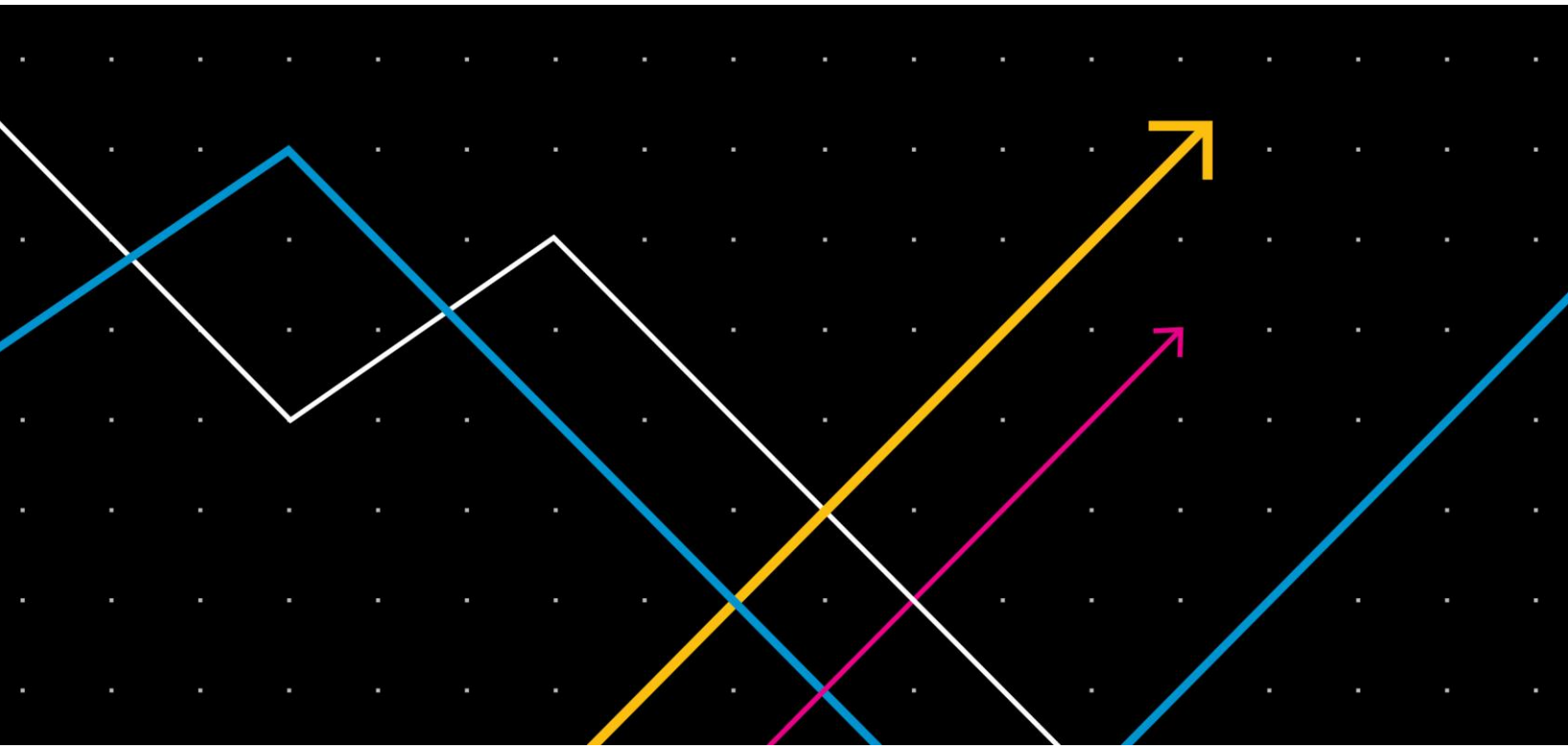

RESEARCH REPORT

The Effects of Teacher Diversity on Hispanic Student Achievement in Texas

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Executive Summary

In fall 2016, students of color made up the majority of public school students for the first time in the United States. But teachers of color are severely underrepresented in the teacher workforce, potentially negatively affecting students' outcomes. Evidence shows the value of a racial match between Black students and Black teachers on several outcomes, but we know much less about these effects for Hispanic and Latino students.

In this report, we study the effects of exposure to Hispanic and Latino teachers on Hispanic and Latino students' scholastic and economic outcomes in Texas public schools, where the Hispanic share of teachers has increased from 15 percent to 27 percent from 1995 to 2018. Our research design relies on within-school comparisons over time that control flexibly for variations in outcome dynamics across school districts. We study short- and medium-term outcomes (e.g., standardized exam scores, discipline rates, and high school dropout rates) and long-term outcomes (e.g., high school graduation rates, college enrollment, college persistence, and college graduation). We find that exposure to teachers of color significantly improves short- and medium-term outcomes among elementary school students. The effects of teacher diversity are smaller and less precisely estimated for later grades and for long-term outcomes. These findings highlight the importance of policies aimed at increasing the representation of teachers of color in public schools.

The Effects of Teacher Diversity on Hispanic Student Achievement

In fall 2016, students of color made up the majority of public school students for the first time in the United States. The educator workforce, however, remains overwhelmingly white, with fewer than 20 percent of teachers or principals identifying as people of color. In many public school systems, teachers and principals do not look like the students they serve. This demographic mismatch may have serious consequences, particularly for students of color. There is evidence of this mechanism for Black students and teachers (Gershenson et al. 2017).

We know less about this relationship for Hispanic and Latino students, who are part of the nation's largest minority group (Delhommer 2019). We address this gap in the literature by providing comprehensive evidence on the impacts of a racial match between Hispanic and Latino teachers and students in Texas, from 1995 to 2018. Leveraging large amounts of administrative data at the student level, our results indicate that teacher race match improves the scholastic outcomes of Hispanic and Latino students, especially during the elementary school years.

Background

Teachers of color bring several practices to the classroom that might improve students' outcomes. These practices and behaviors mostly fit under the umbrella of culturally responsive pedagogy (CRP), a set of behaviors, tactics, and strategies that uses students' "cultural and linguistic backgrounds as resources to support learning." There is a long-standing, wide-ranging scholarly literature on CRP. Scholars have used alternative terms for CRP, including *culturally responsive teaching* (Gay 2010), *culturally responsive classroom management and behavior supports* (Sugai, O'Keeffe, and Fallon 2012), *cultural proficiency* (Lindsey, Robins, and Terrell 2003), and *culturally sustaining pedagogy* (Paris 2012). Debnam and coauthors (2015) investigate *culturally proficient teaching practices*. The study uses data on 142 K–8 teachers in six schools who provided a self-reported measure of their own teaching practices. External observers then rated these teachers on the Assessing School Settings: Interactions of Students and Teachers (ASSIST) rubric. Although teachers tended to rate themselves as being more culturally proficient than the ASSIST rubric, there were correlations between the ratings. Kelley and coauthors (2015) assessed a Latinx-themed reading task that was used with a set of mostly Latinx students to boost their own self-efficacy in reading. After the task, students reported higher self-efficacy in reading.

Other studies in this vein find similar positive associations between student achievement and teachers' culturally responsive practices.

The best evidence to date comes from a randomized controlled trial of teachers employing CRP in a in a school setting with mostly Latinx students who were English language learners (Portes et al. 2018). The authors find that teachers who implemented the instructive conversation responsive pedagogical model facilitated upper elementary students' English language arts outcomes generally. One limitation of the study is that randomization of teachers did not achieve baseline equivalency for English language learners in particular. Most studies of culturally relevant pedagogy do not employ quasi-experimental and experimental designs that would allow researchers to make causal inferences from their results.

The presence of demographically similar educators can positively affect student outcomes through multiple mechanisms, including more responsive treatment from classroom teachers, the creation of school policies that better serve students' needs, differential student effort or behavior when surrounded by educators with similar characteristics ("role modeling effects"), and greater engagement from parents (Grissom, Rodriguez, and Kern 2017). In a comprehensive, systematic review of high-quality studies in this literature (N = 37 studies), Redding (2019) similarly identifies three mechanisms through which teacher-student race match can influence student outcomes.

1. **Shared cultural understanding.** A shared cultural understanding between co-ethnic teachers and students may influence student outcomes. Teachers play an important role in assigning students to school services, selecting students for higher-ability groups, and determining grade promotion. Teachers' perceptions of their students will determine how much students can participate in these opportunities (Ready and Wright 2011). A shared cultural understanding affects pedagogy and instructional choices; teachers of color may hold higher expectations for student learning and implement a diverse set of performance-based assessments that more accurately measure student learning (Gay 2010). Importantly, a shared cultural understanding will improve student outcomes only if it leads to corresponding beliefs and values that will affect teachers' perceptions, pedagogy, and relationships with students. As immigrant generation and nationality affect cultural understanding, shared ethnicity may have a lessened impact for Latinx students (Redding 2019).
2. **Student responsiveness.** Students may respond differently to instruction when it is delivered by a teacher of the same race or ethnicity. When taught by a teacher of the same race or ethnicity, students may internalize the higher expectations they experience in the co-racial classroom (Ferguson 2003), identify with their racial group in a more positive way, and feel

more comfortable reaching out to their teachers to build supportive relationships in school (Kozlowski 2015).

3. **Organizational influence.** The mere presence of teachers of the same race in a school may lead to policies that improve student outcomes. The theory holds that co-racial teachers will be more likely to advocate for their students, resulting in restorative justice approaches to behavior management. Same-race teachers might be more likely to implement culturally relevant curriculum and instruction in the classroom and change white teachers' perceptions of their students' abilities. There is little evidence on how much organizational influence affects student outcomes. When these influences have been measured, studies have generally found that direct student-teacher interactions have a larger effect on students than indirect organizational influence.

Demographic mismatch may mean that students of color fail to accrue these benefits. Indeed, recent empirical research that uses rich data and quasi-experimental methods suggests that this mismatch matters, at least the mismatch between students and teachers. Four outcomes have been examined in the context of teacher-student racial and ethnic matching:

1. teachers' ratings of students' classroom behavior
2. teachers' ratings of students' academic performance
3. students' test scores
4. students' behavioral outcomes, including disciplinary action, assignment to gifted and talented programs, attendance, and dropout

Redding's (2019) overall conclusion is that Black and Latino/a students differentially benefit from assignment to a co-racial or co-ethnic teacher across the four domains he examined. We briefly summarize this evidence.

First, the evidence from studies of teacher ratings of student classroom behavior point to substantive differences in teachers' perceptions of externalized problem behaviors that correspond with racial or ethnic congruence between teachers and students. That is, Black and Latino/a students are less likely to be described as fighting, being disruptive, and being argumentative when rated by a teacher who shares their race or ethnicity (Bates and Glick 2013; Downey and Pribesh 2004; Wright, Gottfried, and Le 2017).

Second, teachers' ratings of students' academic ability follow a similar pattern, though the evidence is strongest for students in the middle and high school (Ehrenberg, Goldhaber, and Brewer 1995; McGrady and Reynolds 2013). Two studies—Gershenson, Holt, and Papageorge (2016) and Fox (2016)—examine teachers' expectations for students' educational attainment, including expectations about high school graduation and college degree attainment. Both studies report higher ratings for Black students assigned to Black teachers.

Third, assignment to a Black teacher is associated with achievement gains for Black students, with the largest effects observed in elementary school. In terms of magnitude, Yarnell and Bohrnstedt (2018) estimate that, for Black students, having a Black teacher reduces the Black-white achievement gap by 20 to 25 percent, though studies outside the southern United States have not reported such clear achievement benefits (Buddin and Zamarro 2009; Ehrenberg, Goldhaber, and Brewer 1995; Fryer and Levitt 2004; Jennings and DiPrete 2010), suggesting that context may matter. There is no clear evidence of a test score boost for Latino/a students assigned to co-ethnic teachers.

Fourth, research that examines impacts on behavioral outcomes shows clear benefits for Black students, but implications for Latino/a students are inconclusive. Specifically, Black students assigned to Black teachers are less likely to experience exclusionary discipline (Lindsay and Hart 2017), are more likely to experience gifted and talented referrals (Grissom and Redding 2016), and have better attendance outcomes (Holt and Gershenson 2017). Finally, only one study looks at long-term outcomes. Using data from North Carolina and Tennessee, Gershenson and coauthors (2017) show a 4 percentage-point reduction in the likelihood of high school dropout for Black students who had a Black teacher in grades three through five.

More recent studies have attempted to investigate these relationships for Latinx students in additional settings on various outcomes. Castro and Calzada (2021) show that Spanish-speaking Latinx teachers are more likely to report the use of culturally responsive teaching practices than non-Latinx teachers, and these practices, coupled with greater reported use of effective teaching strategies, leads to positive outcomes for students. This study does not employ a control group or quasi-experimental designs, so the results cannot be interpreted as causal. But a recent working paper (Seah 2021) attempts to reconcile the mixed evidence on academic and behavioral outcomes for Latinx students matched to Latinx teachers. Seah argues that these studies fail to capture the significant diversity within the Latinx community, particularly the distinction between students whose native language is English compared with those whose native language is Spanish. Replicating and expanding on prior work that uses the National Education Longitudinal Study of 1988, Seah defines a teacher match for Latinx students as being one of both language status and ethnicity. With this nuanced definition, the

author finds that Latinx teachers who are matched to Latinx students in this way are more likely to report positive evaluations of their students' behavior. Finally, Delhommer (2019) finds positive effects for being matched to a same-race teacher on college enrollment for Latinx students. The analyses in the paper suggest that Latinx students do not benefit from these matches on short-term outcomes in high school but do benefit on long-term outcomes such as college enrollment.

Our study aims to contribute to this literature by providing (to our knowledge) the first estimates of the teacher-student ethnic match effects for Hispanic and Latino students, using comprehensive administrative data at the student level from Texas public education agencies. We provide estimates for a range of short-, medium-, and long-term student scholastic outcomes and explore how impacts vary by grade level.

Data

We use administrative data from state education agencies—accessed via the Texas Education Research Center—to study the impact of Latino and Hispanic teachers on Latino and Hispanic students' short- and long-term scholastic outcomes. The Texas Education Research Center links records from the Texas Education Agency (TEA), including Texas Assessment of Academic Skills (TAAS), Texas Assessment of Knowledge and Skills (TAKS), and State of Texas Assessments of Academic Readiness (STAAR) testing data; the Texas Higher Education Coordinating Board (THECB); and the Texas Workforce Commission (TWC). We observe longitudinally linked student records, containing information regarding school enrollment, student and staff demographics, student performance in standardized exams, discipline rates, high school graduation, college enrollment and completion, and labor market earnings. We use deidentified data for students who attended grades three through nine between 1995 and 2018 from these three sources. We provide a brief description of the administrative records of each state agency below.

TABLE 1

Characteristics and Outcomes Measured in This Study

	Description
Student characteristics	
At-risk status	Indicates whether a student is currently identified as at risk of dropping out of school using state criteria, defined in the Texas Education Code 29.081
Free and reduced-price lunch	A student qualifies for free and reduced-price lunch if their family earns less than 130% or 185% of the federal poverty level, respectively
Sex	The Texas Education Agency collects data on students' sex, offering male and female as the two options
Special education	Indicates whether the student participated in a special education instructional and related services program or a general education program using special education support services, supplementary aids, or other special arrangements
Limited English proficiency status	Indicator that the student has been identified as limited English proficient (by the Language Proficiency Assessment Committee) or as English proficient
Race or ethnicity	Texas Education Agency race and ethnicity categories shifted over the years of data included in this study; we include outcomes for Asian, Black, Hispanic, and white students because there were insufficient numbers of teachers of other races or ethnicities to accurately measure the relationship
Immigration status	Indicates whether the student is an immigrant, defined as any person who was not born in any state and has not attended a school in the United States for more than three years
Outcomes	
Discipline	We create two variables to measure discipline: a binary indicator of whether the student incurred at least one incident in that grade level and one indicating whether the student ever recorded a disciplinary action while in grades three through nine
Dropout	A binary variable indicating whether the student left school without graduating; we consider only students who left school without reenrolling in another district, moving out of state, or entering the criminal justice system to have dropped out
High school graduation	Indicator that the student ever graduated from high school
Test scores	We use the standard deviation of the Texas Assessment of Academic Skills, Texas Assessment of Knowledge and Skills, and State of Texas Assessments of Academic Readiness exams to measure student math and reading performance
College enrollment	Indicator that the student enrolled in a postsecondary institution
College graduation	Indicator that the student earned an associate's or bachelor's degree from a postsecondary institution
College persistence	Measure of the number of consecutive years a student is enrolled in a postsecondary institution
Wage	Log wage six years after a person's anticipated high school enrollment date

Sources: Discipline, dropout, high school graduation, and test score data come from the Texas Education Agency. College enrollment, graduation, and persistence come from the Texas Higher Education Coordinating Board. Wage data come from the Texas Workforce Commission.

Texas Education Agency

The TEA oversees primary and secondary public education in Texas and uses the Public Education Information Management System (PEIMS) to store the student and employee data submitted by all districts. We use TEA-collected student demographic data (including race or ethnicity, sex, at-risk status, free and reduced-price lunch status, and immigration status) and data regarding their school

experiences (including limited English proficiency status, special education or gifted status, enrollment and attendance history, discipline records, dropout status, and graduation records). Table 1 contains brief descriptions of these variables.

Although the TEA records include information on all school employees, we focus only on those we consider to be lead classroom teachers or the teacher on record. We exclude all other employees, including assistant teachers, from our analyses. We use the following teacher information from the TEA/PEIMS data: race or ethnicity, sex, experience (years as an educator), and tenure (years at current school).

The TEA is also responsible for collecting and reporting student assessment data. Texas administered three different assessments to students over the course of our study period: TAAS, TAKS, and STAAR. Texas administered TAAS from 1990 through 2002, TAKS from 2003 through 2011, and a combination of TAKS and STAAR from 2011 through the present. Combining these three sources, we have a measure of student reading and math performance in grades three through nine from 1995 to 2018.

Texas Higher Education Coordinating Board

The Texas Higher Education Coordinating Board collects data on all students attending higher education institutions in the state. We combine data from public community, technical, and state colleges; private postsecondary institutions; and public universities and health-related institutions to understand the relationship between teacher-student race match and postsecondary outcomes. We use these records to identify students who enroll in and those who graduate from public or private Texas colleges or universities. We use the enrollment data to create a variable to evaluate persistence in higher education, measured as the number of consecutive years enrolled in a postsecondary institution. This measure includes years spent at any postsecondary institution, not necessarily the years spent at any one community college or university. Additional outcome measures include an indicator of whether a student graduates with an associate's degree or a bachelor's degree from a Texas college.

THECB data do not include students who attended a postsecondary institution outside Texas. For this reason, we expect our estimate of the effects of teacher-student race match underestimates the relationship between college enrollment, persistence, and graduation and teacher-student race match, given that we cannot observe students who do well in high school and pursue higher education in a different state.

Texas Workforce Commission

The TWC data include quarterly wage information for all workers employed in Texas. We sum these quarterly wage data to create an annual wage for each person. We use the Consumer Price Index to adjust wages in years before 2018 and take the log of the annual wages to create a variable for analysis. Finally, in accordance with prior research, we exclude observations for people earning less than the minimum wage in Texas or those earning in the 99th percentile of our sample (Black, Denning, and Rothstein 2020). Because we cannot observe wage data for students who move out of Texas, this variable contains some degree of systematic measurement error (as workers who leave the state tend to have higher wages than workers who stay) and likely understates the effects of programs on student wage outcomes.

Descriptive Statistics

Table 2 summarizes observable characteristics for students in our analysis sample, focusing on students attending grades three through nine in Texas public schools. In 2018, 52 percent of students self-identified as Hispanic, and about 13 percent self-identified as Black. Only a small share of students reported being immigrants (i.e., being in their first year attending school in the US), with Asian students being the plurality among these. About 49 percent of Hispanic students in the sample were classified as having limited English proficiency, and 50 percent reported Spanish as the main language spoken at home. In addition, 62 percent of Hispanic students and 53 percent of Black students were deemed "at risk."[1] For both Hispanic and Black students, about three-quarters of the population received free and reduced-price lunch, a commonly used proxy for socioeconomic status; in contrast, less than a third of Asian and white students received these services. Finally, close to 10 percent of Hispanic students participated in special education programs, and 7 percent participated in gifted and talented programs.

TABLE 2

Average Student Characteristics

Students in grades three through nine in Texas public schools in 2018

	Asian	Black	Hispanic	White
Total	4.5%	12.5%	52.1%	28.0%
Immigrant	7.8%	1.3%	2.2%	0.7%
LEP	47.9%	4.0%	48.8%	3.0%
Spanish-speaking household	0.2%	0.2%	50.0%	1.1%
At-risk	31.9%	52.5%	62.0%	30.3%
FRPL	28.3%	72.5%	75.3%	29.2%
Special education	4.4%	12.2%	9.5%	9.6%
Gifted	22.0%	4.7%	7.4%	12.2%

Source: 2018 Texas Education Agency data via the Texas Education Research Center.

Notes: FRPL = free and reduced-price lunch; LEP = limited English proficiency. See table 1 for descriptions of each variable.

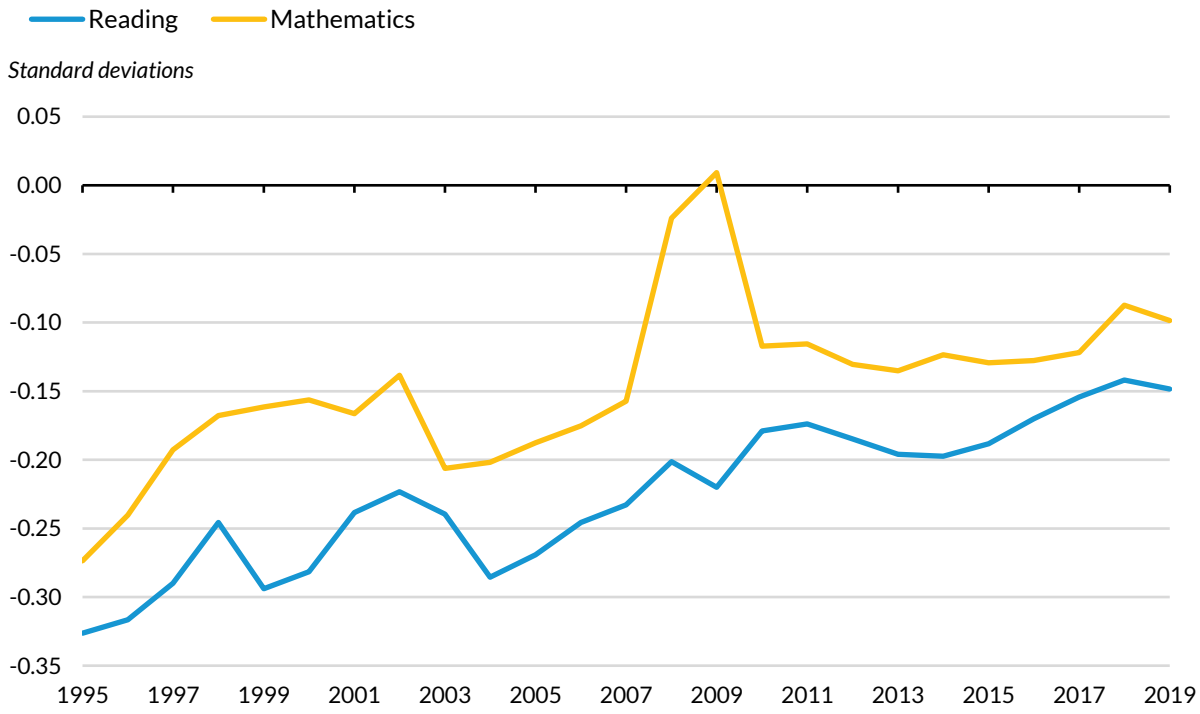
Figure 1 presents the mean time trend for Hispanic students' state exam scores, focusing on grade five cohorts between 1995 and 2019. Test scores are normalized to have mean equal to 0 and standard deviation equal to 1 in a given grade level, subject, and year. Hispanic students tend to score below the state average in both mathematics and reading, but their average relative achievement has increased substantially over the past two and a half decades. In 1995, their scores were about 0.27 standard deviations (SDs) below average (hence the negative number) in mathematics and close to 0.33 SDs below the state mean in reading. Since then, Hispanic students' scores have risen nearly every year. In 2019, mean exam scores for Hispanic students were only about 0.10 and 0.15 SDs below the mean in reading and math, respectively. Nonetheless, the gap between reading and math scores has held largely steady over this period. There are also large abrupt changes in mean scores in some years, which are likely attributable to changes statewide in the exam.[2] In appendix figure A.1, we show a similar figure for Black student outcomes.

We also look at trends in other medium-term educational outcomes of Hispanic students, including the high school graduation rate, the dropout rate, and the rate at which students face disciplinary action (figure 2). Because we need to have data on students' high school years to measure these outcomes, our data are truncated from above. For fifth-graders, we can observe high school graduation and dropout rates only up to 2011.[3] Between 1995 and 2000, the mean graduation rate for Hispanic fifth-graders was around 60 percent. Starting in 2001, the graduation rate increased and was nearly 80 percent by 2011. From 1999 to 2011, dropout rates declined from 10 percent to about 5 percent. There have also been improvements in the share of Hispanic students facing disciplinary action at some point during their K–12 education. Between 1999 and 2005, nearly 70 percent of Hispanic fifth-graders would face at least one disciplinary action while in school, but since then, this rate has fallen to about 50 percent. In appendix figure A.2, we show parallel estimates for Black students.

FIGURE 1

Trends in Hispanic Students' Test Scores

Grade five cohorts



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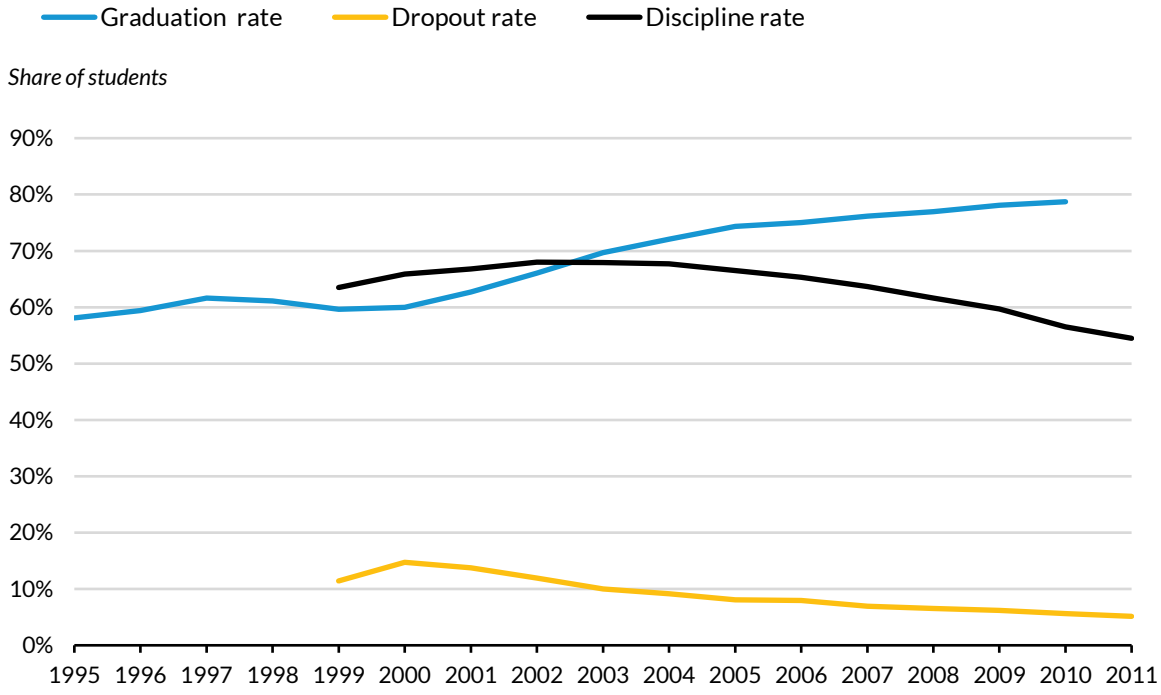
Source: 1995–2018 Texas Education Agency data via the Texas Education Research Center.

FIGURE 2

Trends in Hispanic Students' Medium-Term Outcomes

Grade five cohorts



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Source: 1995–2011 Texas Education Agency data via the Texas Education Research Center.
Note: See table 1 for descriptions of each variable.

In table 3, we report the mean and standard deviation of all educational achievement outcomes for Hispanic students in grades three through six, averaging from 1995 to 2018. These time-averaged statistics are useful for interpreting the regression model estimates in our main results. An additional medium-term outcome we explore is the number of disciplinary events students face per year. We also analyze long-term educational outcomes. First, we have an indicator of whether the student ever enrolls in a Texas postsecondary education institution, which averages 48 to 49 percent over our analysis period. Second, we calculate a proxy for college persistence, measuring the number of consecutive years a person is enrolled in a postsecondary institution. The average is between 4.14 and 4.24 consecutive years from 1995 through 2018. Third, we measure the share of students who graduate with an associate's degree or a bachelor's degree from a Texas institution (unconditional on enrollment), averaging about 8 percent and 11 percent, respectively, in our sample. Finally, we study the labor market earnings (for those working in Texas) of student cohorts for whom we have enough data to follow to adulthood. We measure student wages six years after anticipated high school graduation. So,

for example, if a student is in fifth grade in 2005, we would measure wages in 2018. We have wage data available from 2004 through 2018.

TABLE 3

Hispanic Students' Average Education Outcomes from 1995 to 2018

Students in grades three through six in Texas public schools

	Grade 3		Grade 4		Grade 5		Grade 6	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Short-term outcomes								
Reading scores	-0.20	1.04	-0.21	1.02	-0.23	1.03	-0.26	1.03
Math scores	-0.12	1.00	-0.16	1.01	-0.15	1.01	-0.21	1.00
Medium-term outcomes								
Disciplinary actions	0.08	0.52	0.11	0.62	0.19	0.91	0.69	2.17
Ever disciplined	0.48	0.46	0.51	0.47	0.54	0.47	0.57	0.48
Ever dropped out of HS	0.07	0.24	0.07	0.25	0.08	0.26	0.08	0.26
Ever graduated from HS	0.68	0.46	0.68	0.46	0.68	0.46	0.68	0.46
Long-term outcomes								
Ever enrolled in college	0.48	0.50	0.49	0.50	0.48	0.50	0.48	0.50
College persistence	4.14	2.50	4.19	2.55	4.22	2.58	4.24	2.61
Ever earned an AA	0.08	0.27	0.08	0.27	0.08	0.27	0.08	0.27
Ever earned a BA	0.11	0.31	0.11	0.31	0.11	0.31	0.11	0.31
Has wages	0.60	0.49	0.60	0.49	0.60	0.49	0.60	0.49
Log wages	10.20	0.48	10.20	0.48	10.19	0.48	10.19	0.48
Average observations	**344,832**		**341,838**		**340,643**		**337,944**	

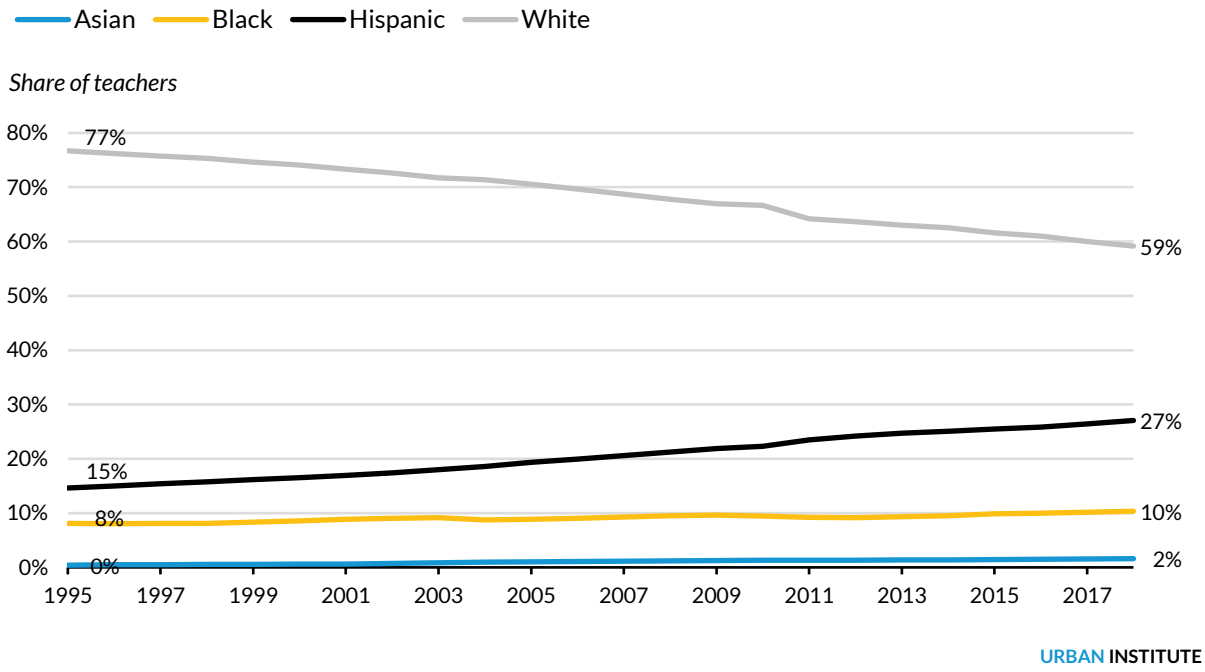
Source: 1995–2018 Texas Education Agency data via the Texas Education Research Center.

Notes: AA = associate's degree; BA = bachelor's degree; HS = high school; SD = standard deviation. See table 1 for descriptions of each variable. Math and reading scores are standardized to have mean 0 and standard deviation 1 in the statewide sample, separately for each grade level and cohort. Disciplinary actions measure the average number of discipline incidents per student per year. Ever disciplined measures the share of students in the sample that ever incurred a disciplinary incident while in grades three through nine. College persistence measures the number of consecutive years a student who enrolls in college remains in school. Log wages is a measure of the log wage of an individual six years after anticipated high school graduation. Average number of observations is based on the number of students with a reading test score between 1995 and 2018.

Our main research questions concern exposure of Hispanic students to Hispanic teachers. In figure 3, we show the state average trend in the racial and ethnic composition of the Texas teacher workforce. In 1995, 77 percent of teachers in Texas were white, while only 15 percent self-reported as Hispanic. Since then, the Hispanic share of teachers has increased by nearly 1 percentage point per year, such that in 2019, the Hispanic share was 27 percent. Though this population has grown, relative to an average Hispanic student share of 52 percent over our sample period, there is a gap in Hispanic teacher representation in Texas public schools. In our evaluation, we want to leverage recent demographic shifts in the Texas teacher workforce to better understand how increased exposure to a diverse teaching body affects students.

FIGURE 3

Teacher Workforce Demographics in Texas



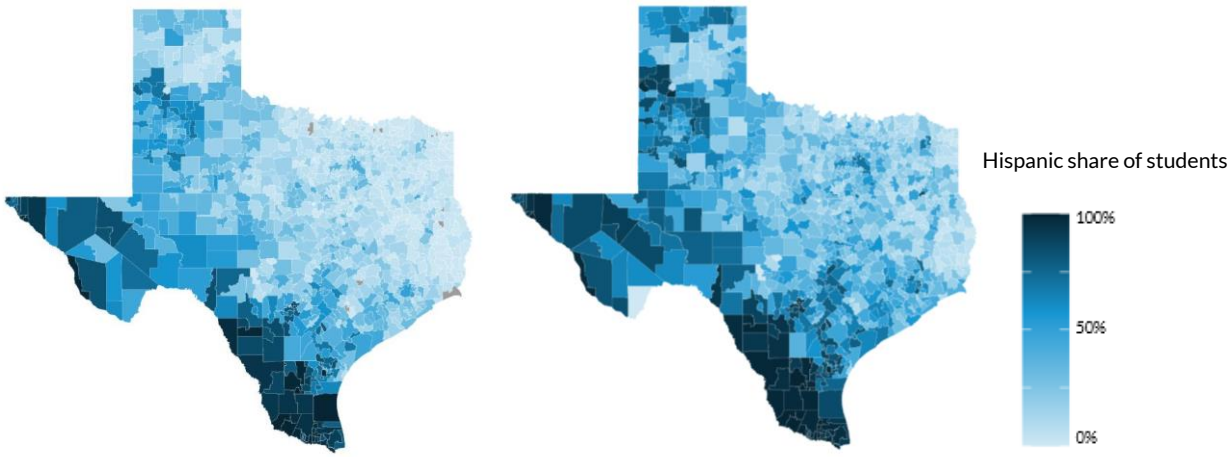
Source: 1995–2018 Texas Education Agency data via the Texas Education Research Center.

Texas is a large state, and its demographics have been changing differentially across its geography. Figure 4 presents a choropleth map of Texas school districts, with color shades corresponding to the Hispanic share of students in 1995 (left panel) and 2018 (right panel). Along the southern border with Mexico, schools were close to 90 percent Hispanic in 1995, and many are almost 100 percent Hispanic today. Schools in the northern "panhandle" were around 50 percent Hispanic in the late 1990s, but many are nearly 90 percent Hispanic today. Furthermore, districts in the Houston and Dallas areas have seen large increases in the Hispanic population, around 15 and 30 percentage points, on average, respectively. In more rural areas, such as East Texas, there has been less growth in the Hispanic student population.

FIGURE 4

Hispanic Share of Students in Texas School Districts

1995 *2018*



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Source: 1995 and 2018 Texas Education Agency data via the Texas Education Research Center.

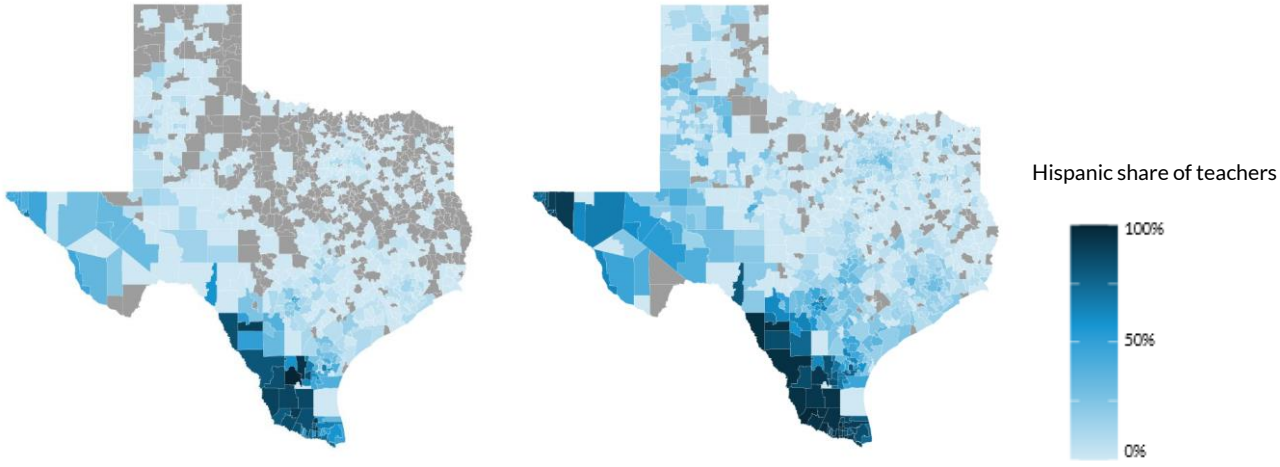
Figure 5 presents analogous maps of the Hispanic share of teachers. Taken together, the two maps show that the teacher-student demographic gap is present, to varying degrees, in almost all districts. Gray denotes districts with no Hispanic lead teachers. In 1995, except in the southernmost part of the state, few districts had a teacher workforce that was more than 15 percent Hispanic. By 2019, although most districts had some Hispanic teachers, rates of growth have been tepid relative to changes in student demographics in most districts. This is visually evident for districts in Houston and Dallas, for example. In addition, growth in the Hispanic share of teachers has been strongest in the westernmost part of the state, near El Paso.

Geographic variation in the rate of change of teacher demographics could be a result of changes in the structure of local labor markets or changes in the demographics of the entire population. In our models of the effects of same-race teachers on student outcomes, we control for this variation, as underlying mechanisms may be linked to unobserved determinants of students' achievement outcomes.

FIGURE 5

Hispanic Share of Teachers in Texas School Districts

1995 *2018*



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Source: 1995 and 2018 Texas Education Agency data via the Texas Education Research Center.
Note: These maps contain data for lead teachers only, not assistant teachers or paraprofessionals. Gray districts indicate zero Hispanic teachers.

Empirical Strategy

Our goal is to estimate the causal impacts of matching a student of color to a teacher of a similar racial or ethnic background on the student's academic outcomes. Ideally, we would like to understand the impacts of a same-race teacher by estimating the structural regression model

$$Y_{it} = \beta_o + \beta M_i + \zeta_{it} \quad (1)$$

where Y_i is an academic outcome for student i in cohort t and M_i is an indicator equal to 1 if the student's randomly assigned teacher is of the same race and is 0 otherwise. The key problem with identifying β—the average effect of race match on Y_i—is that students are not typically assigned to teachers randomly, nor are teachers assigned to schools randomly, meaning that we cannot be sure that unobserved drivers of student outcomes (captured by ζ_i) are uncorrelated with M_i. If such a correlation between M_i and ζ_i exists, estimating equation 1 via ordinary least squares would render estimates suffering from omitted variable bias.

To address this problem, we follow the literature on this topic and estimate the reduced form of a two-stage model of the determinants of student outcomes and teacher race match (Gershenson et al. 2017). The first stage models the race-match indicator as

$$M_i = \pi_o + \pi \bar{M}_{s(i)t} + \eta_i \quad (2)$$

where $\bar{M}_{s(i)t}$ is the share of teachers in student i's school s and cohort t that are the same race as the student. We expect the slope coefficient π to be positive: a larger share of same-race teachers in the school increases the likelihood that a student has a same-race teacher. Our analysis indicates that for Hispanic students, π tends to be about 6.5, suggesting that a 1 percent increase in the Hispanic share of the school faculty increases the likelihood of classroom interaction between a Hispanic student and a Hispanic teacher by 6.5 percent.

Given this two-stage statistical framework, the reduced-form model of the outcome of interest is

$$Y_{it} = \delta_o + \delta \bar{M}_{s(i)} + \epsilon_{it} \quad (3)$$

The parameter of interest here is the reduced-form slope coefficient δ, capturing the combined impact of an increase in the share of same-race teachers on the likelihood of a same-race teacher classroom interaction and the impact of classroom interactions on student outcomes.

Even though the structural model in equation 1 is a more direct way of bringing evidence to the main research question (motivating the use of an instrumental variables estimate of the impact of same-race classroom interactions on student outcomes), this model is more likely to suffer from bias because of violations of the exclusion restriction assumption, which requires that the faculty share of same-race teachers affect student outcomes exclusively via classroom teaching. The literature on teacher diversity has favored the parameters in the reduced-form model in equation 3 as the key estimates, not only because equation 3 requires a slightly less strict identification assumption (consistent estimation of equation 1 requires randomly assigned students to schools and classrooms, while equation 3 requires only random assignment to schools, allowing for nonrandom selection into classrooms) but because it also allows for the (likely) scenario in which a same-race teacher affects outcomes for students of color without necessarily being in the classroom with the student but simply by being present at the school.

Nevertheless, we know that students are not assigned randomly to schools and that the share of teachers of color in a school may be correlated with important determinants of student outcomes both related to the varying quality of public education and to differences in student characteristics. To overcome this problem, we model the residual variation in student outcomes using

$$\epsilon_{it} = \alpha_{s(i)} + \theta_{d(i)t} + Z'_{s(i)t}\Psi + X'_i\Gamma + \nu_{it} \quad (4)$$

where $\alpha_{s(i)}$ are school fixed effects absorbing fixed differences between districts; $\theta_{d(i)t}$ are school district-by-year fixed effects capturing unobserved geographic differences in demographics and school quality that may vary year to year; $Z'_{s(i)t}$ are school-specific time-varying covariates, such as average student test scores in the school, the female share of teachers, and the average demographics of students at the school; and X'_i are student-specific characteristics, such as a quartic polynomial in their previous-year test scores in math and reading, indicators for participation in special education and gifted education programs, at-risk status, and receipt of free and reduced-price lunch (as a crude measure of socioeconomic background).

Of importance here is the inclusion of controls for school fixed effects, district-by-year effects, and a flexible function of student test scores. Recent developments in literature on school value-add suggest that including these controls suffices for the identification of differences in instructional quality across schools. This reaffirms the notion that the controls outlined in equation 4 are sufficient for isolating the impact of the Hispanic faculty share on the outcomes of interest. Further, Texas is a large and populous state whose demographics vary greatly across geography and time. For many locations, the increase in the share of Latino and Hispanic teachers is likely driven by influxes of immigrant populations during our study period. Because the geographically uneven dynamics of immigration could be correlated with unobserved time-varying determinants of student outcomes, the inclusion of district-by-year effects as controls is important for identifying the causal effects of a diverse workforce in public schools.

Net of school value-add effects and district-by-year fluctuations, we argue the remaining variation in the school share of same-race teachers is probably caused by idiosyncratic changes in schools' staffing, driven by retirements, teacher mobility, and other factors unrelated to the education production function. Our preferred estimates of δ, the effect of a 100 percent increase in the share of same-race teachers, come from ordinary least squares estimates of equation 3 that include the controls outlined in equation 4. We estimate these models separately for Hispanic and Black students for the following outcomes: achievement in reading and math, number of disciplinary events, an indicator for ever receiving disciplinary action, an indicator for ever dropping out of high school, a high school graduation indicator, an indicator for ever enrolling in college, an indicator for staying enrolled in college for consecutive terms, indicators for ever receiving an associate's or bachelor's degree, and log annual wages, as reported by the TWC.

Results

Table 4 presents our estimates of the effects of the Hispanic faculty share on Hispanic fifth-graders' scores on state assessments. The columns show how estimates vary as we add an increasingly rich set of controls to the model. Column 1 shows estimates controlling for school and year fixed effects, in which there is no detectable effect in reading and a positive effect for math. Column 2 adds time-varying school covariates, including average test scores in the school, the female share of teachers, the share of students at the school that are of each race or ethnicity, the female share of students, and the free and reduced-price lunch (FRPL) rate. Controlling for school fixed effects, year fixed effects, and school characteristics, faculty share is insignificant for both math and reading scores. In other words, among schools with similar fixed characteristics and whose school-wide demographics have been changing at similar rates, a growing share of Hispanic teachers does not meaningfully correlate with student exam scores.

But there could still be omitted variable bias in the estimates in columns 1 and 2. First, the school-level controls may not adequately capture dynamics in between-school student sorting on unobserved drivers of test scores. Furthermore, figures 4 and 5 have shown that there is large geographic variation in both levels and changes in student and faculty demographics. This means a model that controls for school and year fixed effects would draw comparisons between distant schools in districts that are facing various types of demographic change, making them invalid for estimating causal effects.

We address these identification concerns by controlling for student-specific covariates that include a cubic function of previous-year test scores (both in math and reading), gender, FRPL status, gifted status, and special education status. These additional controls do crucial work in identifying teacher diversity effects. Effects become marginally significant (at the 10 percent confidence level) and positive once we control selection on students' previous-year test scores (columns 3 and 7). This suggests that changing student sorting patterns across schools are important and correlated with changes in the Hispanic faculty share. We also add district-by-year fixed effects to the models, which make our estimates both larger in magnitude and statistically significant at the 5 percent level (columns 4 and 8). This last set of richly controlled models absorb considerable residual variation in the outcome, providing our preferred estimates of the impact of the Hispanic faculty share.

We estimate that the Hispanic faculty share leads to a 0.043 and 0.064 standard-deviation increase in reading and math scores for Hispanic students. The magnitude of these coefficients implies that a 25 percentage-point increase in the Hispanic faculty share, on average, leads to about a 0.01 and a 0.02

standard-deviation increase in reading and math scores. These are meaningful (albeit modest) positive impacts on student achievement.

TABLE 4

Impacts of Hispanic Faculty Share on Hispanic Students' Standardized Exam Scores

Students in grade five

	Reading Score				Math Score			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Hispanic faculty share	-0.015	-0.001	0.035*	0.043**	0.082**	0.031	0.047*	0.064**
	(0.032)	(0.021)	(0.021)	(0.022)	(0.039)	(0.029)	(0.028)	(0.030)
Outcome mean	-0.21				-0.15			
Outcome SD	1.02				1.01			
School FE	X	X	X	X	X	X	X	X
Year FE	X	X	X		X	X	X	
School covariates		X	X	X		X	X	X
Student covariates			X	X			X	X
District-by-year FE				X				X
R^2	0.06	0.08	0.56	0.56	0.07	0.08	0.56	0.58
N schools	5,613				5,601			
N years	24				24			
N students	3,420,769	3,340,063	3,339,342	3,337,353	3,126,337	3,046,091	3,045,363	3,043,373

Source: 1995–2018 Texas Education Agency data via the Texas Education Research Center.

Notes: FE = fixed effects; SD = standard deviation. Standard errors are clustered at the school level in all models. Time-varying school covariates, including average test scores in the school, the female share of teachers, the share of students at the school that are of each race or ethnicity, the female share of students, and the free and reduced-price lunch (FRPL) rate. Student-specific covariates include a cubic function of previous-year test scores (both in math and reading), gender, FRPL status, gifted status, and special education status.

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Looking across elementary school grades (grades three through six), we find statistically significant positive impacts for exposure to Hispanic teachers on Hispanic students' disciplinary action rates, eventual dropout rates, and likelihood of high school graduation. Table 5 shows estimates of our preferred models across these outcomes, separately for students in grades three through six. We show impact estimates and their corresponding standard errors, the R^2 of the model, and the number of observations in each model. Observation totals vary by model because of differential missingness across the various outcomes. All models include the controls reported in table 3, columns 4 and 8. Notably, the test score impacts in grades three and four are larger than in grades five and six.

In terms of behavioral outcomes and high school success measures, the results of the analyses show a similar pattern. Table 5 shows results for the two disciplinary outcomes taken from the administrative data: number of discipline incidents and whether a student was ever disciplined. Student-teacher race matches in earlier grades lead to a reduction in the number of disciplinary events. Students are also less likely to ever receive disciplinary actions when they are matched at these earlier grades. As before, these impacts are concentrated in early elementary school grades. For high school outcomes, the estimates are more imprecise, but they still indicate that exposure to Hispanic teachers is causally linked to improved Hispanic student outcomes, especially for dropout rates. The magnitude of impacts for both disciplinary and high school outcomes is modest, on average, but heterogeneity analyses suggest that the effects may be larger in schools with low baseline Hispanic teacher exposure (table 7).

In similar fashion, table 6 shows our estimates of the impact of the Hispanic faculty share on long-term outcomes, including college enrollment persistence, degree attainment, and earnings. Impact estimates for these outcomes are mixed. We do not detect impacts for college enrollment. But for the earliest grades, there are statistically significant positive impacts of being matched in earlier and later grades on college persistence (measured for a sample that conditions on college enrollment) and evidence that these matches matter for ever earning a bachelor's degree. For wages, we have a sample an order of magnitude smaller because we observe wage outcomes only for the earliest cohorts of third- through sixth-graders in the data. The evidence is not compelling in either direction for wage outcomes across any of the models.

TABLE 5

Impacts of Hispanic Faculty Share on Hispanic Students' Short- and Medium-Term Outcomes

Grades three through six

	Grade 3				Grade 4			
	Impact	**SE**	R^2	***N***	**Impact**	**SE**	R^2	***N***
Reading score	0.182***	(0.027)	0.23	3,437,941	0.098***	(0.021)	0.52	3,440,289
Math score	0.208***	(0.034)	0.23	2,572,236	0.129***	(0.028)	0.48	3,472,473
Disciplinary actions	-0.036***	(0.010)	0.05	3,684,622	-0.041***	(0.013)	0.07	3,603,057
Ever disciplined	-0.051***	(0.008)	0.24	3,684,622	-0.041***	(0.008)	0.23	3,603,057
Ever dropped out of HS	-0.014***	(0.005)	0.05	2,218,747	-0.010**	(0.005)	0.06	2,341,070
Ever graduated from HS	0.016	(0.010)	0.08	1,793,152	0.018*	(0.010)	0.11	1,906,382

	Grade 5				Grade 6			
	Impact	**SE**	R^2	***N***	**Impact**	**SE**	R^2	***N***
Reading score	0.043**	(0.021)	0.52	3,440,289	0.069***	(0.025)	0.56	3,449,117
Math score	0.064**	(0.028)	0.48	3,472,473	0.103**	(0.043)	0.55	3,456,021
Disciplinary actions	-0.071***	(0.013)	0.07	3,603,057	-0.155	(0.117)	0.11	3,471,208
Ever disciplined	-0.034***	(0.008)	0.23	3,603,057	-0.033**	(0.015)	0.20	3,471,208
Ever dropped out of HS	-0.010*	(0.005)	0.06	2,341,070	-0.005	(0.007)	0.07	2,632,316
Ever graduated from HS	0.028***	(0.010)	0.11	1,906,382	0.021	(0.013)	0.14	2,180,726

Source: 1995–2018 Texas Education Agency data via the Texas Education Research Center.

Notes: HS = high school; SE = standard error. Standard errors are clustered at the school level in all models. Models for grades four through five include school fixed effects, district-by-year fixed effects, and time-varying school covariates, such as average test scores in the school, the female share of teachers, the share of students at the school that are of each race or ethnicity, the female share of students, and the free and reduced-price lunch (FRPL) rate. The models also control for student-specific covariates that include a cubic function of previous-year test scores (both in math and reading), gender, FRPL status, gifted status, and special education status. Grade three models include the same controls, excluding previous-year test scores, which are not available at this grade.

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

TABLE 6

Impacts of Hispanic Faculty Share on Hispanic Students' Long-Term Outcomes

Grades three through six

	Grade 3				Grade 4			
	Impact	**SE**	**R^2**	***N***	**Impact**	**SE**	**R^2**	***N***
Ever enrolled in college	-0.002	(0.011)	0.14	1,793,152	0.008	(0.010)	0.17	1,906,382
College persistence	0.175**	(0.084)	0.12	792,885	0.087	(0.080)	0.15	852,024
Ever earned an AA	0.005	(0.007)	0.03	996,042	0.010	(0.007)	0.04	1,110,095
Ever earned a BA	0.028***	(0.009)	0.09	996,042	0.019**	(0.008)	0.13	1,110,095
Has wages	-0.016	(0.015)	0.08	996,042	0.009	(0.014)	0.10	1,110,095
Log wages	-0.023	(0.020)	0.10	443,131	0.040**	(0.019)	0.10	490,347

	Grade 5				Grade 6			
	Impact	**SE**	**R^2**	***N***	**Impact**	**SE**	**R^2**	***N***
Ever enrolled in college	0.006	(0.010)	0.17	1,906,382	0.000	(0.014)	0.19	2,180,726
College persistence	0.032	(0.080)	0.15	852,024	-0.048	(0.101)	0.16	976,821
Ever earned an AA	0.007	(0.007)	0.04	1,110,095	-0.011	(0.007)	0.05	1,358,436
Ever earned a BA	0.013*	(0.008)	0.13	1,110,095	0.001	(0.009)	0.15	1,358,436
Has wages	-0.009	(0.014)	0.10	1,110,095	-0.017	(0.016)	0.10	1,358,436
Log wages	0.029	(0.019)	0.10	490,347	-0.002	(0.021)	0.11	594,068

Source: 1995–2018 Texas Education Agency data via the Texas Education Research Center.

Notes: AA = associate's degree; BA = bachelor's degree; SE = standard error. Standard errors are clustered at the school level in all models. Models for grades four through five include school fixed effects, district-by-year fixed effects, and time-varying school covariates, such as average test scores in the school, the female share of teachers, the share of students at the school that are of each race or ethnicity, the female share of students, and the free and reduced-price lunch (FRPL) rate. The models also control for student-specific covariates that include a cubic function of previous-year test scores (both in math and reading), gender, FRPL status, gifted status, and special education status. Grade three models include the same controls, excluding previous-year test scores, which are not available at this grade.

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Additionally, we estimate models of teacher race-match impacts for students in grades seven through nine (appendix table A.1). The evidence for later grade levels points broadly toward outcome improvements, but most estimates are imprecise, and we cannot reject the hypothesis of null effects. Together, these findings suggest that the importance of teacher diversity is greatest during the elementary school grades.

Here, it is useful to highlight the results of these estimates for Black students in the data as a means of comparison to situate these results with regard to the extant literature. In appendix figures A.1 and A.2, we show that compared with Latino and Hispanic students, Black students' achievement has remained relative flat over this time. This is also the case for long-term outcomes. The Black share of teachers has increased only 2 percentage points during the observed time period from 8 percent to 10 percent of teachers. Therefore, in the Texas context, Black teachers are not as starkly underrepresented as in other states,[4] though we have not measured exposures. We find positive effects of Black teacher share on reading, math, number of disciplinary actions, and whether the student was ever disciplined. These results are consistent with research done in other states (Dee 2004; Egalite, Kisida, and Winters 2015; Lindsay and Hart 2017). The magnitude of effects for both Black students and Latino and Hispanic students in the data are also consistent with these studies in showing small but persistent effects of having teachers of color.

Robustness and Treatment Effect Heterogeneity

We check for the robustness of our results and for treatment effect heterogeneity in table 7. These models are akin to those in tables 5 and 6, except they interact the Hispanic faculty share with indicator variables for four categories of schools:

- **constant-low schools** always have a low Hispanic faculty share during our study period
- **constant-high schools** always have a high Hispanic faculty share
- **rising-from-low schools** have Hispanic faculty shares that have risen in recent years, starting from a low initial share in 1995
- **rising-from-high schools** have seen increases in the Hispanic faculty share starting from already relatively high levels[5]

The omitted category in the interacted models is constant low, such that the interacted coefficients are interpreted relative to schools that have had low levels of Hispanic teacher representation during our entire study period.

Literature on the impact of teachers of color may be greatest in schools with predominantly white teachers, and our findings are generally in line with this theory. Previous work for Black students indicates that the benefits might accrue to the marginal student who would not have been likely to have a Black teacher were it not for the exposure to one or two Black teachers that arrive to the school for largely idiosyncratic reasons (Gershenson et al. 2017). Although not entirely conclusive, the estimates in table 7 suggest this is indeed the case. In column 1, we show our estimates for reading scores. At baseline, the Hispanic faculty share is linked with lower reading scores. But this is offset by a positive and large effect of Hispanic teachers in schools rising from both relatively low levels and relatively high levels of representation. The point estimates suggest that the effects are indeed largest in schools that made gains in Hispanic teacher representation starting from a relatively low level. For math scores, the effect estimate patterns are similar but noisily estimated. Significant patterns emerge for the likelihood of ever being disciplined and for high school dropout. Across the board, the estimates in table 7 suggest that diversity in the teacher workforce is particularly important for Hispanic students who would otherwise be exposed only to predominantly white teachers.

TABLE 7

Impacts of Hispanic Faculty Share on Hispanic Students' Achievement Outcomes

Grade five

	Reading score	Math score	Disciplinary actions	Ever disciplined	Ever dropped out of HS	Ever graduated from HS
	(1)	(2)	(3)	(4)	(5)	(6)
Faculty share	-0.195**	-0.032	-0.050	0.265***	0.089**	-0.056
	(0.084)	(0.131)	(0.113)	(0.053)	(0.035)	(0.095)
Faculty % X 1(constant high)	0.202**	0.091	0.123	-0.256***	-0.087**	0.054
	(0.091)	(0.139)	(0.118)	(0.055)	(0.036)	(0.097)
Faculty % X 1(rising from low)	0.265***	0.120	-0.057	-0.320***	-0.113***	0.117
	(0.086)	(0.133)	(0.113)	(0.054)	(0.035)	(0.096)
Faculty % X 1(rising from high)	0.236***	0.087	-0.033	-0.303***	-0.097***	0.085
	(0.086)	(0.134)	(0.114)	(0.054)	(0.035)	(0.096)
Outcome mean	-0.21	-0.14	0.19	0.52	0.07	0.70
Outcome SD	1.02	1.01	0.91	0.50	0.26	0.46
School FE	X	X	X	X	X	X
District-by-year FE	X	X	X	X	X	X
School covariates	X	X	X	X	X	X
Student covariates	X	X	X	X	X	X
R^2	0.56	0.58	0.08	0.21	0.07	0.12
N schools	4,151	4,148	4,123	4,123	4,019	4,023
N years	19,233	17,745	17,460	17,460	13,153	11,911
N students	3,102,355	2,816,856	3,309,360	3,309,360	2,385,245	1,971,679

Source: 1995–2018 Texas Education Agency data via the Texas Education Research Center.

Notes: FE = fixed effects; HS = high school; SD = standard deviation. Standard errors are clustered at the school level in all models. Time-varying school covariates include average test scores in the school, the female share of teachers, the share of students at the school that are of each race or ethnicity, the female share of students, and the free and reduced-price lunch (FRPL) rate. Student-specific covariates include a cubic function of previous-year test scores (both in math and reading), gender, FRPL status, gifted status, and special education status.

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Discussion

Our results fit in with the literature on teacher-student race matching for students of color. Using a large longitudinal administrative dataset from Texas, we find positive results for elementary school students on reading and math standardized test scores, disciplinary outcomes, and high school dropout. We do not find statistically significant results for long-term outcomes, such as college enrollment, college completion, or labor market earnings. We also do not find consistently positive effects for students in higher grade levels. These results contribute to the evidence that undergirds calls to continue to diversify the teacher workforce. The present study, combined with the literature, not only indicates that the workforce should become more diverse but prompts an investigation of what teachers of color do differently in the classroom.

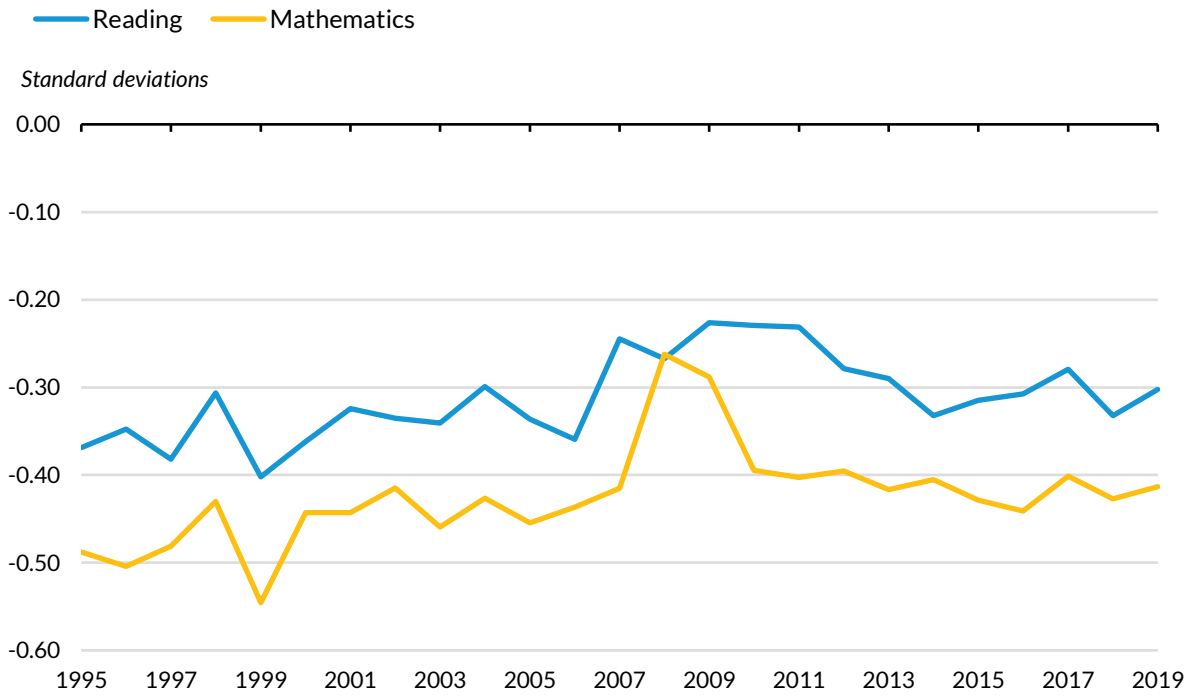
As the country's young generations become increasingly diverse, it is important to build on existing knowledge of why a diverse teacher workforce matters for the success of public schools. Using a large administrative dataset, the present study builds and expands upon the previous literature by exploring these questions for Latino and Hispanic students in a diverse state. The results are consistent with previous studies that measure these relationships in different states and contexts. The results indicate several areas where additional research could help stakeholders and policymakers develop short- and long-term strategies to address challenges regarding teacher diversity. A limitation of this work is that we cannot observe classroom dynamics, so we are left to speculate about which teacher practices produce these results. Additionally, we need more research to understand how teacher recruitment policies at a school level interact with teacher sorting across schools. We also need to improve our understanding of how colleges, as the producers of teaching degrees, affect workforce diversity. In addition, there are implications for pedagogical training, and future work should look at whether the practices of diverse teachers can be transferred or taught to others.

Appendix

FIGURE A.1

Trends in Black Students' Test Scores

Grade five cohort



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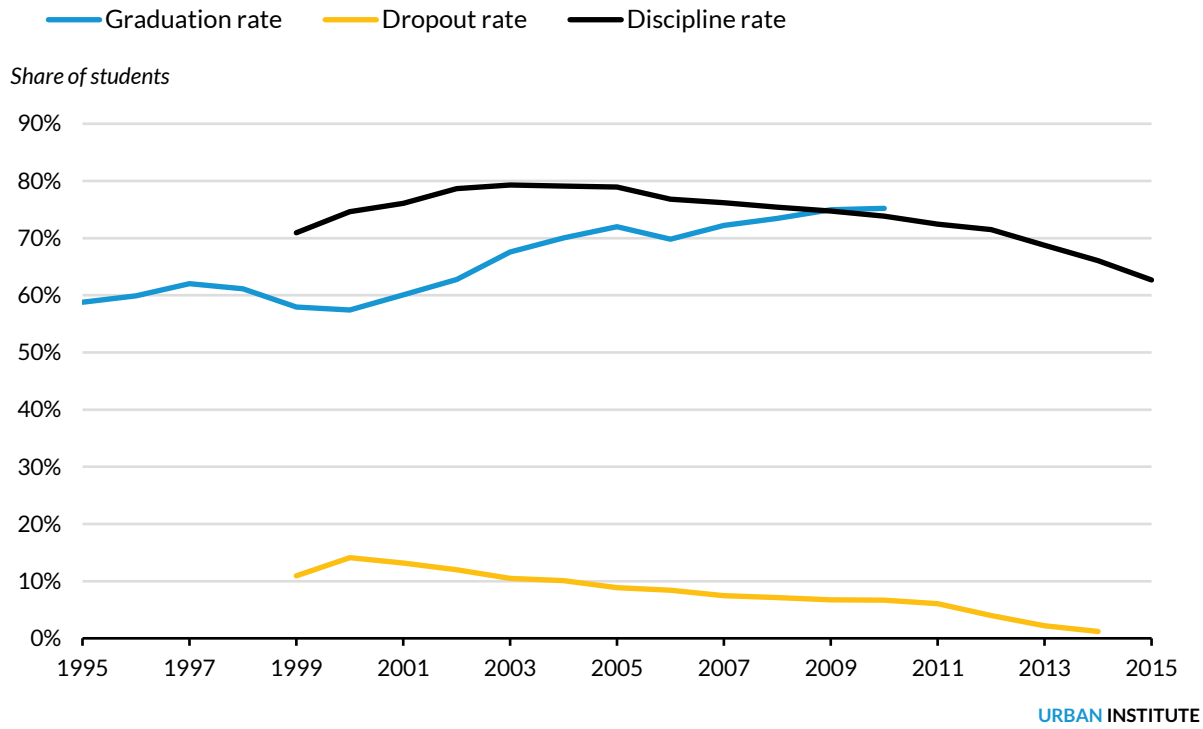
Source: 1995–2018 Texas Education Agency data via the Texas Education Research Center.

FIGURE A.2

Trends in Black Students' Medium-Term Outcomes

Grade five cohort



Source: 1995–2015 Texas Education Agency data via the Texas Education Research Center.

TABLE A.1

Impacts of Hispanic Faculty Share on Hispanic Students' Outcomes

Grades seven through nine

	Grade 7				Grade 8			
	Impact	**SE**	R^2	***N***	**Impact**	**SE**	R^2	***N***
Reading score	-0.033	(0.027)	0.61	3,402,874	0.014	(0.025)	0.61	3,177,789
Math score	0.009	(0.045)	0.63	3,314,301	0.070	(0.046)	0.59	2,632,259
Disciplinary actions	-0.155	(0.161)	0.13	3,438,943	-0.179	(0.153)	0.14	3,357,283
Ever disciplined	-0.009	(0.017)	0.20	3,438,943	-0.043**	(0.017)	0.19	3,357,283
Ever dropped out of HS	0.010	(0.008)	0.08	2,810,789	-0.009	(0.008)	0.09	2,939,305
Ever graduated from HS	-0.005	(0.014)	0.17	2,348,411	0.002	(0.013)	0.19	2,458,410
Ever enrolled in college	-0.015	(0.014)	0.21	2,348,411	0.000	(0.013)	0.22	2,458,410
College persistence	-0.010	(0.107)	0.17	1,050,110	0.144	(0.102)	0.18	1,113,692
Ever earned an AA	-0.004	(0.007)	0.05	1,506,085	-0.003	(0.007)	0.05	1,604,239
Ever earned a BA	0.013	(0.009)	0.16	1,506,085	0.010	(0.009)	0.18	1,604,239
Has wages	-0.007	(0.016)	0.10	1,506,085	0.003	(0.015)	0.10	1,604,239
Log wages	-0.019	(0.020)	0.11	655,145	-0.011	(0.019)	0.11	698,685

	Grade 9			
	Impact	**SE**	R^2	***N***
Reading score	0.034	(0.048)	0.58	2,763,061
Math score	0.167**	(0.083)	0.53	2,438,919
Disciplinary actions	-0.536**	(0.255)	0.16	3,880,549
Ever disciplined	-0.028	(0.027)	0.20	3,880,549
Ever dropped out of HS	0.004	(0.015)	0.10	3,650,445
Ever graduated from HS	0.020	(0.020)	0.24	3,150,402
Ever enrolled in college	-0.014	(0.018)	0.23	3,150,402
College persistence	0.317*	(0.168)	0.18	1,318,735
Ever earned an AA	0.004	(0.007)	0.06	2,161,326
Ever earned a BA	0.002	(0.010)	0.18	2,161,326
Has wages	-0.019	(0.018)	0.11	2,161,326
Log wages	0.020	(0.023)	0.12	896,132

Source: 1995–2018 Texas Education Agency data via the Texas Education Research Center.

Notes: AA = associate's degree; BA = bachelor's degree; HS = high school; SE = standard error. Standard errors are clustered at the school level in all models. All models include school fixed effects, district-by-year fixed effects, and time-varying school covariates, including average test scores in the school, the female share of teachers, the share of students at the school that are of each race or ethnicity, the female share of students, and the free and reduced-price lunch (FRPL) rate. The models also control for student-specific covariates that include a cubic function of previous-year test scores (both in math and reading), gender, FRPL status, gifted status, and special education status.

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

TABLE A.2

Impacts of Black Faculty Share on Black Students' Outcomes

Grades three through six

	Grade 3				Grade 4			
	Impact	**SE**	**R^2**	***N***	**Impact**	**SE**	**R^2**	***N***
Reading score	0.105**	(0.052)	0.25	1,008,896	0.100***	(0.033)	0.50	987,239
Math score	0.134**	(0.063)	0.26	721,007	0.098**	(0.042)	0.47	993,570
Disciplinary actions	-0.307***	(0.059)	0.11	1,001,485	-0.287***	(0.064)	0.13	994,227
Ever disciplined	-0.022*	(0.012)	0.25	1,001,485	-0.005	(0.011)	0.24	994,227
Ever dropped out of HS	0.006	(0.009)	0.07	655,219	0.014	(0.009)	0.08	695,828
Ever graduated from HS	0.004	(0.015)	0.10	592,703	0.005	(0.015)	0.13	635,008
Ever enrolled in college	-0.004	(0.017)	0.12	592,703	-0.015	(0.016)	0.15	635,008
College persistence	0.138	(0.109)	0.14	287,430	0.127	(0.100)	0.16	314,976
Ever earned an AA	-0.005	(0.009)	0.04	357,217	-0.002	(0.008)	0.04	397,937
Ever earned a BA	-0.008	(0.012)	0.09	357,217	-0.004	(0.012)	0.12	397,937
Has wages	-0.023	(0.023)	0.08	357,217	0.026	(0.022)	0.10	397,937
Log wages	-0.057*	(0.034)	0.08	140,491	-0.038	(0.031)	0.09	156,129
	Grade 5				**Grade 6**			
	Impact	**SE**	**R^2**	***N***	**Impact**	**SE**	**R^2**	***N***
Reading score	0.009	(0.030)	0.54	957,138	0.045	(0.031)	0.53	982,474
Math score	0.030	(0.046)	0.57	868,469	-0.000	(0.042)	0.55	983,424
Disciplinary actions	-0.442***	(0.090)	0.16	995,961	-0.465**	(0.181)	0.18	991,310
Ever disciplined	0.002	(0.011)	0.22	995,961	-0.039***	(0.014)	0.20	991,310
Ever dropped out of HS	-0.007	(0.008)	0.08	745,798	0.019**	(0.009)	0.08	790,811
Ever graduated from HS	0.006	(0.014)	0.14	681,869	-0.016	(0.019)	0.15	725,805
Ever enrolled in college	-0.022	(0.016)	0.16	681,869	-0.011	(0.019)	0.16	725,805
College persistence	0.099	(0.090)	0.17	344,231	-0.024	(0.102)	0.17	371,255
Ever earned an AA	-0.004	(0.007)	0.04	440,907	0.006	(0.008)	0.04	490,625
Ever earned a BA	-0.027**	(0.012)	0.13	440,907	-0.011	(0.011)	0.13	490,625
Has wages	0.023	(0.022)	0.10	440,907	0.010	(0.022)	0.10	490,625
Log wages	-0.064**	(0.025)	0.09	172,642	-0.084***	(0.028)	0.09	192,056

Source: 1995–2018 Texas Education Agency data via the Texas Education Research Center.

Notes: AA = associate's degree; BA = bachelor's degree; HS = high school; SE = standard error. Standard errors are clustered at the school level in all models. All models include school fixed effects, district-by-year fixed effects, and time-varying school covariates, including average test scores in the school, the female share of teachers, the share of students at the school that are of each race or ethnicity, the female share of students, and the free and reduced-price lunch (FRPL) rate. The models also control for student-specific covariates that include a cubic function of previous-year test scores (both in math and reading), gender, FRPL status, gifted status, and special education status.

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

TABLE A.3

Impacts of Black Faculty Share on Black Students' Outcomes

Grades seven through nine

	Grade 7				Grade 8			
	Impact	**SE**	R^2	***N***	**Impact**	**SE**	R^2	***N***
Reading score	0.086***	(0.025)	0.57	984,374	0.044	(0.027)	0.58	937,186
Math score	0.054*	(0.032)	0.62	963,834	-0.039	(0.050)	0.57	793,963
Disciplinary actions	-0.507**	(0.211)	0.17	996,565	-0.484**	(0.194)	0.17	983,761
Ever disciplined	-0.033**	(0.014)	0.20	996,565	-0.013	(0.013)	0.19	983,761
Ever dropped out of HS	0.017**	(0.008)	0.09	846,262	0.008	(0.008)	0.09	884,009
Ever graduated from HS	-0.030*	(0.015)	0.17	778,937	-0.022	(0.016)	0.19	810,225
Ever enrolled in college	-0.001	(0.020)	0.17	778,937	-0.017	(0.016)	0.18	810,225
College persistence	-0.085	(0.110)	0.17	401,756	-0.141	(0.101)	0.17	425,641
Ever earned an AA	0.005	(0.007)	0.04	543,445	0.008	(0.007)	0.04	576,872
Ever earned a BA	-0.014	(0.013)	0.14	543,445	-0.016	(0.012)	0.15	576,872
Has wages	-0.008	(0.020)	0.09	543,445	-0.011	(0.020)	0.10	576,872
Log wages	-0.009	(0.031)	0.09	212,722	0.039	(0.027)	0.10	227,511

	Grade 9			
	Impact	**SE**	R^2	***N***
Reading score	-0.015	(0.056)	0.55	782,242
Math score	-0.247***	(0.080)	0.53	713,663
Disciplinary actions	-0.263	(0.418)	0.18	1,160,407
Ever disciplined	0.006	(0.024)	0.20	1,160,407
Ever dropped out of HS	0.011	(0.019)	0.10	1,104,730
Ever graduated from HS	-0.013	(0.027)	0.24	1,035,322
Ever enrolled in college	-0.004	(0.026)	0.19	1,035,322
College persistence	-0.239	(0.189)	0.17	510,593
Ever earned an AA	-0.004	(0.007)	0.04	770,188
Ever earned a BA	-0.019**	(0.010)	0.16	770,188
Has wages	0.010	(0.021)	0.09	770,188
Log wages	-0.050	(0.030)	0.10	282,980

Source: 1995–2018 Texas Education Agency data via the Texas Education Research Center.

Notes: AA = associate's degree; BA = bachelor's degree; HS = high school; SE = standard error. Standard errors are clustered at the school level in all models. All models include school fixed effects, district-by-year fixed effects, and time-varying school covariates, including average test scores in the school, the female share of teachers, the share of students at the school that are of each race or ethnicity, the female share of students, and the free and reduced-price lunch (FRPL) rate. The models also control for student-specific covariates that include a cubic function of previous-year test scores (both in math and reading), gender, FRPL status, gifted status, and special education status.

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Notes

[1] At-risk status indicates whether a student is at risk of dropping out of school using the following state-defined criteria. This includes any student younger than 21 who

- is in prekindergarten, kindergarten, or grade 1, 2, or 3 and did not perform satisfactorily on a readiness test or assessment instrument administered during the current school year;
- is in grade 7, 8, 9, 10, 11, or 12 and did not maintain an average equivalent to 70 on a scale of 100 in two or more subjects in the foundation curriculum during a semester in the preceding or current school year or is not maintaining such an average in two or more subjects in the foundation curriculum in the current semester;
- was not advanced from one grade level to the next for one or more school years;
- did not perform satisfactorily on an assessment instrument administered to the student and who has not in the previous or current school year subsequently performed on that instrument or another appropriate instrument at a level equal to at least 110 percent of the level of satisfactory performance on that instrument;
- is pregnant or is a parent;
- has been placed in an alternative education program in accordance with Texas Education Code (TEC) §37.006 during the preceding or current school year;
- has been expelled in accordance with TEC §37.007 during the preceding or current school year;
- is on parole, probation, deferred prosecution, or other conditional release;
- was previously reported through the Public Education Information Management System to have dropped out of school;
- is a student of limited English proficiency, as defined by TEC §29.052;
- is in the custody or care of the Department of Protective and Regulatory Services or has, during the current school year, been referred to the department by a school official, officer of the juvenile court, or law enforcement official;
- is homeless, as defined in No Child Left Behind, title X, part C, section 725(2), the term "homeless children and youths," and its subsequent amendments; or
- resided in the preceding school year or resides in the current school year in a residential placement facility in the district, including a detention facility, substance abuse treatment facility, emergency shelter, psychiatric hospital, halfway house, or foster group home.

[2] Three different state assessments were used in Texas from 1995 through 2018. TAAS was used from 1990 through 2002, and TAKS replaced TAAS in 2003 and was used through the spring of 2011. Starting in 2012, Texas began to test students using STAAR.

[3] The TEA makes dropout data available from 1999 through 2018.

[4] Constance A. Lindsay, Erica Blom, and Alexandra Tilsley, "Diversifying the Classroom: Examining the Teacher Pipeline," Urban Institute, October 5, 2017, https://www.urban.org/features/diversifying-classroom-examining-teacher-pipeline.

[5] We compute the school categories using the following procedure. Starting with a school-level panel of schools, for each school, we estimate a linear time trend model of the Hispanic faculty share from 1995 to 2018. Then, we categorize schools based on the cross-sectional distribution of estimated intercepts and time trend slopes from these models. Constant schools are those for which a model using only a constant as the regressor has similar root mean squared error to a model using a constant and a linear time trend (within 2 percentage points). Rising schools are those for which the addition of the linear time trend to the model leads to meaningful root mean squared error reductions of more than 2 percentage points. Among constant schools, we define low and high faculty share categories based on whether the estimated intercept is below or above the median from the empirical distribution of intercept estimates. Similarly, among rising schools, we categorize schools into rising from low and rising from high based on the median of the distribution of estimated intercepts.

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