." For female students, and black female students in particular, having a demographically similar teacher makes them feel more cared for, challenges them to work harder and aspire higher, and provides them with more effective communication and feedback.

We also find that black male students perceive black male teachers especially high in terms of the Care, Confer, and Control scales. As mentioned previously, the Care and Confer scales have implications in terms of the quality of teacher-student relationships and providing effective instructional feedback. The Control scale reflects the quality of classroom management, as it includes items such as "Student behavior in this class is under control," and "Students in this class treat the teacher with respect." This suggests that black male teachers may be particularly well-suited to garner respect and assert authority over black male students.

Despite what previous studies have shown, we find no strong evidence of student achievement benefits in math and ELA resulting from same-race or same-gender matches. In previous research, however, these effects have been generated from large datasets and have generally been quite small in magnitude (e.g., Egalite, Kisida, & Winters, 2014). Our results suggest that studies focused on achievement effects may have only observed the tip of the iceberg with regards to the benefits of demographically similar teachers for minority students. Compared to the effect sizes reported in previous studies that have focused on student achievement, the effect sizes we find on measures of student academic perceptions and attitudes are considerably larger.

It is important to consider that the measures relied upon in this study are generated from student reports, and thus the results might be driven by a bias for demographically similar teachers instead of reflecting substantial differences in actual instructional practices by teachers. Only by validating these measures through external means could we fully answer this question. Future research needs to determine the extent to which students' reports of academic perceptions and attitudes translate into tangible benefits in school and later-life outcomes, such as high school and college attainment and employment.

Much of the existing literature on this topic has been motivated by the fact that minority teachers are underrepresented in the teaching force, and that this underrepresentation may put minority students at a disadvantage (U.S. Department of Education, 2016). Our results support this line of thinking from a new angle. A growing literature demonstrates that there are numerous teacher characteristics beyond value-added measures of academic achievement that contribute to student success (Jackson, 2016; Jennings & DiPrete, 2010; Kraft & Grace, 2016). Similarly, our results show that understanding the consequences of the underrepresentation of minority teachers

requires looking beyond test scores. We must instead make efforts to measure the quality of student-teacher interactions across multiple domains. Only then can the full implications of the teacher gender gap and the teacher diversity gap be fully considered.

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Table 1.

Descriptive statistics of the analytic sample

Scale	Mean	SD	Min	Max
Student Characteristics				
Male	0.50	0.50	0	1
White	0.28	0.45	0	1
Black	0.38	0.49	0	1
Hispanic	0.34	0.47	0	1
FRL	0.57	0.49	0	1
ELL	0.13	0.34	0	1
Gifted	0.10	0.30	0	1
Special Education	0.09	0.28	0	1
Grade	6.09	1.37	4	8
Teacher Characteristics				
Male	0.18	0.38	0	1
White	0.57	0.49	0	1
Black	0.37	0.48	0	1
Hispanic	0.06	0.23	0	1
Years of Experience	10.01	8.83	0	46
Masters/ Advanced Degree	0.36	0.48	0	1
Dependent Variables				
Care	3.71	1.01	1	5
Captivate	3.59	0.95	1	5
Happy	3.83	1.07	1	5
Confer	3.68	0.86	1	5
Effort	4.01	0.71	1	5
College	3.77	1.18	1	5
Clarify	3.99	0.76	1	5
Control	3.42	0.84	1	5
Challenge	4.11	0.73	1	5
Consolidate	3.78	0.94	1	5

Notes: n = 82,409 students, 1,909 teachers, 231 schools

Table 2.

Sample Means of the Key Independent Variables, by Student Characteristics

	All	Male Students	Female Students	White Students	Black Students	Hispanic Students	Grades 4-5	Grades 6-8
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Same Race	0.48	0.48	0.48	0.80	0.59	0.09	0.52	0.45
Same Sex	0.50	0.18	0.83	0.50	0.51	0.50	0.51	0.50
Same Race, Same Sex	0.24	0.08	0.40	0.40	0.30	0.04	0.27	0.23
Same Race, Other Sex	0.24	0.40	0.07	0.40	0.29	0.04	0.26	0.23
Other Race, Same Sex	0.26	0.10	0.42	0.10	0.21	0.46	0.24	0.27
Other Race, Other Sex	0.26	0.42	0.10	0.10	0.20	0.46	0.24	0.27
Observations	93,386	46,751	46,635	25,841	35,726	31,819	32,901	60,485

Notes: n = 82,409 students, 1,909 teachers, 231 schools

Table 3.

Effects of Teacher/Student Demographic Match on Academic Perceptions and Attitudes

	All Observations		Controlling for Prior Test Scores		Randomized Sample Only	
	Other Race	Other Sex	Other Race	Other Sex	Other Race	Other Sex
Scale	(1)	(2)	(3)	(4)	(5)	(6)
Care	-.04**	-.07***	-.03**	-.07***	-.05	-.08***
	(.02)	(.01)	(.02)	(.01)	(.03)	(.03)
Captivate	-.01	-.07***	-.02	-.06***	-.01	-.06***
	(.02)	(.01)	(.02)	(.01)	(.03)	(.02)
Happy	-.04**	-.05***	-.04**	-.05***	-.06*	-.04*
	(.02)	(.01)	(.02)	(.01)	(.04)	(.03)
Confer	-.02	-.05***	-.02	-.05***	-.02	-.05**
	(.02)	(.01)	(.02)	(.01)	(.03)	(.02)
Effort	-.03	-.03***	-.03	-.03***	-.03	-.04
	(.02)	(.01)	(.02)	(.01)	(.04)	(.03)
College	-.02	-.06***	-.02	-.06***	n/a	n/a
	(.02)	(.01)	(.02)	(.01)		
Clarify	-.03*	-.05***	-.03	-.05***	-.02	-.03
	(.02)	(.01)	(.02)	(.01)	(.03)	(.02)
Control	-.04***	-.02*	-.03**	-.02*	-.02	-.03
	(.01)	(.01)	(.01)	(.01)	(.03)	(.02)
Challenge	-.02	-.03***	-.02	-.04***	.00	-.06**
	(.02)	(.01)	(.02)	(.01)	(.03)	(.02)
Consolidate	-.04**	-.04***	-.04**	-.04***	-.03	-.05**
	(.02)	(.01)	(.02)	(.01)	(.04)	(.03)

Notes: Models include controls for student gender, student race, FRL, ELL Sp.Ed., gifted, prior math and ELA scores, class size, class pct. male, class pct. of each race, class pct. FRL, class pct. ELL, class pct. gifted, class pct. Sp.Ed; grade, teacher, and year fixed effects. Standard errors in parentheses are robust to clustering at the school level; *** p<0.01, ** p<0.05, and * p<0.10

Table 4

Effects of Teacher/Student Demographic Match on Academic Perceptions and Attitudes, Results by All Demographic Pairings

	All Observations			Controlling for Prior Test Scores			Randomized Sample Only		
	Same Race, Other Sex	Other Race, Same Sex	Other Race, Other Sex	Same Race, Other Sex	Other Race, Same Sex	Other Race, Other Sex	Same Race, Other Sex	Other Race, Same Sex	Other Race, Other Sex
Scale	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Care	-.08***	-.05***	-.11***	-.08***	-.04**	-.11***	-.06*	-.03	-.13***
	(.02)	(.02)	(.02)	(.02)	(.02)	(.02)	(.03)	(.04)	(.04)
Captivate	-.08***	-.02	-.08***	-.08***	-.03	-.08***	-.06**	-.01	-.06
	(.02)	(.02)	(.02)	(.02)	(.02)	(.02)	(.03)	(.04)	(.04)
Happy	-.08***	-.06***	-.09***	-.07***	-.06***	-.09***	-.05	-.06	-.11**
	(.02)	(.02)	(.02)	(.02)	(.02)	(.02)	(.04)	(.04)	(.04)
Confer	-.06***	-.03	-.07***	-.06***	-.03	-.07***	-.07**	-.04	-.07**
	(.01)	(.02)	(.02)	(.01)	(.02)	(.02)	(.03)	(.04)	(.04)
Effort	-.03*	-.03	-.06***	-.03	-.03	-.06***	-.02	-.02	-.07
	(.02)	(.02)	(.02)	(.02)	(.02)	(.02)	(.04)	(.04)	(.05)
College	-.07***	-.03	-.08***	-.07***	-.03	-.08***	n/a	n/a	n/a
	(.02)	(.02)	(.02)	(.02)	(.02)	(.02)			
Clarify	-.05***	-.03*	-.08***	-.05***	-.03	-.08***	-.04	-.03	-.06
	(.02)	(.02)	(.02)	(.02)	(.02)	(.02)	(.03)	(.04)	(.04)
Control	-.03**	-.05***	-.06***	-.03**	-.04**	-.06***	-.03	-.02	-.06
	(.01)	(.02)	(.02)	(.01)	(.02)	(.02)	(.03)	(.03)	(.04)
Challenge	-.04***	-.03*	-.06***	-.05***	-.03	-.06***	-.05	.01	-.05
	(.01)	(.02)	(.02)	(.02)	(.02)	(.02)	(.03)	(.04)	(.04)
Consolidate	-.04**	-.04**	-.08***	-.03**	-.03	-.07***	-.02	-.00	-.08*
	(.01)	(.02)	(.02)	(.02)	(.02)	(.02)	(.03)	(.04)	(.04)

Notes: Models include controls for student gender, student race, FRL, ELL Sp.Ed., gifted, 2009 math and ELA scores (columns 4, 5, and 6 only), class size, class pct. male, class pct. of each race, class pct. FRL, class pct. ELL, class pct. gifted, class pct. Sp.Ed; grade, teacher, and year fixed effects. Standard errors in parentheses are robust to clustering at the school level; *** p<0.01, ** p<0.05, and * p<0.10

Table 5

Subgroup Estimates of the Effects of Teacher/Student Demographic Match on Academic Perceptions and Attitudes, Using Randomization Sample

	White Male Teachers			White Female Teachers			Black Male Teachers			Black Female Teachers		
Scale	SROS	ORSS	OROS	SROS	ORSS	OROS	SROS	ORSS	OROS	SROS	ORSS	OROS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Care	-.09	-.06	-.15	-.07	-.02	-.13***	-.08	-.18*	-.29**	-.09*	-.06	-.19**
	(.13)	(.09)	(.10)	(.04)	(.05)	(.04)	(.12)	(.10)	(.13)	(.05)	(.07)	(.07)
Captivate	-.10	.02	-.06	-.11**	.00	-.03	.06	-.08	-.13	-.04	-.06	-.12*
	(.12)	(.10)	(.09)	(.04)	(.05)	(.05)	(.10)	(.15)	(.13)	(.05)	(.06)	(.07)
Happy	-.06	-.08	-.14	-.14***	-.07	-.14***	.09	-.14	-.18	-.04	-.01	-.05
	(.12)	(.09)	(.10)	(.04)	(.05)	(.05)	(.14)	(.14)	(.13)	(.05)	(.06)	(.07)
Confer	-.07	-.06	-.04	-.07	.02	-.03	-.07	-.28**	-.33***	-.14***	-.17**	-.25***
	(.08)	(.08)	(.09)	(.04)	(.05)	(.04)	(.14)	(.13)	(.11)	(.04)	(.06)	(.06)
Effort	.13	-.10	.07	-.18***	.00	-.22***	.03	-.32*	-.21	-.15**	-.09	-.31***
	(.09)	(.09)	(.10)	(.04)	(.05	(.05)	(.13)	(.17)	(.20)	(.06)	(.07)	(.08)
College	-.03	.09	.03	-.11***	.05*	-.02	-.01	-.11	-.05	-.12***	-.19***	-.27***
	(.06)	(.07)	(.06)	(.03)	(.03)	(.03)	(.05)	(.10)	(.08)	(.02)	(.03)	(.04)
Clarify	-.15	-.01	.05	-.01	.08	.00	.14	-.07	-.08	-.15***	-.15*	-.28***
	(.13)	(.10)	(.11)	(.05)	(.05)	(.05)	(.11)	(.10)	(.12)	(.04)	(.08)	(.07)
Control	-.04	.06	-.02	-.03	.01	.03	-.13	-.22**	-.23*	.05	.01	-.01
	(.09)	(.10)	(.11)	(.04)	(.04)	(.04)	(.08)	(.09)	(.11)	(.04)	(.06)	(.06)
Challenge	-.03	.11	.08	-.06	.08	-.02	.09	-.05	-.12	-.13***	-.18**	-.30***
	(.11)	(.10)	(.08)	(.05)	(.05)	(.05)	(.12)	(.12)	(.13)	(.04)	(.07)	(.07)
Consolidate	-.13	-.02	-.08	.02	.10*	.02	.05	-.22*	-.27*	-.08*	-.16**	-.28***
	(.13)	(.11)	(.10)	(.05)	(.05)	(.05)	(.12)	(.12)	(.12)	(.04)	(.07)	(.07)

Notes: Models include controls for student gender, student race, FRL, ELL Sp.Ed., gifted, prior math and ELA scores, class size, class pct. male, class pct. of each race, class pct. FRL, class pct. ELL, class pct. gifted, class pct. Sp.Ed; grade, and teacher fixed effects. Standard errors in parentheses are robust to clustering at the school level; SROS = Same Race, Other Sex; ORSS = Other Race, Same Sex; OROS = Other Race, Other Sex; *** p<0.01, ** p<0.05, and * p<0.10

Table 6

The Effects of Teacher/Student Demographic Match on Achievement Outcomes in 2011

	ELA			Math		
	Same Race, Other Sex	Other Race, Same Sex	Other Race, Other Sex	Same Race, Other Sex	Other Race, Same Sex	Other Race, Other Sex
	(1)	(2)	(3)	(4)	(5)	(6)
All Students	.00	.01	.03	-.00	-.03	-.03
	(.01)	(.02)	(.02)	(.01)	(.02)	(.02)
Subgroups:						
White Students	-.03	.02	-.03	.01	.01	-.07*
	(.04)	(.04)	(.05)	(.03)	(.04)	(.04)
Black Students	-.02	-.03	.00	-.03	-.03	.00
	(.03)	(.03)	(.04)	(.03)	(.03)	(.04)
Hispanic Students	.06	.01	.05	.01	.03	.01
	(.06)	(.05)	(.05)	(.04)	(.03)	(.04)
Male Students	.02	-.02	.04	-.01	-.02	-.03
	(.04)	(.05)	(.05)	(.03)	(.04)	(.04)
Female Students	-.07*	.00	.01	.02	-.01	.01
	(.04)	(.02)	(.03)	(.03)	(.02)	(.04)
White Male Students	.01	.09	.00	-.04	-16*	-.07
	(.04)	(.11)	(.05)	(.06)	(.09)	(.06)
White Female Students	-.06	.03	.06	.03	.01	-.10
	(.07)	(.04)	(.08)	(.04)	(.05)	(.06)
Black Male Students	.06	.02	.08	-.05	-.05	-.04
	(.08)	(.11)	(.09)	(.05)	(.11)	(.08)
Black Female Students	-.08	-.04	.02	-.00	-.00	.03
	(.07)	(.05)	(.08)	(.05)	(.05)	(.09)

Notes: Models include controls for student gender, student race, FRL, ELL Sp.Ed., gifted, twice-lagged test scores in math and ELA, class size, class pct. male, class pct. of each race, class pct. FRL, class pct. ELL, class pct. gifted, class pct. Sp.Ed; and grade and school fixed effects. Standard errors in parentheses are robust to clustering at the school level; *** p<0.01, ** p<0.05, and * p<0.10

Appendix A

Care Scale

Elementary Items (α = .84):
I like the way my teacher treats me when I need help.
My teacher is nice to me when I ask questions.
My teacher in this class makes me feel that he/she really cares about me.
If I am sad or angry, my teacher helps me feel better.
The teacher in this class encourages me to do my best
My teacher seems to know if something is bothering me.
My teacher gives us time to explain our ideas.

Secondary Items (α = .78):
My teacher seems to know if something is bothering me.
My teacher really tries to understand how students feel about things.
My teacher in this class makes me feel that s/he really cares about me.

Captivate Scale

Elementary Items (α = .69):
School work is interesting.
We have interesting homework
Homework helps me learn.
School work is not very enjoyable. (Do you agree?)*

Secondary Items (α = .83):
I like the ways we learn in this class.
My teacher makes lessons interesting.
My teacher makes learning enjoyable.
This class does not keep my attention--I get bored.*

Happy Scale

Elementary Items (α = .65):
This class is a happy place for me to be.
Being in this class makes me feel sad or angry.*

Secondary Items (α = .63):
This class is a happy place for me to be.
Being in this class makes me feel angry.*

Confer Scale

Elementary Items (α = .76):
When he/she is teaching us, my teacher asks us whether we understand

My teacher asks questions to be sure we are following along when he/she is teaching
My teacher checks to make sure we understand what he/she is teaching us.
My teacher tells us what we are learning and why.
My teacher wants us to share our thoughts
Students speak up and share their ideas about class work.
My teacher wants me to explain my answers -- why I think what I think

Secondary Items (α = .70):
Students speak up and share their ideas about class work.
My teacher gives us time to explain our ideas.
Students get to decide how activities are done in this class.
My teacher wants us to share our thoughts.

Effort Scale
Elementary (α = .53)
I have pushed myself hard to understand my lessons in this class.
I have done my best quality work in this class
When doing schoolwork for this class, I try to learn as much as I can and I don't worry about how long it takes.
In this class, I take it easy and do not try very hard to do my best.*
In this class, I stop trying when the work gets hard.*
I am happy with how well I have done in this class.
Overall, between homework, reading, and other class assignments, I worked hard in this class.

Secondary Items (α = .74):
I have pushed myself hard to completely understand my lessons in this class.
I have done my best quality work in this class all year long
When doing schoolwork for this class, I try to learn as much as I can and I don't worry about how long it takes.
In this class, I take it easy and do not try very hard to do my best.*
In this class, I stop trying when the work gets hard.*
Overall, between homework, reading, and other class assignments, I worked hard in this class.

College Scale
Elementary (α = .72) and Secondary Items (α = .78):
My teacher makes me want to go to college.
Because of my teacher, I think more about going to college.

Clarify Scale

Elementary Items (α = .78):

If you don't understand something, my teacher explains it another way
In this class, we learn to correct our mistakes.
My teacher explains difficult things clearly
My teacher has several good ways to explain each topic that we cover in this class
My teacher knows when the class understands, and when we do not.
My teacher explains things in very orderly ways.
I understand what I am supposed to be learning in this class
This class is neat -- everything has a place and things are easy to find.

Secondary Items (α = .79):

My teacher explains difficult things clearly.
When s/he is teaching us, my teacher thinks we understand even when we don't.*
My teacher has several good ways to explain each topic that we cover in this class
If you don't understand something, my teacher explains it another way
My teacher knows when the class understands, and when we do not.

Control Scale

Elementary Items (α = .60):

Our class stays busy and does not waste time.
My classmates behave the way my teacher wants them to.
Students behave so badly in this class that it slows down our learning*
Everybody knows what they should be doing and learning in this class.

Secondary Items (α = .84):

Student behavior in this class makes the teacher angry.*
My classmates behave the way my teacher wants them to.
I hate the way that students behave in this class.*
Student behavior in this class is under control.
Student behavior in this class is a problem.*
Students in this class treat the teacher with respect.
Our class stays busy and doesn't waste time

Challenge Scale

Elementary Items (α = .63):

My teacher pushes everybody to work hard.
In this class, my teacher accepts nothing less than our full effort.
My teacher pushes us to think hard about things we read.
In this class we have to think hard about the writing we do.

Secondary Items (α = .82):
In this class, we learn to correct our mistakes.
In this class, my teacher accepts nothing less than our full effort.
In this class, we learn a lot almost every day.
My teacher wants me to explain my answers -- why I think what I think.
My teacher doesn't let people give up when the work gets hard.
My teacher asks questions to be sure we are following along when s/he is teaching.
My teacher asks students to explain more about answers they give.

Consolidate Scale
Elementary Items (α = .52):
My teacher takes the time to summarize what we learn each day.
When my teacher marks my work, he/she writes on my papers to help me understand how to do better

Secondary Items (α = .79):
My teacher checks to make sure we understand what s/he is teaching us.
My teacher takes the time to summarize what we learn each day.
We get helpful comments to let us know what we did wrong on assignments.
The comments that I get on my work in this class help me understand how to improve.

* Items are reverse coded

Response Scale:
1: Totally Untrue
2: Mostly Untrue
3: Somewhat
4: Mostly
5: Totally True

Appendix B

Appendix Table B1.

Descriptive Statistics of Dependent Variables, by Student Characteristics

Scale	All Students	Male Students	Female Students	White Students	Black Students	Hispanic Students
Care	3.71	3.67	3.75	3.68	3.77	3.66
Captivate	3.59	3.57	3.63	3.49	3.65	3.61
Happy	3.83	3.79	3.89	3.90	3.77	3.84
Confer	3.68	3.63	3.72	3.65	3.75	3.60
Effort	4.02	3.95	4.09	4.07	4.05	3.92
College	3.76	3.71	3.80	3.60	3.94	3.72
Clarify	3.98	3.94	4.02	3.94	4.04	3.96
Control	3.42	3.41	3.42	3.52	4.33	3.40
Challenge	4.11	4.08	4.14	4.09	4.18	4.06
Consolidate	3.78	3.75	3.80	3.64	3.87	3.80
Math 2011	0.10	0.09	0.11	0.54	-0.24	-0.02
ELA 2011	0.09	0.00	0.17	0.55	-0.18	-0.07

Notes: n = 82,409 students, 1,909 teachers, 231 schools

Appendix Table B2.
Correlations among the Dependent Variables

Panel A: *Year One Data*

	College	Effort	Confer	Happy	Captivate	Care	Clarify	Control	Challenge	Consolidate
College	1.00									
Effort	0.42	1.00								
Confer	0.50	0.41	1.00							
Happy	0.43	0.45	0.48	1.00						
Captivate	0.51	0.46	0.52	0.62	1.00					
Care	0.56	0.45	0.70	0.60	0.61	1.00				
Clarify	0.53	0.49	0.66	0.58	0.64	0.71	1.00			
Control	0.29	0.34	0.39	0.45	0.40	0.39	0.44	1.00		
Challenge	0.48	0.46	0.53	0.42	0.50	0.54	0.63	0.35	1.00	
Consolidate	0.48	0.39	0.55	0.48	0.58	0.60	0.65	0.34	0.58	1.00

Note: Data on ‘College’ come from 2009-10 only; all other correlations are calculated across two years of data (2009-10 and 2010-11)