NATIONAL CENTER for ANALYSIS of LONGITUDINAL DATA in EDUCATION RESEARCH

TRACKING EVERY STUDENT'S LEARNING EVERY YEAR

A program of research by the American Institutes for Research with Duke University, Northwestern University, Stanford University, University of Missouri-Columbia, University of North Carolina at Chapel Hill, University of Texas at Dallas, and University of Washington

Teachers and School Climate: Effects on Student Outcomes and Academic Disparities

Ben Backes
James Cowan
Dan Goldhaber
Roddy Theobald

WORKING PAPER No. 274 - 1022 • October 2022

Teachers and School Climate: Effects on Student Outcomes and Academic Disparities

Ben Backes
American Institutes for Research/CALDER

James Cowan
American Institutes for Research/CALDER

Dan Goldhaber
American Institutes for Research/CALDER
University of Washington/CEDR

Roddy Theobald
American Institutes for Research/CALDER

Contents

Acknowledgments

The research reported here was supported by the Institute of Education Sciences, U.S. Department of Education, through Grant R305S210012 to the Massachusetts Department of Elementary and Secondary Education (DESE). The opinions expressed are those of the authors and do not represent the views of the Institute, the U.S. Department of Education, or DESE. The authors thank Claire Abbott, Matthew Deninger, Ronald Ferguson, Andrew Ho, Elana McDermott, Shelagh Peoples, Kathryn Sandel, and Aubree Webb, and members of the project's advisory board, for comments that improved the manuscript.

CALDER working papers have not undergone final formal review and should be cited as working papers. They are intended to encourage discussion and suggestions for revision before final publication. Any opinions, findings, and conclusions expressed in these papers are those of the authors and do not necessarily reflect the views of our funders. All errors are our own.

CALDER • American Institutes for Research
1400 Crystal Drive 10th Floor, Arlington, VA 22202
202-403-5796 • www.caldercenter.org

Teachers and School Climate: Effects on Student Outcomes and Academic Disparities

Ben Backes, James Cowan, Dan Goldhaber, and Roddy Theobald

CALDER Working Paper No. 274-1022
October 2022

Abstract

Student-teacher relationships are at the core of student experiences in schools and, arguably, fundamental to influencing student outcomes. Using a statewide, student-level school climate survey from Massachusetts, we investigate teachers' contributions to school climate, which we refer to as climate value added (VA), and how it varies by student race/ethnicity. We first show that climate VA contributes to student learning: Teachers whose students report positive feelings about climate also contribute more to student test scores and to an aggregate of nontest student outcomes (student absences, suspensions, and grade progression). And teachers identified by students of color as contributing to better school climate have outsize effects on learning gains for these students. Differences in teachers' climate effects across racial/ethnic groups are largest on topics aligned with cultural competency, school participation, and comfort with faculty. Lastly, we find that Black students assigned to Black teachers report better school climate than Black students assigned to other teachers.

1. Introduction

Research in education, economics, and psychology suggests that teachers contribute in a variety of ways to the learning environment. They form relationships with students and help inculcate effective learning habits (Battistich et al., 1997; Davis, 2003; Thomas & Oldfather, 1997). Teaching practices mediate students' feelings of belonging and engagement (Liu & Loeb, 2021; Rowley et al., 2019). They manage classroom behavior and establish expectations for students' work (Ferguson & Danielson, 2014; Kane et al., 2011). These teaching skills contribute to student academic outcomes in the short run and have lasting effects on the educational trajectories of students (Backes et al., 2022; Blazar & Kraft, 2017; Jackson, 2018; Rose et al., 2022). But understanding which teaching skills contribute to these outcomes is an important empirical question given that teaching effectiveness is multidimensional.

There is also evidence that some teachers treat students differently depending on their race and ethnicity. For example, on average, teachers have lower academic expectations, engage in less demanding instructional practices, and more frequently discipline students of color relative to white students.[1] Disparities in the treatment of students may contribute to racial inequities in students' sense of social belonging, classroom engagement, and disciplinary outcomes (Anyon et al., 2016; Voight et al., 2015).

Other research highlights the positive role that teachers play for students of color (Evans, 1992; Gay, 2002; Hess & Leal, 1997; Steele & Aronson, 1995). A number of studies have found effects associated with the demographic match between teachers and their students, including on outcomes such as student test scores (Blazar, 2021; Dee, 2004; Egalite et al., 2015) and disciplinary outcomes (Holt & Gershenson, 2019; Lindsay & Hart, 2017). Much of this empirical literature focuses on student outcomes rather than specific teaching skills, but other research has suggested that teachers' contributions to the school climate and their ability to foster productive relationships with individual students are important components of culturally responsive teaching (Banks, 2004; Brookover et al., 1978; Thapa et al., 2013).

In this paper, we use data from a statewide student survey about school climate from Massachusetts to assess teachers effects on students' learning environment. Although the surveys

[1] For evidence on expectations for students, see Carlana (2019), Ferguson (2003), Oates (2003), Papageorge et al. (2019), Rangel & Shi (2020), and Shi & Zhu, (2021a). For evidence on instructional practices, see Harber et al. (2012) and Taylor (1979). For evidence on suspensions, see Holt & Gershenson (2019), Lindsay & Hart (2017), and Shi & Zhu (2021b).

ask about general school climate, we use standard statistical approaches to isolate teacher effects, which we refer to as *climate value added* (VA). We then investigate how climate VA contributes to other student outcomes and explore how the impacts of teachers vary by student race and ethnicity. The survey covers an array of topics related to school climate: cultural competency, relationships, participation, emotional safety, physical safety, bullying, instruction, mental health, and discipline. We estimate that the variation in teacher effects on school climate is about 0.1 standard deviations, which is comparable in magnitude to teacher effects on tests and behavioral measures (Hanushek & Rivkin, 2010; Jackson, 2018). The estimated effects of teachers are similar in size whether we include controls for schoolwide climate responses or include school fixed effects in the VA models to isolate within-school variation in student responses. Climate VA is also predictive of student survey responses in out-of-sample analyses that examine differences in teacher assignments within schools. It is also positively correlated with teacher contributions to test scores, and to a lesser extent, an index of several nontest measures.

We further document that students' assessments of climate, as shaped by their teachers, differ by student race/ethnicity. Teachers who improve school climate tend to do so for all students, but the perceptions of white students and students of color do differ for individual teachers. We estimate climate VA separately by student racial/ethnic groups and find the correlation between climate VA obtained from white students and students of color is about 0.7. The perceptions of students of color differ most significantly on topics aligned with cultural competency, participation in school, and comfort approaching teachers about emotional or personal problems. We also find evidence of student-teacher racial-matching effects on school climate. Matches improve school climate perceptions by about 0.06 SDs for Black students, which is about 50% of the discrepancy in climate reports between white and Black students.

Teachers who contribute positively to school climate also improve academic achievement. We estimate that a one SD improvement in climate VA increases student test scores by about 0.02 SDs for both white students and students of color. When we estimate climate VA separately by student racial/ethnic groups, we find that an inclusive climate—as measured by the portion of a teacher's contribution to school climate that accrues specifically to students of color—has similar effects on student achievement, but only for students of color. A one SD increase in the inclusive climate measure is also associated with an improvement of about 0.02 SDs in test scores for students of color. Our findings provide additional evidence for culturally responsive teaching as a distinct dimension of effective teaching and provide some new evidence on specific mechanisms.

2. Background and Prior Literature

School climate encompasses more than just instruction and pedagogy. In addition to instruction, it includes rules and norms of behavior, academic engagement, and relationships between students and teachers (Thapa et al., 2013). There is a large body of research demonstrating the direct effects of teachers on instruction (Koedel et al., 2015), but teachers also directly contribute to these other dimensions of the learning environment. They encourage productive academic habits in their students—such as studiousness, autonomy, and persistence—and play a role in developing students' self-regulation of social behavior by setting classroom routines and culture (Davis, 2003). Their management of the classroom contributes to social interactions among students (Johnson, 1981). They form relationships with individual students and serve as academic role models (Battistich et al., 1997; Davis, 2003; Thomas & Oldfather, 1997). The empirical literature suggests that teachers' contributions to students' learning environments are educationally significant. Teachers who foster positive classroom environments and encourage academic engagement among students have positive effects on students' short- and long-run academic trajectories (Backes et al., 2022; Blazar & Kraft, 2017; Jackson, 2018; Kraft, 2019; Liu & Loeb, 2021).

Several scholars have identified school climate as a potential component of culturally responsive teaching (Banks, 2004; Brookover et al., 1978; Ferguson, 2016; Thapa et al., 2013). For instance, Ferguson (2016) argues that students' preparation for formal schooling, the instructional practices of their teachers, and the nurturing aspects of school organization all contribute to positive schooling environments for students of color. This is consistent with research documenting disparities in students' experiences with the learning environment. For instance, researchers have found that teachers and administrators disproportionately subject students of color to discipline (Barrett et al., 2021; Liu et al., 2022; Shi & Zhu, 2021b). Others have found that teachers have lower expectations for Black students, on average, and that Black students consequently have less access to advanced coursework (Ferguson, 2003; Hart, 2020; Papageorge et al., 2021; Shi & Zhu, 2021a). Using a survey of teachers, Saft and Pianta (2001) found similar disparities in the strength of teacher-reported relationships with students. These findings suggest that improvements in the school climate may have benefits for students of color.

This line of studies is closely related to an empirical literature that uses student-teacher racial/ethnic matching as a proxy for culturally responsive teaching practices. Most of these papers focus on Black students and researchers have found that having a Black teacher improves a battery of educational outcomes. These include student test scores (Blazar, 2021; Dee, 2004; Egalite et al., 2015), student assessments (Dee, 2005; Fox, 2016; Gershenson, 2016; Quinn, 2020), disciplinary outcomes (Holt & Gershenson, 2019; Lindsay & Hart, 2017), access to advanced coursework (Hart, 2020), and educational attainment (Gershenson et al., 2019). A smaller set of papers have examined similar outcomes for Hispanic students and found generally consistent results (Lindsay et al., 2021).

Although these studies have found matching effects on a variety of educational outcomes, specific mechanisms remain an ongoing topic of research. Many of the student-teacher racial matching papers interpret the match effect as representing culturally responsive teaching practices (Goldhaber et al., 2019). These interpretations are consistent with research about the characteristics of culturally responsive teaching, which emphasizes the importance of engaging with students' cultural backgrounds and maintaining high expectations for all students (Gay, 2002). But other papers raise competing explanations. Gershenson et al. (2019) suggest that Black teachers act as role models for students and provide information about the potential benefits of academic engagement. Edmonds (2022), who assesses the effectiveness of graduates of historically Black colleges and universities, suggests that matching effects reflect differences in pre-service educational and preparation experiences rather than direct role model effects. Alesina et al. (2018) and Carlana (2019) suggest that biases may also play an important role. Interestingly, these papers point to different aspects of the school climate as potential explanations.

In this study, we assess teacher effects on school climate and how these effects vary by student race/ethnicity. This study also contributes to a literature on how student perceptions of school climate are related to teaching and academic outcomes. We use student surveys administered at scale to investigate the extent to which student reports of school climate can be attributed to teachers and the relationship between teacher climate effects and the test and nontest outcomes of their students. Prior work has generally shown that students' reports of climate, engagement with the academic curriculum, and respectful interactions with school personnel are associated with student learning improvements (Chaplin et al., 2014; Ferguson, 2012; Raudenbush & Jean, 2015), although Blazar and Pollard (2022) find a *negative* relationship between teacher effects on the student engagement and effects on math scores. Student perceptions of the classroom climate also predict student behaviors, such as attendance, engagement with school work, and effort (Ferguson, 2016). However, there is relatively little evidence about how well these measures can predict other student outcomes and some uncertainty over whether they capture teacher effects or non-random student-teacher sorting

(Bacher-Hicks et al., 2019). We use a battery of research designs to show that teachers' effects on the school climate also have impacts on student outcomes.

3. Data

3.1 The Views of Climate and Learning Survey

The Massachusetts Department of Elementary and Secondary Education (DESE) has administered a survey of school climate to students since 2018. The *Views of Climate and Learning (VOCAL)* survey is included as an optional, separate component in the annual state standardized tests for students in grades 4 (since 2019), 5, 8, and 10. DESE calculates scores on three dimensions (engagement, safety, and environment) and nine topics (cultural and linguistic competency, relationships, participation, emotional safety, physical safety, bullying, instruction, mental health, and discipline) of school climate. The survey scoring is supported by psychometric analyses of the student survey results (DESE, 2018a, 2018b). Throughout this paper, we refer to the topics on the survey using the labels developed by DESE. These labels may depart in some respects from other uses in the research literature, although the general framing of the surveys is similar to those used in other research on student perceptions and teaching effectiveness (Blazar & Kraft, 2017; Ferguson & Danielson, 2014). We list the topics and dimensions in Table 1, and we show the individual questions aligned with each of the topics on the 2019 survey administration in Appendix Tables A.1–A.4.

Although the survey is intended to measure school climate, climate covers a variety of topics related to the role of teachers in the school community, and the survey asks questions specifically about classroom activities and students' relationships with teachers. The survey includes one topic explicitly aligned with the instructional environment, which asks about how teachers support student learning and students' interest in the curriculum. Other questions, particularly in the participation topic, ask about how well teachers encourage engagement in school. And the relationships and emotional safety topics both include questions about the strength of student-teacher relationships.

The survey also covers topics aligned with the conceptualizations of culturally responsive teaching practices described in the previous section. One topic specifically intends to measure cultural competence, with questions about demographic representation in instructional materials; the extent to which school personnel respect students regardless of their backgrounds; expectations for advanced coursework; general respect from school personnel; and inclusive social environments. Related concepts are also found elsewhere in the survey. For instance, the instructional environment topic asks whether teachers have high expectations for all students, and the disciplinary topic asks whether all students are held to the same standards and whether disciplinary interventions are fair.

3.2 Sample and Summary Statistics

We use administrative data from Massachusetts that cover the 2011–2019 academic years. The data include student enrollment records, course registration and transcripts, standardized testing results from the Massachusetts Comprehensive Assessment System (MCAS), and disciplinary records. We combine these data with information on teacher assignments to generate a student-teacher linked dataset covering math and English language arts (ELA) classes in grades 4, 5, 8, and 10. For the 2018 and 2019 school years, we link this information to student survey responses on the climate survey. In most analyses, we use the overall survey index constructed by DESE. We standardize the scored responses by grade and year and use them to estimate a general measure of teachers' contributions to school climate.

We use the student enrollment data to identify student race/ethnicity in our sample and construct nonexclusive race/ethnicity identifiers for each of the groups covered in the administrative report (American Indian, Asian, Black, Native Hawaiian or Pacific Islander, and

Hispanic).[2] Hispanic students comprise 19% of the sample;[3] Black students, 12% of the sample; and Asian students, 8% of the sample. American Indian (3%) and Native Hawaiian or Pacific Islander (1%) students are less common in Massachusetts. We combine these data with several other student outcomes derived from the administrative data. We use standardized test data for math and ELA in grades 3–8 and 10. We additionally use several nontest outcomes (absences, discipline, grade retention, and course grades) that previously have been used in the literature on teacher effectiveness (e.g., Jackson, 2018).

The enrollment data report the total number of days a student was in attendance for at least half the school day. We use the difference between this count and the number of days enrolled as the measure of absences. The state also tracks the total number of suspensions in each year and the total number of days suspended. We identify the total number of days suspended (in-school or out-of-school) as a measure of disciplinary outcomes. For each of the count variables, we use $\ln(x + 1)$ as an outcome variable as in prior studies (Jackson, 2018). In some analyses, we use course grades, which are available for students in grades 8 and 10. The administrative data include course schedules with grades reported on a numeric (0%–100%) or grade point (0.0–4.0) scale. We drop ungraded courses and convert numeric grades to a grade point average.

In the analyses that follow, we use a sample of students matched to their teachers in math and ELA in grades 4–8 and 10 between 2012 and 2019. The matched sample includes about 85%–90% of students in each school year and grade. Summary statistics for the matched samples

[2] The data allow districts to report multiple racial/ethnic identities per student. Because students tend to self-identify differently as they age, we then take the maximum of each of these identifiers for each student in the sample (Viano & Baker, 2020). The percentages do not add to one because the race/ethnicity identifiers are not mutually exclusive (i.e., students can report multiple identities).

[3] 26% of Hispanic students report a race other than white (about 60% Black and 39% American Indian).

are shown in Table 2. We use the student data and teacher climate VA to construct two analytical samples. The *survey sample* includes data from the 2018 and 2019 school years for students with VOCAL survey outcomes. Overall, 80% of students with non-missing test scores in the relevant years can be matched to VOCAL survey responses.[4] The student *outcomes sample* includes student-teacher linkages and other academic outcomes for the 2012–2019 school years. In both cases, we limit the sample to teachers with a leave-out estimate of teacher climate VA. Because we use school fixed effects in our main specifications, we also restrict the sample to include school-grade-year cells with at least two teachers with non-missing climate VA estimates. One concern about this restriction is the generalizability of treatment effects estimated from fixed-effects models. Identification of the effects of teaching assignments comes only from cells with multiple teachers with climate VA estimates. This disproportionately excludes smaller schools with fewer classes per grade. Our findings therefore may not be representative of the effects of teacher climate VA in smaller schools (Miller et al., 2019). In our sample, we are missing climate VA data for about 45% of teachers in the student outcomes sample. We provide summary statistics for both samples and their unrestricted counterparts in Appendix Tables A1 and A2.

3.3 Perceptions of School Climate by Student Race/Ethnicity

In Table 3 and Figure 1, we report differences in the survey responses by student race/ethnicity. For each of the nine survey topics, we regress student responses on indicators for race/ethnicity and subject-grade-year effects. The coefficients indicate the average difference in

[4] Although there are some differences in response rates by student race/ethnicity, these are mostly a function of differences in school-level reporting rates. Overall, response rates are 2.5 percentage points lower for Black students, 2.7 percentage points lower for Hispanic students, and 5.1 percentage points lower for Asian students than for white students. Within schools, response rates are 0.9 percentage points lower for Black and Hispanic students than for white students and 0.6 percentage points higher for Asian students.

standardized survey responses for each of the specified groups and for white students in the same subject, grade, and school year. We then add school-subject-grade-year and classroom fixed effects to compare responses to students in the same school or classroom, respectively. Reports of overall school climate vary by students' race/ethnicity, but a notable finding is that climate measures are systematically lower for Black than for white students and tend to be higher for Asian students (Figure 1), and these findings show up both across and within schools (i.e., the differences show up in models with and without school fixed effects). Students of all non-white racial or ethnic groups report lower cultural competence of their teachers than white students do; this is the only topic for which all groups' perceptions of school climate are lower than those of white students.

Most of the difference between overall climate differences and within-classroom climate differences is mediated by schools. In each row of Table 3, we report the differences across racial/ethnic groups with and without school and classroom controls. Most of the total change between the unconditional racial/ethnic climate differences (column 1) and the within-classroom climate differences (column 4) comes from the introduction of school fixed effects in column 2. Black students' reports of climate are about 0.14 SDs lower than those of white students overall and 0.07 SDs lower than those of white students in the same school. The reports of Hispanic students are 0.03 SDs lower than those of white students overall, but 0.03 SDs *higher* than those of white students in their school. Finally, the reports of Asian students are 0.10 SDs higher than those of white students and 0.06 SDs higher than those of white students in the same school. The stability of the differences in climate reports across columns 2–4, on the other hand, suggests that relatively little of the difference in the perceptions of students of color and white students can be explained by differences in assignments to tracks, classrooms, or teachers. In other words, these differences reflect different perceptions of the same environment more than differences in the learning environment.

Each of the non-white student groups reports lower perceptions of cultural and linguistic competence (Figure 1). Responses also vary by student race/ethnicity for several of the topics on the VOCAL survey, as illustrated in Figure 1. Black students report the lowest scores for their schools' cultural competence relative to white students in the sample (0.16 SD), but Hispanic and Asian students also report worse cultural competence (0.04 SD).[5]

Apart from the cultural competence of school personnel, Black students also have lower perceptions of school climate on topics related to relationships with school personnel and other students (0.21 SD), and bullying (0.20 SD). However, they report more positive experiences on two topics related to classroom instruction (participation and instruction). These differences hold even relative to other students in the same classroom, which suggests that they are not explained by differences in teacher assignments.

Asian and Hispanic students generally report more favorable perceptions of school climate relative to other students in the same school. Asian students report better relationships with school personnel, and Hispanic students report better relationships relative to white students in the same school and classroom. Both groups report more equitable perceptions of discipline. And although Hispanic students report worse experiences on the bullying and safety topics, these differences appear to be driven by school-level factors.[6]

---

[5] The relationships displayed in Figure 1 are similar when broken down by elementary (grades 4 and 5) versus secondary (grades 8 and 10) levels, with the exception of cultural competence, where reported within-school differences between white students and students of color are concentrated in the upper grades and close to zero in elementary school.

[6] Results are similar when examining climate perceptions among non-white Hispanic students. They report better school climate (relative to white students) by about 0.05 SD in each model.

3.4 Estimation of Climate VA

We use VOCAL survey responses from 2018 and 2019 to estimate the effects of teachers on students' perceptions of school climate, which we refer to as *climate value added*. Following the approaches commonly used in the teaching effectiveness literature, we estimate a standard two-step value-added model for teacher effects on the survey responses. Our preferred specification follows standard methods used for student test scores and other outcomes (Bacher-Hicks et al., 2019; Chetty et al., 2014a; Kane & Staiger, 2008; Koedel et al., 2015) and includes student, classroom, and school covariates:

$$Y_{ijst} = X_i\beta + W_{-js}\rho + \epsilon_{ijst} \tag{1}$$

We then estimate annualized performance measures using the mean residual from Eq. (1):

$$\hat{\theta}_{jt} = \sum_{j(i,t)=j} Y_{ijst} - X_i\hat{\beta} - W_{-js}\hat{\rho} \tag{2}$$

We estimate these models separately by subject and grade level. The control vector X_i includes student race/ethnicity; gender; free and reduced-price lunch (FRL) status; participation in special education or English learner programs; cubic polynomials of prior math and ELA standardized test scores; lagged suspensions, absences, and grade progression; and the classroom and school-grade-year means of each of these covariates. We also include a leave-out measure of school climate, W_{-js}, by taking the average of each of the nine dimensions of school climate from all students in school s not taught by teacher j. We omit teacher j because these climate reports include responses from the current school year and we do not want controls to include outcomes data in Eq. (2). Otherwise, this specification is similar to the common approach of including school means of the lagged outcomes in value-added models. We also show below that this specification yields results very similar to those using school-by-year fixed effects in place of the climate controls and other school characteristics.

Value-added models similar to Eq. (1) have been commonly used in prior research to estimate teacher effects on outcomes such as standardized tests, attendance, and discipline. In this context, several studies suggest that the value-added research design provides relatively unbiased estimates of teacher effects (Bacher-Hicks et al., 2019; Chetty et al., 2014a; Kane & Staiger, 2008; Koedel et al., 2015). There is less empirical evidence on the performance of models like Eq. (1) for capturing teacher effects on student surveys, but similar value-added models have been used in much of the extant work. Kane et al. (2013) and Bacher-Hicks et al. (2019) estimate similar value-added models with student responses on the Tripod survey (Ferguson & Danielson, 2014). Blazar and Kraft (2017) use student surveys to estimate similar value-added models assessing teacher effects on student perceptions and behavior in class.

We defer a comprehensive discussion of the research design for the next section, but it is helpful to discuss a few potential identification issues with the estimated teacher effects. The key identifying assumption is that student residuals, ϵ_{ijst}, are orthogonal to teacher assignments. There are good reasons to question this assumption. First, students, teachers, parents, and administrators all plausibly contribute to school climate. Any unobserved components of school climate—including the contributions of others in the community—will bias teacher estimates. We account for this possibility by including the leave-out climate mean W_{-js}.[7] Controlling for average school climate adjusts the portion of climate that is common across classrooms within a school. This controls for a host of potential contributions to the general school climate: the behavior or perceptions of students enrolled in a particular school, the contributions of principals or other faculty, and support from families or other members of the school community. The

[7] Including students from teacher j in Eq. (1) risks overcontrolling for the teacher effect. Researchers typically include classroom and/or school means of prior-year outcomes in value-added models, which are generally not influenced by the teacher under consideration.

adjustment ensures that teachers are compared to others working in schools with similar perceptions of school climate. Including group means of key variables is a common approach in the value-added literature to adjust for unobservable variation at the group level (Altonji & Mansfield, 2018; Chetty et al., 2014a). We also estimate supplemental models that include school-by-year fixed effects in place of the school covariates and climate controls; the estimated variance of teacher climate effects in these models is nearly identical to that of our preferred model. In addition, in the analyses to follow, we demonstrate that climate VA is predictive of student perceptions *within* schools, which would not be the case if our estimated VA merely reflected general school-level climate.

Second, we must assume that students are not assigned to classrooms based on factors that predict their survey responses (conditional on the covariates in the model). As noted above, the value-added model includes controls for several student characteristics that are frequently used to determine classroom assignments, including prior achievement, participation in special education and English language programming, and controls for supplemental or advanced coursetaking. Although these variables predict teacher and classroom assignments, and thus should mitigate bias from intentional classroom sorting, they are poor predictors of survey responses, a problem also noted by Bacher-Hicks et al. (2019) in their study of student perception surveys. The R^2 from a regression of survey responses on the control vector X_i (i.e., omitting the mean school climate response, W_{-js}) is only 0.02. One may therefore be concerned that the estimated teacher climate effects reflect within-school sorting rather than the contributions of teachers.

One important consideration is that, in practice, there is relatively little sorting on student perceptions of school climate. One way to assess the potential biases from within-school sorting is to examine the extent of sorting across classrooms by students' prior climate responses on the VOCAL survey. Unlike students' responses in the current school year, these responses do not share common teacher effects. Although this is not possible within our estimation sample because students were not systematically surveyed in the year before they are observed in our data, we can examine the classroom assignments of students in our sample in *other* school years. We construct a sample of students in grades 4, 7, and 9 in 2017 or 2018 (who are surveyed in grades 5, 8, and 10 in 2018 or 2019) or in grades 5, 6, 9, and 11 in 2019 (who are surveyed in grades 4, 5, 8, and 10 in 2018). We then estimate the additional variance in prior- or next-year survey responses explained by classroom assignments above what can be explained by school assignments. In other words, we estimate the models

$$Y_{ijst} = F_{st}\psi + \epsilon_{ijst} \tag{3}$$

$$Y_{ijst} = F_{jt}\psi + \epsilon_{ijst} \tag{4}$$

The R^2 from the restricted model (with school-year fixed effects only) is 0.07; adding the classroom effects increases the R^2 only to 0.08. Using the current climate outcomes instead, the R^2 increases from 0.07 in a regression with school-year fixed effects to 0.10 with classroom fixed effects. The larger increase in R^2 when adding classroom effects to the model with current student perceptions provides some suggestive evidence of teacher effects on the climate surveys. By contrast, the R^2 from regressions of prior-year test scores increases from about 0.18 using school-year effects to 0.32–0.36 using classroom fixed effects, indicating much more substantial sorting on academic achievement. Nonetheless, in Section 4 below, we discuss additional steps to ensure that the main findings are not driven by nonrandom student assignments.

Given the evidence that the cultural competence of teachers is an important consideration in their ability to connect with students and may therefore influence the educational outcomes for students of color, we construct a second climate VA measure using data separately for white and students of color in our sample. We pool all students of color together to ensure an adequate sample of teachers for whom both types of climate VA can be estimated.[8] Estimation of the group-specific teacher effects is mostly a straightforward extension of the approach described above. We first estimate Eq. (1) separately by group and then construct an estimated teacher effect for each student group. To ensure a minimal number of observations inform each estimate, we retain classrooms with at least five students in each group. The remaining sample includes 2,280 teachers.

After estimating teacher VA, we construct empirical Bayes predictions of each measure; additional details for the empirical Bayes approach are described in Appendix B. For the general climate VA, we follow the approach used by Kane and Staiger (2008) and Chetty et al. (2014a) to decompose the residual variance into student, classroom, and teacher components.[9] For the group-specific VA, we follow the approach developed by Mulhern and Opper (2022), who show that the attenuation bias in a regression of student outcomes on multiple dimensions of teaching effectiveness depends on the variance of the measurement error in each measure (i.e., the sampling variance of the estimated group-specific teacher effects) and their covariance. When the two measures share common sources of error (e.g., a common disruptive student), naïve regressions of student outcomes on multiple single-dimensional empirical Bayes estimates may be misleading. Using the multidimensional empirical Bayes predictions, we summarize teachers' contributions to inclusive climates using the difference

[8] Several prior studies have used student testing data and found that teachers differ in their effectiveness in working with students from different demographic or educational backgrounds. Delgado (2021) shows that teachers differ in their effectiveness across racial/ethnic groups and that contributions to test scores for students of color represent a distinct dimension of teaching skill. Other studies have found that teachers specialize in instruction for English language learners (Loeb et al., 2014) and students with learning disabilities (Wood et al., 2022).
[9] Because we only use 2 years of data to construct the value-added measures, we do not incorporate "drift" (Chetty et al., 2014a) into the estimates of teacher climate value added.

$$\hat{\theta}_{j,-t}^{nw-w} = \hat{\theta}_{j,-t}^{\text{nonwhite}} - \hat{\theta}_{j,-t}^{\text{white}} \tag{5}$$

The climate VA measure $\hat{\theta}_{j,-t}^{nw-w}$ represents the portion of a teacher's contribution to school climate that accrues specifically to students of color. We refer to this as a measure of teachers' effects on inclusive school climate.

4. Estimating the Effects of Climate VA on Student Outcomes

To investigate how teacher effects on school climate are related to student outcomes (including test scores, behavioral outcomes, and survey responses), we regress a given student outcome on teacher survey VA and school-grade-year or track-year fixed effects (α_{st}):

$$Y_{ijst} = X_{it}\beta + \hat{\theta}_{j,-t}\,\delta + \alpha_{st} + \epsilon_{ijt} \tag{6}$$

In Eq. (6), the coefficient on teacher survey VA, δ, identifies the effect of measured teaching quality on student outcome Y_{ijst} using variation within school-grade-subject-year (or school-track-subject-year) cells, which removes any variation due to overall school climate. We follow Jackson (2014) and define tracks using the 10 most common courses in each grade and honors status in math and ELA classes. We supplement the track assignment indicators with indicators for other common courses that signal information about student track, particularly in middle school (Backes et al., 2022). These include art electives, advanced foreign language courses, advanced math courses, supplemental or tutorial courses, and English as a second language courses. The control vector X_{it} includes prior-year test scores in math and ELA, participation in special education programs, student gender and race/ethnicity, FRL participation, and classroom means of each of these variables.

The key identifying assumption embedded in Eq. (6) is that teacher climate VA is conditionally independent of student unobservables given the control vector X_{it} and indicators for school cohort (or cohort and track). As Bacher-Hicks et al. (2019) note, one problem that arises with student survey data is that observable characteristics, such as prior test scores, predict little of the variation in student perceptions of school climate. For instance, the within-cohort R^2 in Eq. (6) using the VOCAL survey responses as an outcome and X_{it} as the control vector is only 0.01. One may therefore be concerned about the conditional independence assumption, particularly when survey responses are included as the dependent variable. Given the timeline of survey implementation, we cannot control for students' prior survey responses in Eq. (6). We therefore incorporate two additional research designs to mitigate concerns that within-school sorting of students to teachers explains our results.

The first way we address teacher-student matching concerns is to identify schools that appear not to intentionally sort students to classrooms based on their overall perceptions of school climate. We wish to avoid the possibility that schools assign students with similar dispositions toward school climate to the same classroom such that we attribute artifacts of student assignment policies to individual teachers. Because the student characteristics we do observe poorly predict school climate perceptions, the traditional value-added approach may not be sufficient to properly adjust for student unobservables without controls for prior survey responses. Thus, we identify schools where students' observations about school climate in *the other year* for which we have VOCAL data do not systematically vary across classrooms. The assumption here is that if principals are not sorting students to classrooms based on their responses in the other year, then they likely are not sorting students to classrooms based on factors that we cannot observe that would influence their ratings of the school climate in the current year. We follow Ishii and Rivkin (2009) and Clotfelter et al. (2006) and test for sorting based on a statistical test of the comparability of prior survey responses across classrooms.

Because tracking is more common in middle and high school, we condition all tests of sorting on the school track. That is, we test a regression of student outcomes on classroom fixed effects against a restricted model with only school-track-year effects. Formally, for outcome k, we conduct an F-test of the classroom fixed effects in the regression

$$A_{icslt,k} = \alpha_{c,k} + \alpha_{slt,k} + \epsilon_{icslt,k} \tag{7}$$

We do not have prior-year survey measures for most of the students in our analytical sample; thus, we use a sample of students with class assignments and a survey measure in either the prior or the next school year. In particular, we use a sample of students in grades 5, 6, 9, and 11 during the 2019 school year or grades 4, 7, and 9 during the 2017 and 2018 school years. For the 2019 sample, the outcomes is the student's prior-year survey score. For the 2017 and 2018 samples, we replace the prior-year survey score with the next-year survey score.

Because standard tests of statistical significance are likely to generate higher rejection rates in larger schools, we use a randomization inference procedure to generate the low-sorting sample. We draw 200 iterations of the data and reshuffle classroom assignments within school, grade, subject, and year for each iteration. We use the distribution of the test statistics over this simulated data to generate p-values for each school. We retain schools where the observed student assignments exhibit less sorting than the 80th percentile test statistic. We show the empirical distribution of p-values in Figure 2. As the figure demonstrates, there are many schools with clear sorting of students to classrooms (those with p-values near 0) and many with only one classroom per cohort (those with p-values of 1). But the distribution is relatively uniform for schools with p-values above 0.2, which comprises our low-sorting sample.

We provide an initial assessment of this research design in Table 4. We show the relationship between lagged student outcomes and teacher climate VA conditional on school (or track) fixed effects. For both the survey and outcomes samples, we do observe some evidence of sorting within school and grade by climate VA. In the survey sample, climate VA is associated with prior achievement and suspensions conditional on student track. A one SD increase in climate VA is associated with lower prior math and ELA scores by about 0.01 SD and 0.2% more prior suspensions. The results are similar in the 2012–2019 sample with student outcomes. However, these relationships are weaker in the low-sorting sample, with the omnibus test failing to reject the null hypothesis in the outcomes sample.

We also implement a second research design based on the teacher switching test proposed by Chetty et al. (2014a, 2014b).[10] The specific version of the switching test proposed by Chetty et al. (2014a, 2014b) regresses annually differenced school achievement data on an average value-added measure that excludes data from those years. Given the timeline of the survey implementation, we cannot construct a leave-out measure in this way, but we can use climate VA estimated in the 2018 and 2019 school years to "predict" student outcomes in 2017 and earlier. Using data from these years, we instrument teacher climate VA with the school-grade-year mean in regressions with school-subject-grade and subject-grade-year fixed effects:

$$\hat{\theta}_{j,-t} = X_{it}\pi + \bar{\theta}_{sg,-t}\,\xi + \nu_{sg} + \nu_{gt} + \eta_{ijsgt} \tag{8}$$

$$Y_{ijsgt} = X_{it}\beta + \hat{\theta}_{j,-t}\,\delta + \alpha_{sg} + \alpha_{gt} + \epsilon_{ijsgt}$$

[10] The teacher switching design incorporates changes in assignments within schools (across grades) and across schools. For the instrument exclusion restriction to hold, the change in average climate value added must be correlated with changes in climate only through the effects of individual teachers. Correlated errors in the surveys at the school level are one potential violation of this research design (e.g., all students in a school systematically report superior climate in one school year). For this reason, the switching design typically excludes all data outside the differencing window to estimate teacher value added. In theory, one could use climate value added from 2018 for school switchers as an instrument for 2019 teacher assignments since the out-of-school estimate should be uncorrelated with the change in school-level climate. However, there are few school switchers between 2018 and 2019, which is insufficient to use the switching design to validate estimates of climate value added.

The empirical Bayes estimates are constant for each teacher prior to 2018, so the only variation in the instrument $\bar{\theta}_{sg,-t}$ comes from teachers entering or leaving the school-grade assignment. Thus, the research design exploits teacher turnover to estimate the effects of climate VA on out-of-sample student outcomes.

5. Teacher Effects on School Climate

5.1 Variability of Estimated Teacher Effects

We present estimates of the variability of teacher effects on the survey outcomes in Table 5. We follow Kane and Staiger (2008) and estimate the SD of teacher effects as the square root of the covariance between average residuals in consecutive years. We also test the hypothesis that the teacher effects are jointly zero using the regression approach suggested by Jackson (2014).[11] In the baseline model without school effects, we estimate that one SD in teacher survey VA corresponds to about 0.09 SDs on the survey measure; the estimate with school-by-year effects included in the model is 0.08 SDs. The teacher effects are jointly significant in both cases. Overall, the variability in teacher climate VA is similar to what has been reported for teacher VA to student tests (e.g., Chetty et al., 2014a), nontest outcomes (Jackson, 2018), and survey and other socio-emotional measures (Blazar & Kraft, 2017; Kraft, 2019).

To better understand the relationship between climate VA and other dimensions of teaching effectiveness, we estimate teacher VA to math and ELA test scores (test VA) and to a nontest composite of absences, suspensions, and grade progression (nontest VA).[12] We then estimate correlations between climate and the other VA estimates. As before, we use the year-to-

[11] In particular, at the teacher level, we regress mean residuals in 2019 on mean residuals in 2018.
[12] We estimate test and nontest value added using the same approach as described for climate value added in Subsection 3.4. For full details, see Backes et al. (2022). The nontest index is constructed using a factor model with the three outcomes. The factor model suggests a single behavioral factor, which we use as the dependent variable.

year covariance in each measure as an estimate of the variability of the teacher effect and the covariance in mean residuals across both years and outcomes to estimate the covariance between different teaching skills. We estimate a correlation of about 0.20–0.25 between test and climate VA. This correlation is slightly lower than the average of about 0.4 reported by Mihaly et al. (2013) using the Tripod survey.[13] We estimate that climate VA is correlated with nontest VA at about 0.10. The correlation between climate VA and nontest VA is not statistically significant; however, we show in Section 6 that these relationships are significant when estimated on a larger sample of student outcomes data.

In Table 6, we present estimates of the correlation in teacher climate VA across student racial/ethnic groups. We construct these correlations similarly to the way that we construct those above, using covariances in mean climate residuals across school years. That is, we estimate the stable covariance in teacher effects across groups as the covariance in estimates of the group-specific climate VA in different school years. Teachers who improve climate outcomes tend to do so for all students: The correlation in overall teacher climate VA for white students and students of color is 0.70. This is on the high end of the range of correlations in test VA for white and Black students documented by Delgado (2021) and similar to those estimated for English learners and non-English learners by Loeb et al. (2014).

In the remaining rows, we explore teacher effects on each of the dimensions of school climate to better understand the sources of difference in teacher effects for white students and students of color. We repeat the estimation process using each of the topic scores, omitting the physical safety topic, for which we do not find statistically significant teacher effects. The lowest

[13] The VA model described in Eq. (2) is somewhat different than that estimated by Mihaly et al. (2013) in that it includes controls for overall school climate (the leave-out climate means). Using a specification more similar to theirs yields an almost identical estimate of 0.4 for the correlation between climate and test VA.

correlations across racial/ethnic groups are for teacher effects on cultural and linguistic competency (0.47), participation (0.56), and emotional safety (0.61). Notably, these topics align with several factors identified in the empirical and theoretical literatures on culturally responsive teaching practices.

5.2 Teacher Characteristics and Climate VA

We next provide some descriptive evidence on the relationships between teacher characteristics and learning climate as perceived by students. We estimate a modified version of Eq. (1) replacing the individual teacher effects with a vector of teacher characteristics, including experience, licensure pathway, birth cohort, and an indicator for student-teacher racial or ethnic matching. These results are shown in Table 7.

We find that student-teacher racial/ethnic matching improves students' perceptions of learning climate. We estimate that matches improve school climate perceptions by about 0.03–0.04 SDs. To put this effect size in context, it is approximately 50% of the within-classroom discrepancy in climate reports between white and Black students (see Table 3). The match effect is most pronounced for Black students in our sample, whose reports of climate are about 0.06–0.07 SDs higher when they have a Black teacher; estimated coefficients for other groups in our sample are generally not significant.

As is the case with other student outcomes, teacher experience predicts student perception of school climate. Students in classrooms with teachers with 1–3 years of experience report better school climate by about 0.02 SDs than the omitted groups, which is novice teachers with no prior teaching experience. In the cross section, more experienced teachers are slightly more effective than early career teachers: Those with 7–9 years of experience are about 0.03 SDs more effective at improving climate than novices.

We also find some evidence that teacher age predicts climate, even controlling for teacher experience. Holding teaching experience equal, teachers in more recent birth cohorts tend to have higher climate VA than their older counterparts. Relative to teachers born before 1960 and controlling for teacher experience, teachers born in the 1960s have higher climate responses by about 0.03 SDs, and teachers born between the 1970s and the 1990s have higher climate responses by about 0.04–0.05 SDs. By contrast, there is little evidence that licensure pathway or licensure tests predict climate VA.

6. Results

A few studies have used student surveys to assess engagement, instructional effectiveness, or school climate, but there is less evidence on using these measures as a source of information on teacher effectiveness. Thus, we begin by demonstrating that climate VA does predict within-school variation in students' perceptions of school climate and then explore how climate VA contributes to other student outcomes.

6.1 Climate VA and Student Survey Responses

We begin by assessing the relationship between climate VA and student perceptions of school climate. We show several results that, taken together, suggest that estimated VA reflects teachers' contributions to school climate rather than school-level factors or student sorting. In Table 8, we show the coefficients on the standardized climate VA measure from a regression of the overall climate index (Panel A) or the individual survey topics (Panel B). Recall that we estimate one SD in teacher effects on school climate corresponds to about 0.09 SDs on the climate measure. The results in Panel A are similar. We estimate that one SD improvement in climate VA improves student perceptions of climate by about 0.11 SDs. In Panel B, we show that a one SD improvement in climate VA has an average effect of about 0.08 SDs across the nine topics of the VOCAL Survey. This is reassuring as the estimated variation in school climate effects reported in Table 5 is based on the year-to-year covariance in the estimated value-added measures, while the reports in Table 8 are based on differences in teacher assignments for students in the same school cohort. If the estimated teacher climate VA measures only reflect general school climate, then within-cohort variation in the predicted teacher effects should be unrelated to students' perceptions of school climate. The fact that they do predict student perceptions—and that the magnitude of this relationship matches the estimated variance in the effects of teachers on climate—suggests that the results are driven by teachers and not general school factors.

In addition, the estimated coefficients on climate VA are similar without student controls (column 1) and when we restrict the sample to low-sorting school tracks (columns 4 and 5). If climate VA were substantially biased by the systematic assignment of students with better views on school climate to particular teachers, we would expect to see weaker relationships between climate VA and student perceptions in schools with weaker evidence of sorting students to classrooms based on out-of-sample reports of school climate. This is not what we observe. The coefficients in columns 4 and 5 are similar to, or slightly larger than, those in columns 1–3.

In the remaining panels, we separate the effects by grade level. As might be expected, the effect of teachers on school climate is larger in elementary classrooms, which are usually self-contained. In Panel C, we show that one SD in climate VA improves student reports of climate by 0.19–0.21 SDs. In Panel D, we repeat the exercise for students in grades 8 and 10, which are almost always departmentalized. In these grades, a one SD increase in the climate VA measure improves student reports of climate by about 0.07 SDs.

In Figure 3, we break out the effects of teacher climate VA by topic and show that estimated effects of climate VA are generally larger on topics more closely aligned to instruction or relationships with individual teachers. The results are organized by the three dimensions. The effects of teacher climate VA are larger on the environmental and engagement domains, which include more questions aligned to the classroom environment and relationships with school personnel, than the safety domain, which includes more topics related to overall school climate. Among the individual topics, we estimate the largest effects of teacher climate VA on relationships with school personnel, classroom participation, the instructional environment, and emotional safety. A one SD increase in teacher climate VA is associated with about 0.07–0.08 SDs in each of these topic scores. On the other hand, climate VA has the smallest effect on physical safety and bullying (0.03–0.04 SDs). We view these patterns as consistent with the interpretation that climate VA captures teacher contributions to climate.

6.2 Climate VA and Student Academic Outcomes

In this subsection, we describe the relationship between climate VA and a variety of student outcomes. In Table 9, we use a sample of students in 2012–2019 to estimate the effects of climate VA on a range of other academic outcomes.[14] Each row of Table 9 displays the coefficient on climate VA for a different student outcome. We vary the specifications across columns of the table.

In the first panel, we show results for the set of outcomes available for students in all grades. We estimate that a one SD increase in climate VA improves test scores by about 0.02 SDs. The relationship between climate VA and student learning is similar in magnitude to the effects of teacher content knowledge as measured by licensure tests (Clotfelter et al., 2006;

[14] The two samples are generally similar, although the outcomes sample is slightly less diverse in terms of English proficiency and student race/ethnicity.

Cowan et al., 2020). A one SD improvement in climate VA is also comparable to about 30%–50% of the improvement in teaching effectiveness between the first and second year of teaching (Papay & Kraft, 2015; Wiswal, 2013). The results are little changed with the inclusion of track fixed effects in place of school-grade-subject-year effects (column 2) or the sample of students who appear to be randomly sorted across classrooms based on previous climate perceptions (column 3). Because we use data from 2012–2019 to estimate these regressions using climate VA from 2018–2019, and because teaching effectiveness varies with experience and over time (Chetty et al., 2014a; Goldhaber & Hansen, 2013), we re-estimate each of these models with controls for teacher experience in columns 4–6. The results are nearly identical. Finally, in column 7, we instrument climate VA with the mean in the school-grade-subject-year cell following Jackson (2018) to identify the effects of teachers through changes in school personnel. The estimated effect is almost identical to the estimates from the selection on observables designs, but it is less precise and not statistically significant.

To assess the relationships between climate VA and other nontest student outcomes, we aggregate three nontest outcomes—absences, suspensions, and grade retention—into a single nontest index and then regress this index on climate VA and other controls.[15] Climate VA improves student performance on the aggregate index by about 0.003–0.006 SDs. The estimated effect from the switching design in column 7 is not statistically significant, but the point estimate (0.012) is consistent with the effects in the other columns. In the remaining rows, we consider the effects on the nontest outcomes separately. We see that contributions come primarily by effects on absences (about a 0.3%–0.5% reduction per SD of climate VA) and days suspended (0.1% reduction per SD of climate VA). In Panel B, we limit the sample to students in grades 8

[15] Prior research has shown that teacher effects on these measures explain a variety of long-run student academic outcomes (Backes et al., 2022; Jackson, 2018; Liu & Loeb, 2021).

and 10 with information about class grades and grade point average. Teacher climate VA improves overall GPA by about 0.01–0.02 points and the course grade by about 0.04–0.06 points.

6.3 Group-Specific Climate VA and Student Outcomes

In Table 10, we use the group-specific climate VA measures estimated in Section 4. In Panel A, we regress the climate responses on the VA measure constructed using responses from white students ("Climate VA, white students") and the difference between climate VA for students of color and climate VA for white students ("ΔClimate VA"). We focus on the coefficient on ΔClimate VA, which provides an estimate of the effect of teacher contributions on inclusive climate. We standardize this measure so that the coefficient is interpretable as the effect of a one SD increase in the difference between climate for students of color and climate for white students. As the regressions additionally include the climate VA measure for white students, the estimated coefficients have a ceteris paribus interpretation. We estimate each of these regressions separately for white students (columns 1–3) and students of color (columns 4–6). We find that teachers who improve climate for students of color tend to promote better climate for all students: The coefficient on the inclusive climate measure is 0.05 SDs and statistically significant. However, the effect is significantly larger for students of color. We estimate that improvements in the inclusive climate measure improves reports of school climate by about 0.09–0.12 SDs.

In the remaining panels, we assess whether teachers with higher climate VA reduce disparities in educational outcomes. We find little evidence that the general climate VA measure has larger effects for students of color: The coefficient in both samples is about 0.02, which is similar to that reported for the overall climate VA in Table 9. However, we find that teachers identified by students of color as contributing to positive school climate also reduce disparities in educational outcomes between students of color and white students. The estimated effect of the inclusive climate VA measure on test scores is close to zero and statistically insignificant for white students, but 0.02 for students of color. This finding, which suggests that teachers who promote an inclusive climate do not have deleterious effects on white students, is consistent with the extensive literature on student-teacher racial matching. We do not find similar results using the nontest index. The point estimates are small and statistically insignificant. Thus, it does appear that the differential information about school climate provided by students of color predicts larger-than-expected improvements in learning outcomes, at least on standardized tests.

7. Discussion

In this paper, we demonstrate three empirical patterns related to teacher effects on the school climate. First, teachers affect students' perceptions of the school climate, and teachers who contribute more to the school learning environment also have positive effects on student achievement and engagement. We estimate that one SD in climate VA corresponds to about 0.1 SDs on the climate survey scale and about 0.02 SDs in student test scores. We further show that assignment to teachers with higher VA to climate improves student perceptions within schools and cohorts and that effects are comparable in schools that do not make classroom assignments based on students' perceptions of the learning environment in other years. These patterns strongly suggest that climate VA captures teacher effects on the environment and not general school climate factors or nonrandom student-teacher sorting.

This finding is broadly consistent with a lengthy literature emphasizing the importance of school climate in improving student academic outcomes (Thapa et al., 2013). It also builds on an empirical literature investigating teachers' contributions to school climate or other student perception data (Bacher-Hicks et al., 2014; Blazar & Kraft, 2017; Ferguson & Danielson, 2015;

Kane et al., 2013; Rowley et al., 2019). As with prior work, we find that teachers do matter in terms of students' perceptions of their learning environment, and teachers who positively influence school climate also tend to have positive effects on other student outcomes. The variability of estimated teacher effects on climate in this study is similar to that reported in prior work using different survey instruments (Blazar & Kraft, 2017; Mihaly et al., 2013). In contrast to the findings in Bacher-Hicks et al. (2014), we also find that climate data provides information on teaching effectiveness, although with careful consideration of the contributions of others in the school community.

Second, we show that perceptions of school climate are not uniform for all students. Students of color have significantly lower perceptions of the cultural competency of teachers and other school faculty. These differences are most pronounced for Black students, particularly in middle and high school, and appear even when we compare students within the same classroom. Black students additionally report worse experiences on topics aligned to student-teacher relationships, bullying, and mental health outcomes. Similar findings have been reported in the extensive literature on school climate (Thapa et al., 2013).

Our contribution in this paper is to show that differences in student perceptions of climate are at least partially mediated by teachers. Teachers who improve school climate tend to do so for all students: The correlation in reports of climate VA for the same teacher by white students and students of color is about 0.7. But there are differences in the perceptions of the same teacher by student race/ethnicity, and teachers whose students of color report better school climate in one year also have higher reports of school climate among students of color in other years. This finding, which is consistent with evidence from test scores for Black students and English learners (Delgado, 2021; Loeb et al., 2014), provides some evidence of culturally responsive teaching as a distinct skill. In our study, students' reports of climate VA exhibit the weakest correlations on topics aligned with cultural representation, holding high expectations for all students, encouraging participation in the classroom and school community, and providing emotional support to students. These skills may be important components of culturally responsive teaching. And the findings are consistent with evidence that teacher skills and preparation are important mechanisms to explain demographic matching effects on outcomes for students of color (Edmonds, 2022).

Finally, we provide evidence that these teaching skills have an impact on student success: Assignment to a teacher rated more highly by students of color improves their test scores in addition to their perceptions of school climate. A one SD improvement in the inclusive climate measure improves test scores for students of color by about 0.02 SDs but does not affect achievement for white students or nontest outcomes. Taken together, our findings suggest that teachers contribute to the school climate, that students respond to these contributions, and that they have consequences for student achievement. We also find that these skills overlap with culturally responsive instruction. Teachers' ability to engage students in coursework, hold high expectations for all students, and form supportive relationships contribute to academic achievement for students of color.

References

Alesina, A., Carlana, M., La Ferrara, E., & Pinotti, P. (2018). *Revealing stereotypes: Evidence from immigrants in schools* (No. 25333). National Bureau of Economic Research.

Altonji, J. G., & Mansfield, R. K. (2018). Estimating Group Effects Using Averages of Observables to Control for Sorting on Unobservables: School and Neighborhood Effects. *American Economic Review*, *108*(10), 2902–2946. https://doi.org/10.1257/aer.20141708

Anyon, Y., Nicotera, N., & Veeh, C. A. (2016). Contextual Influences on the Implementation of a Schoolwide Intervention to Promote Students' Social, Emotional, and Academic Learning. *Children & Schools*, *38*(2), 81–88. https://doi.org/10.1093/cs/cdw008

Bacher-Hicks, A., Billings, S., & Deming, D. (2019). *The school to prison pipeline: Long-run impacts of school suspensions on adult crime* (No. w26257). National Bureau of Economic Research. https://doi.org/10.3386/w26257

Bacher-Hicks, A., Kane, T., & Staiger, D. (2014). *Validating teacher effect estimates using changes in teacher assignments in Los Angeles* (No. w20657). National Bureau of Economic Research. https://doi.org/10.3386/w20657

Backes, B., Cowan, J., Goldhaber, D., & Theobald, R. (2022). *Teachers and Students' Postsecondary Outcomes: Testing the Predictive Power of Test and Nontest Teacher Quality Measures* (CALDER Working Paper No. 270–1022). National Center for the Analysis of Longitudinal Data in Education Research. https://caldercenter.org/publications/teachers-and-students%E2%80%99-postsecondary-outcomes-testing-predictive-power-test-and-nontest

Backes, B., & Hansen, M. (2018). The impact of Teach for America on non-test academic outcomes. *Education Finance and Policy, 13*(2), 168–193. https://doi.org/10.1162/edfp_a_00231

Banks, J. A. (2004). Multicultural education: Historical development, dimensions, and practice. In J. A. Banks & McGee Banks, C. A. (Eds), *Handbook of research on multicultural education*.

Barrett, N., McEachin, A., Mills, J. N., & Valant, J. (2021). Disparities and discrimination in student discipline by race and family income. *Journal of Human Resources, 56*(3), 711–748. https://doi.org/10.3368/jhr.56.3.0118-9267R2

Battistich, V., Solomon, D., Watson, M., & Schaps, E. (1997). Caring school communities. *Educational Psychologist, 32*(3), 137–151.

Blazar, D. (2021). *Teachers of Color, Culturally Responsive Teaching, and Student Outcomes: Experimental Evidence from the Random Assignment of Teachers to Classes*. Annenberg Institute at Brown University. https://www.edworkingpapers.com/ai21-501

Blazar, D., & Pollard, C. (2022). *Challenges and Tradeoffs of "Good" Teaching: The Pursuit of Multiple Educational Outcomes* (No. 22–591; EdWorkingPaper). Anenberg Institute at Brown University. https://www.edworkingpapers.com/ai22-591

Blazar, D., & Kraft, M. A. (2017). Teacher and teaching effects on students' attitudes and behaviors. *Educational Evaluation and Policy Analysis*, *39*(1), 146–170.

Brookover, W. B., Schweitzer, J. H., Schneider, J. M., Beady, C. H., Flood, P. K., & Wisenbaker, J. M. (1978). Elementary school social climate and school achievement. *American Educational Research Journal, 15*(2), 301–318. https://doi.org/10.3102/00028312015002301

Carlana, M. (2019). Implicit stereotypes: Evidence from teachers' gender bias. *The Quarterly Journal of Economics, 134*(3), 1163–1224. https://doi.org/10.1093/qje/qjz008

Chaplin, D., Gill, B., Thompkins, A., & Miller, H. (2014). *Professional practice, student surveys, and value-added: Multiple measures of teacher effectiveness in the Pittsburgh Public Schools* (REL 2014–024). U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Mid-Atlantic. https://ies.ed.gov/ncee/edlabs/regions/midatlantic/pdf/REL_2014024.pdf

Chetty, R., Friedman, J. N., & Rockoff, J. E. (2014a). Measuring the impacts of teachers I: Evaluating bias in teacher value-added estimates. *American Economic Review, 104*(9), 2593–2632. https://doi.org/10.1257/aer.104.9.2593

Chetty, R., Friedman, J. N., & Rockoff, J. E. (2014b). Measuring the impacts of teachers II: Teacher value-added and student outcomes in adulthood. *American Economic Review, 104*(9), 2633–2679. https://doi.org/10.1257/aer.104.9.2633

Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2006). Teacher-student matching and the assessment of teacher effectiveness. *Journal of Human Resources, 41*(4), 778–820. https://doi.org/10.3368/jhr.XLI.4.778

Cowan, J., Goldhaber, D., Jin, Z., & Theobald, R. (2020). *Teacher Licensure Tests: Barrier or Predictive Tool?* (CALDER Working Paper No. 245–1020). National Center for the Analysis of Longitudinal Data in Education Research. https://caldercenter.org/publications/teacher-licensure-tests-barrier-or-predictive-tool

Davis, H. A. (2003). Conceptualizing the role and influence of student-teacher relationships on children's social and cognitive development. *Educational Psychologist, 38*(4), 207–234.

Dee, T. S. (2004). Teachers, race, and student achievement in a randomized experiment. *The Review of Economics and Statistics, 86*(1), 195–210.

Dee, T. S. (2005). A teacher like me: Does race, ethnicity, or gender matter? *American Economic Review: Papers and Proceedings, 95*(2), 27.

Delgado, W. (2021). *Heterogeneous teacher effects, comparative advantage, and match quality: Evidence from Chicago Public Schools*. Unpublished manuscript.

Egalite, A. J., Kisida, B., & Winters, M. A. (2015). Representation in the classroom: The effect of own-race teachers on student achievement. *Economics of Education Review, 45*, 44–52. https://doi.org/10.1016/j.econedurev.2015.01.007

Evans, M. O. (1992). An estimate of race and gender role-model effects in teaching high school. *The Journal of Economic Education, 23*(3), 209–217.

Ferguson, R. F. (2003). Teachers' perceptions and expectations and the Black-White test score gap. *Urban Education, 38*(4), 460–507. https://doi.org/10.1177/0042085903038004006

Ferguson, R. F. (2015). *The Influence of Teaching Beyond Standardized Test Scores: Engagement, Mindsets, and Agency*. The Achievement Gap Initiative at Harvard University.

Ferguson, R. F. (2016). *Aiming Higher Together: Strategizing Better Educational Outcomes for Boys and Young Men of Color*. Urban Institute. https://www.urban.org/research/publication/aiming-higher-together-strategizing-better-educational-outcomes-boys-and-young-men-color

Ferguson, R. F., & Danielson, C. (2014). How framework for teaching and tripod 7Cs evidence distinguish key components of effective teaching. In T. J. Kane, K. A. Kerr, & R. C. Pianta (Eds.), *Designing teacher evaluation systems: New guidance from the measures of effective teaching project*. Jossey-Bass.

Fox, L. (2016). Seeing potential: The effects of student–teacher demographic congruence on teacher expectations and recommendations. *AERA Open, 2*(1), 233285841562375. https://doi.org/10.1177/2332858415623758

Gay, G. (2002). Preparing for culturally responsive teaching. *Journal of Teacher Education*, *53*(2)*,* 106–116. https://doi.org/10.1177/0022487102053002003

Gershenson, S. (2016). Linking teacher quality, student attendance, and student achievement. *Education Finance and Policy, 11*(2), 125–149. https://doi.org/10.1162/EDFP_a_00180

Gershenson, S., Hart, C. M. D., Hyman, J., Lindsay, C., & Papageorge, N. W. (2019). *The long-run impacts of same-race teachers*. Annenberg Institute at Brown University. https://www.edworkingpapers.com/ai19-43

Goldhaber, D., & Hansen, M. (2013). Is it Just a Bad Class? Assessing the Long-term Stability of Estimated Teacher Performance. *Economica*, *80*(319), 589–612. https://doi.org/https://doi.org/10.1111/ecca.12002

Goldhaber, D., Theobald, R., and Tien, C. (2019). Why we need a diverse teacher workforce. *Phi Delta Kappan, 100*(5), 25–30.

Hanushek, E. A., & Rivkin, S. G. (2010). Generalizations about using value-added measures of teacher quality. *American Economic Review, 100*(2), 267–271.

Harber, K. D., Gorman, J. L., Gengaro, F. P., Butisingh, S., Tsang, W., & Ouellette, R. (2012). Students' race and teachers' social support affect the positive feedback bias in public schools. *Journal of Educational Psychology, 104*(4), 1149.

Hart, C. M. D. (2020). An honors teacher like me: Effects of access to same-race teachers on black students' advanced-track enrollment and performance. *Educational Evaluation and Policy Analysis*, *42*(2), 163–187. https://doi.org/10.3102/0162373719898470

Hess, F. M., & Leal, D. L. (1997). Minority teachers, minority students, and college matriculation: A new look at the role-modeling hypothesis. *Policy Studies Journal, 25*(2), 235–248.

Holt, S. B., & Gershenson, S. (2019). The impact of demographic representation on absences and suspensions. *Policy Studies Journal*, *47*(4), 1069–1099. https://doi.org/10.1111/psj.12229

Ishii, J., & Rivkin, S. G. (2009). Impediments to the estimation of teacher value added. *Education Finance and Policy, 4*(4), 520–536. https://doi.org/10.1162/edfp.2009.4.4.520

Jackson, C. K. (2014). Teacher quality at the high school level: The importance of accounting for tracks. *Journal of Labor Economics, 32*(4), 645–684. https://doi.org/10.1086/676017

Jackson, C. K. (2018). What do test scores miss? The importance of teacher effects on non–test score outcomes. *Journal of Political Economy, 126*(5), 2072–2107.

Johnson, D. W. (1981). Student-student interaction: The neglected variable in education. *Educational Researcher, 10*(1), 5–10. https://doi.org/10.3102/0013189X010001005

Kane, T., McCaffrey, D., Miller, T., & Staiger, D. (2013). *Have we identified effective teachers? Validating measures of effective teaching using random assignment.* Bill & Melinda Gates Foundation.

Kane, T., & Staiger, D. (2008). *Estimating teacher impacts on student achievement: An experimental evaluation* (No. w14607). National Bureau of Economic Research. https://doi.org/10.3386/w14607

Kane, T. J., Taylor, E. S., Tyler, J. H., & Wooten, A. L. (2011). Identifying Effective Classroom Practices Using Student Achievement Data. *Journal of Human Resources*, *46*(3), 587–613.

Koedel, C., Mihaly, K., & Rockoff, J. E. (2015). Value-added modeling: A review. *Economics of Education Review*, *47*, 180–195. https://doi.org/10.1016/j.econedurev.2015.01.006

Kraft, M. A. (2019). Teacher effects on complex cognitive skills and social-emotional competencies. *Journal of Human Resources, 54*(1), 1–36.

Lindsay, C. A., & Hart, C. M. D. (2017). Exposure to same-race teachers and student disciplinary outcomes for Black students in North Carolina. *Educational Evaluation and Policy Analysis, 39*(3), 485–510. https://doi.org/10.3102/0162373717693109

Lindsay, C., Monarrez, T., & Luetmer, G. (2021). *The Effects of Teacher Diversity on Hispanic Student Achievement in Texas*. Urban Institute.

Liu, J., & Loeb, S. (2021). Engaging teachers: Measuring the impact of teachers on student attendance in secondary school. *Journal of Human Resources*, *56*(2), 343–379. https://doi.org/10.3368/jhr.56.2.1216-8430R3

Liu, J., Hayes, M. S., & Gershenson, S. (2022). *From referrals to suspensions: New evidence on racial disparities in exclusionary discipline*. Annenberg Institute at Brown University. https://doi.org/10.26300/AXVG-ZP19

Loeb, S., Soland, J., & Fox, L. (2014). Is a good teacher a good teacher for all? Comparing value-added of teachers with their English learners and non-English learners. *Educational Evaluation and Policy Analysis, 36*(4), 457–475. https://doi.org/10.3102/0162373714527788

Massachusetts Department of Elementary and Secondary Education [DESE]. (2019a). *2017 Views of Climate and Learning (VOCAL) Validity Study.* Malden, MA: Author.

Massachusetts Department of Elementary and Secondary Education [DESE]. (2019b). *2018 Views of Climate and Learning (VOCAL) Validity Study.* Malden, MA: Author.

Massachusetts Department of Elementary and Secondary Education. (2021). Views of Climate and Learning (VOCAL) survey project. https://www.doe.mass.edu/research/vocal/

Mihaly, K., McCaffrey, D. F., Staiger, D. O., & Lockwood, J. R. (2013). *A Composite Estimator of Effective Teaching*. Bill and Melinda Gates Foundation.

Miller, D. L., Shenhav, N., & Grosz, M. Z. (2019). *Selection into Identification in Fixed Effects Models, with Application to Head Start* (NBER Working Paper No. 26174). National Bureau of Economic Research. https://doi.org/10.3386/w26174

Mulhern, C., & Opper, I. M. (2022). *Measuring and Summarizing the Multiple Dimensions of Teacher Effectiveness* (EdWorkingPaper No. 21–451). Annenberg Institute at Brown University. https://www.edworkingpapers.com/ai21-451

Oates, G. L. S. C. (2003). Teacher-student racial congruence, teacher perceptions, and test performance. *Social Science Quarterly, 84*(3), 508–525.

Papageorge, N. W., Gershenson, S., & Kang, K. M. (2019). Teacher Expectations Matter. *The Review of Economics and Statistics*, *102*(2), 234–251. https://doi.org/10.1162/rest_a_00838

Papay, J. P., & Kraft, M. A. (2015). Productivity returns to experience in the teacher labor market: Methodological challenges and new evidence on long-term career improvement. *Journal of Public Economics*, *130*, 105–119. https://doi.org/10.1016/j.jpubeco.2015.02.008

Raudenbush, S. W., & Jean, M. (2015). To What Extent Do Student Perceptions of Classroom Quality Predict Teacher Value Added. In T. J. Kane, K. A. Kerr, & R. C. Pianta (Eds.), *Designing Teacher Evaluation Systems* (pp. 170–202). John Wiley & Sons, Inc. https://doi.org/10.1002/9781119210856.ch6

Rose, E. K., Schellenberg, J. T., & Shem-Tov, Y. (2022). *The Effects of Teacher Quality on Adult Criminal Justice Contact* (NBER Working Paper No. w30274). National Bureau of Economic Research.

Rowley, J. F. S., Phillips, S. F., & Ferguson, R. F. (2019). The stability of student ratings of teacher instructional practice: Examining the one-year stability of the 7Cs composite. *School Effectiveness and School Improvement, 30*(4), 549–562. https://doi.org/10.1080/09243453.2019.1620293

Saft, E. W., & Pianta, R. C. (2001). Teachers' perceptions of their relationships with students: Effects of child age, gender, and ethnicity of teachers and children. *School Psychology Quarterly, 16*(2), 125–141. https://doi.org/10.1521/scpq.16.2.125.18698

Shi, Y., & Zhu, M. (2021a). *"Model minorities" in the classroom? Positive evaluation bias towards Asian students and its consequences*. Unpublished manuscript.

Shi, Y., & Zhu, M. (2021b). *Equal time for equal crime? Racial bias in school discipline*. Annenberg Institute at Brown University. https://www.edworkingpapers.com/ai21-383

Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African Americans. *Journal of Personality and Social Psychology, 69*(5), 797.

Stepner, M. (2013). VAM: Stata module to compute teacher value-added measures.

Thapa, A., Cohen, J., Guffey, S., & Higgins-D'Alessandro, A. (2013). A review of school climate research. *Review of Educational Research, 83*(3), 357–385. https://doi.org/10.3102/0034654313483907

Thomas, S., & Oldfather, P. (1997). Intrinsic motivations, literacy, and assessment practices: "That's my grade. That's me." *Educational Psychologist, 32*(2), 107–123.

Viano, S., & Baker, D. J. (2020). How administrative data collection and analysis can better reflect racial and ethnic identities. *Review of Research in Education, 44*(1), 301–331. https://doi.org/10.3102/0091732X20903321

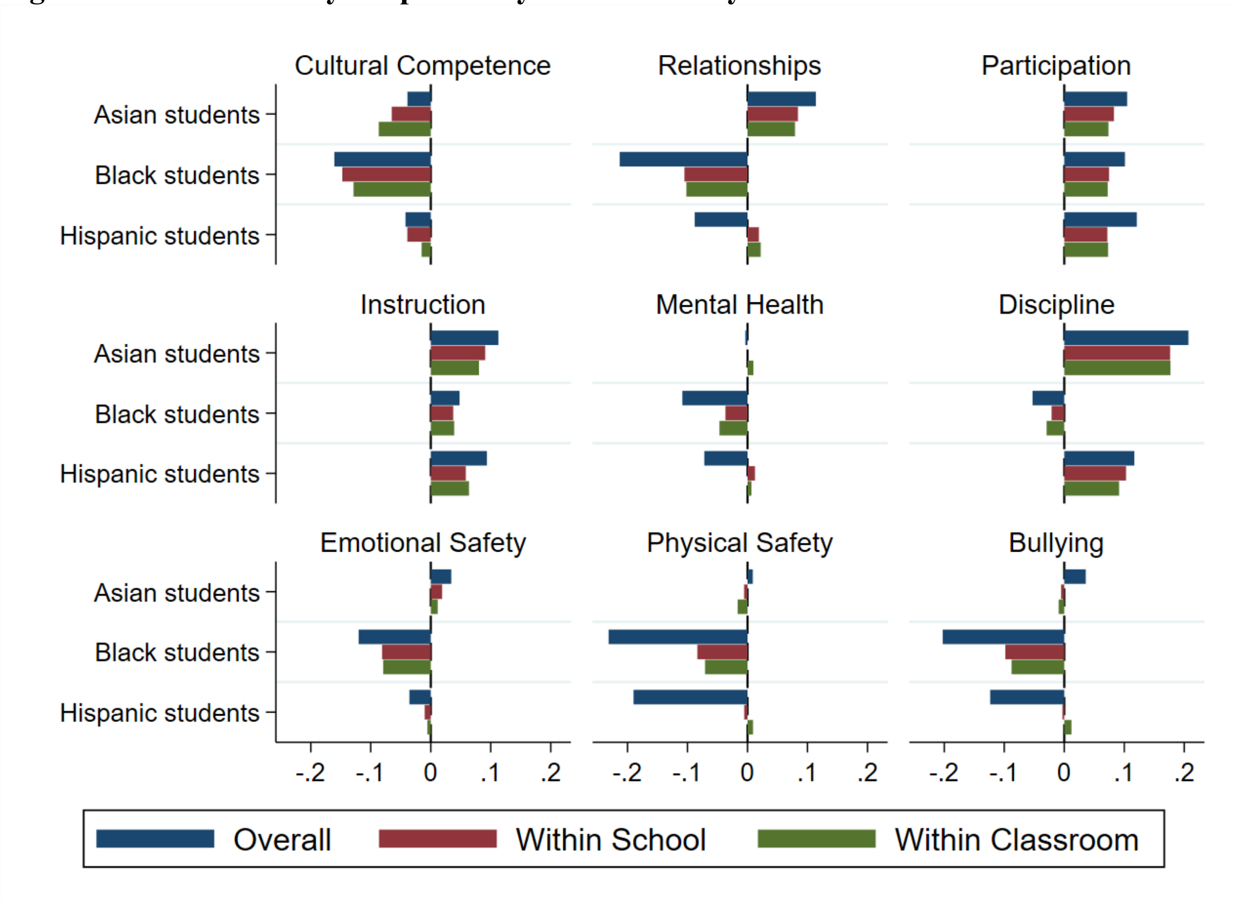
Voight, A., Hanson, T., O'Malley, M., & Adekanye, L. (2015). The Racial School Climate Gap: Within-School Disparities in Students' Experiences of Safety, Support, and Connectedness. *American Journal of Community Psychology*, *56*(3–4), 252–267. https://doi.org/10.1007/s10464-015-9751-x

Wiswall, M. (2013). The dynamics of teacher quality. *Journal of Public Economics*, *100*, 61–78. https://doi.org/10.1016/j.jpubeco.2013.01.006

Wood, W. J., Lai, I., Filosa, N. R., Imberman, S. A., Jones, N. D., & Strunk, K. O. (2022). *Are effective teachers for students with disabilities effective teachers for all?* (Working Paper No. 30212). National Bureau of Economic Research. https://doi.org/10.3386/w30212

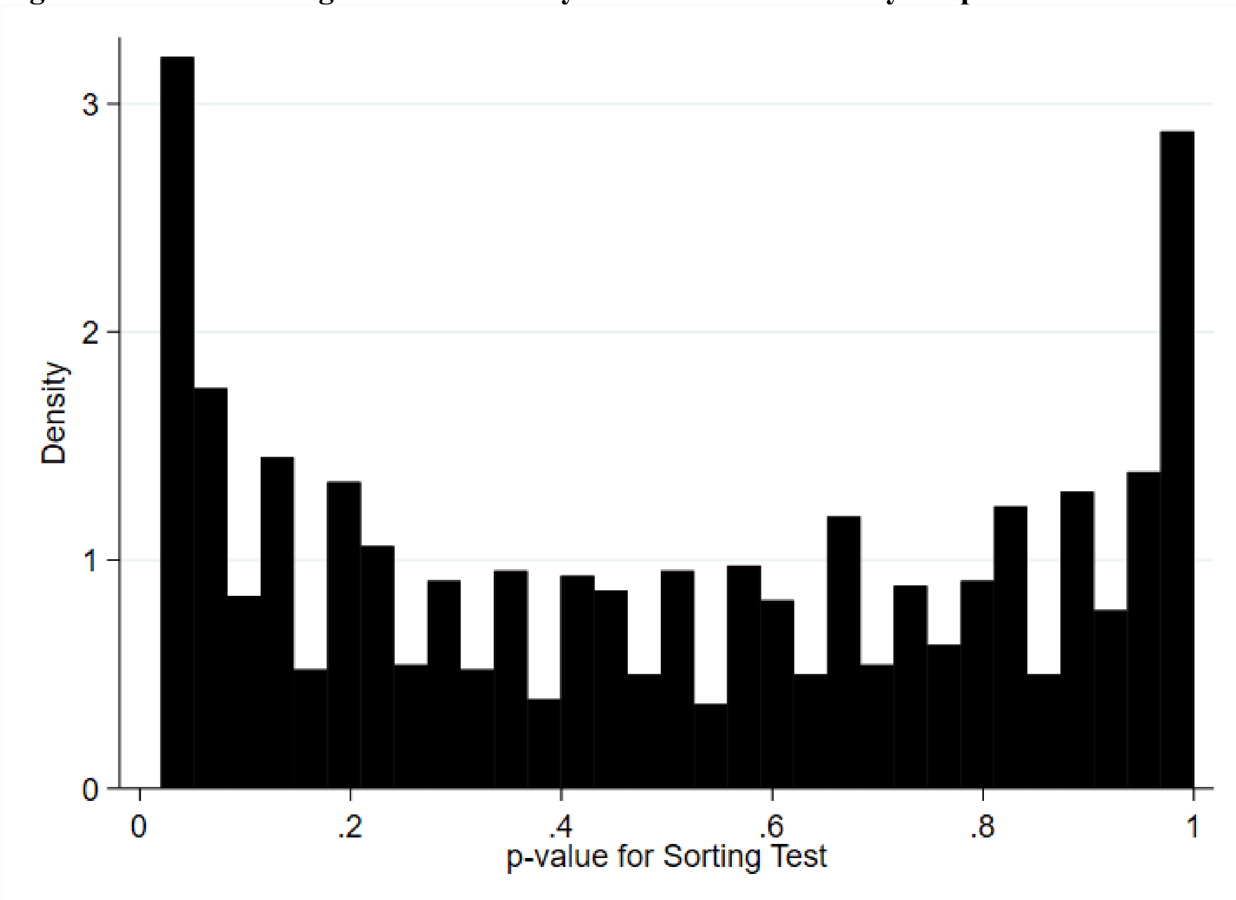
Tables and Figures

Figure 1. Student Survey Responses by Race/Ethnicity



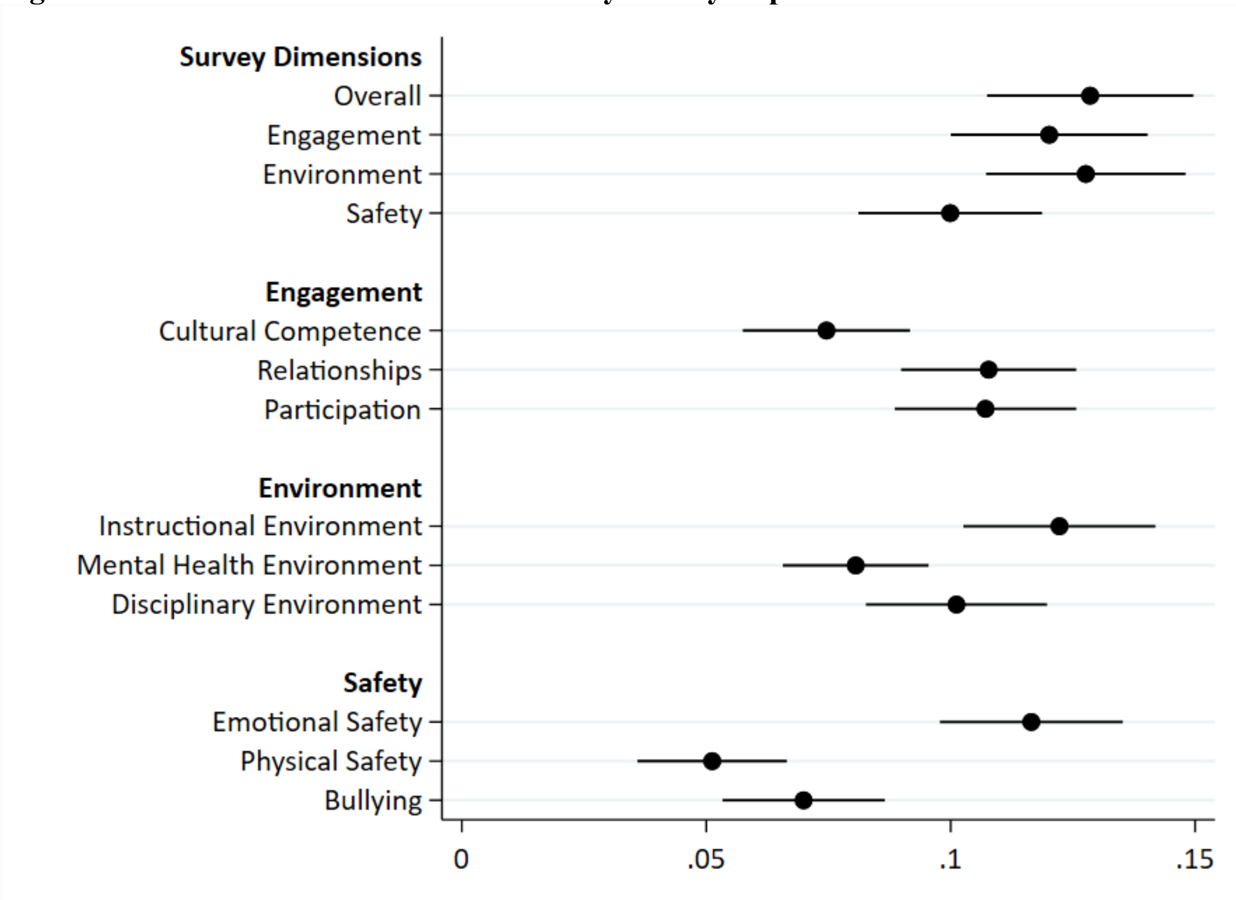
Notes: Coefficients on student race/ethnicity from specified regressions. The baseline regression includes subject-by-grade-by-year fixed effects. The "within school" model includes school-by-subject-by-grade-by-year fixed effects. The "within classroom" model includes classroom-by-subject fixed effects. 95% confidence intervals constructed from standard errors clustered by teacher and student.

Figure 2. Test of Sorting to Classrooms by Prior or Future Survey Responses



Notes: Histogram of randomization based *p*-values from test of sorting by prior (or future) climate responses to classrooms within academic tracks. The test statistics are constructed from F-tests of a model including classroom-by-characteristic and school-by-track-by-year-by-characteristic fixed effects against the restricted model, including only school-by-track-by-year-by-characteristic effects after a simulation procedure that randomly reassigns students to classrooms within school, grade, subject, and year. Schools with $p > 0.20$ are retained in the low-sorting sample.

Figure 3. Estimated Effects of Climate VA by Survey Topic



Notes: Coefficients on climate value added from regressions using survey topic scores as dependent variable. Regressions include student characteristics and track-school-year fixed effects. 95% confidence intervals constructed from standard errors clustered by teacher and student.

Table 1. Views of Climate and Learning (VOCAL) Survey Dimensions and Topics

Dimension	Topic	Description
Engagement	Cultural Competence	The extent that students feel adults/students value diversity, manage dynamics of differences, and avoid stereotypes.
	Relationships	The extent that students feel there is a social connection and respect between staff/teachers and students, and between students and their peers.
	Participation	The extent that students feel engaged intellectually, emotionally, and behaviorally in the classroom, and the extent that students or their parents are engaged in school life.
Safety	Emotional Safety	The extent that students feel a bond to the school, and the extent adults/students support the emotional needs of students.
	Physical Safety	The extent that students feel physically safe within the school environment.
	Bullying/Cyber-bullying	The extent that students report different types of bullying behaviors occurring in the school and the extent that school/staff/students try to counteract bullying.
Environment	Instructional Environment	The extent that students feel the instructional environment is collaborative, relevant, challenging, and supportive of learning.
	Mental Health Environment	The extent that students have access to support systems that effectively support their social, emotional, and mental health well-being.
	Discipline Environment	The extent that discipline is fair; applied consistently and evenly; and a shared responsibility among staff, teachers, and students.

Source: Massachusetts Department of Elementary and Secondary Education. (2021). Views of Climate and Learning (VOCAL) survey project. https://www.doe.mass.edu/research/vocal/

Table 2. Summary Statistics

	(1) Survey Sample			(2) Outcomes Sample		
	Mean	SD	N	Mean	SD	N
Leave-out climate VA	0.001	0.454	390578	-0.003	0.502	1741326
Lag math test	0.051	0.879	390578	0.044	0.904	1741326
Lag ELA test	0.028	0.871	390578	0.035	0.904	1741326
Lag retention	0.001	0.031	390578	0.001	0.032	1741326
Lag log absences	1.759	0.868	390578	1.754	0.832	1741326
Lag log days suspended	0.037	0.232	390578	0.034	0.224	1741326
Limited English proficient	0.046	0.210	390578	0.034	0.181	1741326
Male	0.502	0.500	390578	0.502	0.500	1741326
FRL	0.280	0.449	390578	0.300	0.458	1741326
Asian student	0.090	0.286	390578	0.086	0.281	1741326
Black student	0.100	0.299	390578	0.092	0.288	1741326
Pacific Islander student	0.007	0.086	390578	0.008	0.087	1741326
Hispanic student	0.167	0.373	390578	0.148	0.355	1741326
American Indian student	0.024	0.152	390578	0.024	0.154	1741326
Survey score	0.008	0.987	390578			
Math/ELA test				0.064	0.887	1741326
Nontest index				0.100	0.833	1741326
Retained				0.003	0.058	1741326
Log absences				1.825	0.840	1741326
Log days suspended				0.046	0.267	1741326
Grade point average				2.973	0.856	884175
Course grade				2.797	1.024	884731

Note: Samples for analysis of teacher climate effects on survey and student outcomes.

Table 3. Perceptions of School Climate by Student Race/Ethnicity

	(1)	(2)	(3)	(4)
Asian student	0.096***	0.063***	0.047***	0.052***
	(0.007)	(0.006)	(0.006)	(0.006)
Black student	-0.136***	-0.068***	-0.060***	-0.062***
	(0.008)	(0.006)	(0.006)	(0.006)
Hispanic student	-0.030***	0.028***	0.036***	0.038***
	(0.006)	(0.005)	(0.005)	(0.005)
N	739476	739412	729382	737132
School-Grade-Year FE		Y		
School-Track-Year FE			Y	
Classroom FE				Y

Notes: Coefficients on student race/ethnicity (with white students as the omitted category) from regressions using survey dimension scores as dependent variable. 95% confidence intervals constructed from standard errors clustered by teacher and student.

**p* < 0.10 ***p* < 0.05 ****p* < 0.01.

Table 4. Climate Value Added and Student Sorting

	Survey Sample			Outcomes Sample		
	(1)	(2)	(3)	(4)	(5)	(6)
Lag ELA score	0.002	-0.012*	-0.010	-0.009	-0.013***	-0.006
	(0.008)	(0.006)	(0.007)	(0.006)	(0.004)	(0.004)
Lag math score	0.000	-0.017**	-0.013*	-0.005	-0.011***	-0.003
	(0.009)	(0.007)	(0.008)	(0.006)	(0.004)	(0.004)
Lag absences	-0.001	0.006	0.003	0.004	0.005***	-0.000
	(0.005)	(0.005)	(0.006)	(0.003)	(0.002)	(0.002)
Lag days suspended	0.001	0.002**	0.003**	0.001	0.001**	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Lag retained	-0.000	-0.000	-0.000	0.000*	0.000*	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	1946240	1910760	1226780	8712955	8572310	5427560
School-Grade-Year FE	Y			Y		
School-Track-Year FE		Y	Y		Y	Y
Low-Sorting Sample			Y			Y

Notes: Regressions of observable characteristics on climate value added and specified fixed effects. Omnibus test conducted as a joint test of the climate value-added coefficients in a seemingly unrelated regression. Standard errors clustered by teacher and student in parentheses.

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

Table 5. Variability of Climate Value Added and Correlation With Test and Nontest VA

	Standard Deviation		Correlation			
			Test VA		Nontest VA	
Climate VA	0.09	0.08	0.22	0.25	0.12	0.09
Covariance test *p*-value	< 0.01	< 0.01	< 0.01	< 0.01	0.68	0.50
School-Year FE		Y		Y		Y

Notes: Estimated standard deviation of survey value added (columns 1 and 2) and correlations with test and behavior value added (columns 4–6). Test value added calculated using math and ELA standardized test scores. Nontest value added calculated using index constructed from log absences, log days suspended, and an indicator for grade retention. All value-added models include prior math and ELA scores, grade repetition status, prior days absent, prior days suspended, gender, race/ethnicity, FRL status, participation in special education programming, English proficiency, classroom means of each of these variables, student enrollment in advanced math, art electives, foreign language courses, supplemental/tutorial courses, and English as a second language courses and are estimated separately by subject and grade level. Models in odd columns additionally include school means of each of the control variables and a leave-teacher-out estimate of school climate. Models in even-numbered columns instead contain school-by-year effects. Standard deviation of teacher effects calculated as covariance between mean value-added residuals in 2018 and 2019. Covariance between teaching skills calculated using covariance between mean survey value-added residuals in 2019 and mean residuals from test or nontest value added in 2018. Test of significance from regression of mean residuals in 2019 on mean residuals in 2018 for given skills. All covariances estimated on a sample of 5,051 teachers with data in both years.

Table 6. Correlation in Climate VA Across Student Racial/Ethnic Groups

	Standard Deviation of Climate VA		White-SOC TVA Correlation
	White Students	Students of Color	
	(1)	(2)	(3)
Overall Climate	0.07	0.09	0.70
<u>Topics</u>			
Cultural and Linguistic Competency	0.04	0.07	0.47
Relationships	0.07	0.07	0.71
Participation	0.07	0.06	0.56
Emotional Safety	0.07	0.09	0.61
Bullying/Cyber-bullying	0.04	0.08	1.00
Instructional Environment	0.08	0.08	0.75
Mental Health Environment	0.03	0.07	0.85
Disciplinary Environment	0.09	0.10	0.73

Notes: Estimated standard deviation of climate value added (columns 1 and 2) and correlations (column 3) by student race/ethnicity. All value-added models include prior math and ELA scores, grade repetition status, prior days absent, prior days suspended, gender, race/ethnicity, FRL status, participation in special education programming, English proficiency, classroom means of each of these variables, student enrollment in advanced math, art electives, foreign language courses, supplemental/tutorial courses, and English as a second language courses and are estimated separately by subject and grade level, school means of each of the control variables, and a leave-teacher-out estimate of school climate. Standard deviation of teacher effects calculated as covariance between mean value-added residuals in 2018 and 2019. All covariances estimated on a sample of 2,280 teachers with at least five students in each group in each year.

Table 7. Teacher Characteristics and Climate Value Added

	(1)	(2)	(3)	(4)
Student-teacher racial/ethnic matching				
Match	0.027*		0.036**	
	(0.014)		(0.016)	
Match x Black student		0.074***		0.057***
		(0.019)		(0.020)
Match x Asian student		-0.044		-0.062*
		(0.034)		(0.034)
Match x Hispanic student		-0.004		0.015
		(0.018)		(0.020)
Teacher experience and licensure				
1–3 years	0.024**	0.024**		
	(0.012)	(0.012)		
4–6 years	0.025**	0.025**		
	(0.013)	(0.013)		
7–9 years	0.029**	0.029**		
	(0.013)	(0.013)		
10+ years	0.013	0.013		
	(0.013)	(0.013)		
Communication and Literacy Skills Test	-0.005	-0.005		
	(0.004)	(0.004)		
Subject Test	0.005	0.005		
	(0.003)	(0.003)		
Provisional license	-0.003	-0.003		
	(0.005)	(0.005)		
Teacher birth cohort				
1960s	0.028***	0.028***		
	(0.008)	(0.008)		
1970s	0.043***	0.043***		
	(0.009)	(0.009)		
1980s	0.050***	0.050***		
	(0.009)	(0.009)		
1990s	0.052***	0.052***		
	(0.012)	(0.012)		
N	696845	696845	694835	694835
School-Grade-Year FE	Y	Y		
Classroom FE			Y	Y

Notes: Estimated effects of teacher characteristics on climate value added using value-added specifications described in text. All regressions include student characteristics. Models in columns (1) and (2) include school-subject-level-year fixed effects and classroom mean characteristics. Models in columns (3) and (4) include classroom fixed effects. Models in columns (2) and (4) additionally include interactions of these variables with student race/ethnicity. Standard errors clustered by teacher and student in parentheses.

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

Table 8. Climate Value Added and Survey Outcomes

	(1)	(2)	(3)	(4)	(5)
Panel A. Overall Survey Score					
Climate VA	0.124***	0.121***	0.129***	0.136***	0.134***
	(0.010)	(0.010)	(0.011)	(0.014)	(0.014)
N	390882	390882	383789	246882	246882
Panel B. Topic Scores					
Climate VA	0.089***	0.087***	0.092***	0.099***	0.097***
	(0.007)	(0.007)	(0.008)	(0.010)	(0.010)
N	3517938	3517938	3517938	2266992	2266992
Panel C. Grades 4 & 5					
Climate VA	0.196***	0.192***	0.191***	0.206***	0.206***
	(0.018)	(0.018)	(0.018)	(0.022)	(0.022)
N	139052	139052	138694	85986	85986
Panel D. Grades 8 & 10					
Climate VA	0.068***	0.067***	0.067***	0.070***	0.066***
	(0.010)	(0.010)	(0.010)	(0.013)	(0.013)
N	251830	251830	245095	160896	160896
Student Controls		Y	Y		Y
School-Grade-Year FE	Y	Y			
School-Track-Year FE			Y	Y	Y
Low-Sorting Sample				Y	Y

Notes: Regressions of survey outcomes on leave-out predictions of climate value added. Student controls include prior math and ELA scores, grade repetition status, prior days absent, prior days suspended, gender, race/ethnicity, FRL status, participation in special education programming, English proficiency, classroom means of each of these variables, student enrollment in advanced math, art electives, foreign language courses, supplemental/tutorial courses, and English as a second language courses. Low-sorting sample includes all schools that do not demonstrate strong evidence of sorting of students to classrooms using randomization inference procedure described in the text. Standard errors clustered by teacher and student in parentheses.

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

Table 9. Climate Value Added and Student Academic Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A. Student Outcomes: All Grades							
Test Scores	0.017***	0.021***	0.018***	0.018***	0.022***	0.019***	0.020
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.014)
Nontest Index	0.004**	0.004**	0.005**	0.004**	0.004**	0.006**	0.012
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.010)
Log Days Absent	-0.002	-0.003*	-0.004**	-0.002	-0.003*	-0.005**	0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.011)
Log Days Suspended	-0.001***	-0.001**	-0.001	-0.001***	-0.001**	-0.001	-0.007**
	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.004)
Retained	0.000	0.000	-0.000	0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
N	1735218	1707519	1081463	1735218	1707519	1081463	1235565
Panel B. Student Outcomes: Grades 8 & 10							
Grade Point Average	0.013***	0.009***	0.016***	0.012***	0.009**	0.015***	0.009
	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.022)
Course Grade	0.042***	0.042***	0.056***	0.039***	0.040***	0.054***	0.041
	(0.009)	(0.010)	(0.011)	(0.009)	(0.010)	(0.011)	(0.033)
N	877297	852191	561183	877297	852191	561183	610597
Teacher Experience				Y	Y	Y	
School-Grade-Year FE	Y			Y			
School-Track-Year FE		Y	Y		Y	Y	
Low-Sorting Sample			Y			Y	
Switching Instrument							Y

Notes: Regressions of student outcomes on leave-out predictions of climate value added. Student controls include prior math and ELA scores, grade repetition status, prior days absent, prior days suspended, gender, race/ethnicity, FRL status, participation in special education programming, English proficiency, classroom means of each of these variables, student enrollment in advanced math, art electives, foreign language courses, supplemental/tutorial courses, and English as a second language courses. Low-sorting sample includes all schools that do not demonstrate strong evidence of sorting of students to classrooms using randomization inference procedure described in the text. Switching instrument uses mean teacher quality at the school-grade-year-subject level to instrument for assigned teacher quality in models with school-grade-subject and subject-grade-year fixed effects. Standard errors clustered by teacher and student (or by school for regressions in column 7) in parentheses.
$^*p < 0.10$ $^{**}p < 0.05$ $^{***}p < 0.01$.

Table 10. Climate VA and Student Outcomes by Race/Ethnicity

	White Students			Students of Color		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Overall Climate						
Climate VA, white students	0.196***	0.210***	0.230***	0.219***	0.224***	0.214***
	(0.020)	(0.021)	(0.027)	(0.024)	(0.027)	(0.035)
ΔClimate VA	0.052***	0.054***	0.052**	0.127***	0.128***	0.085**
	(0.017)	(0.019)	(0.025)	(0.022)	(0.025)	(0.034)
N	164518	160810	106358	85472	81853	49891
Panel B. Test Scores						
Climate VA, white students	0.021***	0.024***	0.023***	0.023***	0.021***	0.030***
	(0.007)	(0.007)	(0.008)	(0.007)	(0.008)	(0.010)
ΔClimate VA	0.007	0.010	0.001	0.019***	0.021***	0.019**
	(0.006)	(0.006)	(0.008)	(0.006)	(0.007)	(0.008)
N	724625	709755	464261	325735	311478	192735
Panel C. Nontest Index						
Climate VA, white students	0.011***	0.009**	0.012***	-0.008	-0.006	-0.003
	(0.004)	(0.004)	(0.004)	(0.007)	(0.007)	(0.010)
ΔClimate VA	0.001	-0.001	-0.000	-0.003	-0.002	-0.003
	(0.004)	(0.004)	(0.005)	(0.006)	(0.006)	(0.009)
N	724625	709755	464261	325735	311478	192735
School-Grade-Year FE	Y			Y		
School-Track-Year FE		Y	Y		Y	Y
Low-Sorting Sample			Y			Y

Notes: Regressions of survey outcomes on leave-out predictions of climate value added. Student controls include prior math and ELA scores, grade repetition status, prior days absent, prior days suspended, gender, race/ethnicity, FRL status, participation in special education programming, English proficiency, classroom means of each of these variables, student enrollment in advanced math, art electives, foreign language courses, supplemental/tutorial courses, and English as a second language courses. Low-sorting sample includes all schools that do not demonstrate strong evidence of sorting of students to classrooms using randomization inference procedure described in the text. Standard errors clustered by teacher and student in parentheses.
*$p < 0.10$ **$p < 0.05$ ***$p < 0.01$.
$p < 0.001$

Appendix A. Additional Tables and Figures

Table A.1 Fourth-Grade Survey Items by Topic

Culture and Linguistic Competence	Adults working at this school treat **all** students respectfully.
Culture and Linguistic Competence	Teachers at this school accept me for who I am.
Culture and Linguistic Competence	Students like to have friends who are different from themselves (for example, boys and girls, rich and poor, or classmates of different color).
Culture and Linguistic Competence	I read books **in class** that include people who are similar to me (for example, we look the same, speak the same, or live in similar neighborhoods).
Relationships	Students at my school get along well with each other.
Relationships	Students respect each other in school.
Relationships	My teachers care about me as a person.
Participation	I get the chance to take part in school events (for example, science fairs, art or music shows).
Participation	My teachers use my ideas to help my classmates learn.
Participation	My teachers will explain things in different ways until I understand.
Participation	When I need help, my teachers use my interests to help me learn.
Participation	My teachers ask me to share what I have learned in a lesson.
Participation	When I am stuck, my teachers want me to try again before they help me.
Participation	My classmates behave the way my teachers want them to.
Emotional Safety	Teachers support (help) students who come to class upset.
Emotional Safety	I am happy to be at our school.
Emotional Safety	I feel comfortable talking to my teacher(s) about something that is bothering me.
Emotional Safety	Students will help other students if they are upset.
Physical Safety	I feel safe at our school.
Physical Safety	I have seen **more than one** fight at my school in the last month.
Bullying/Cyber-bullying	If I tell my teacher my classmate is being bullied, my teacher will help that person.
Bullying/Cyber-bullying	I have been hit by other students **more than once** in school.

Bullying/Cyber-bullying	Teachers don't let students tease each other.
Bullying/Cyber-bullying	Students at school try to stop bullying when they see it happening.
Bullying/Cyber-bullying	Teachers, students, and the principal work together to stop bullying.
Bullying/Cyber-bullying	In my school, older students scare or pick on younger students.
Bullying/Cyber-bullying	In my school, groups of students tease or pick on one student.
Bullying/Cyber-bullying	My teachers have taught me about what to do if I am bullied.
Instructional Environment	Students help each other learn.
Instructional Environment	My teachers are proud of me when I work hard in school.
Instructional Environment	My teachers help me succeed with my schoolwork when I need help.
Instructional Environment	My schoolwork is hard but not too hard.
Instructional Environment	My teachers support me even when my work is not my best.
Instructional Environment	When I am home, I like to learn more about the things we are learning school.
Mental Health Environment	In school, I learn how to manage (control) my feelings when I am upset.
Mental Health Environment	At our school, students learn to care about other students' feelings.
Discipline Environment	Students help decide school rules.
Discipline Environment	School rules are fair for all students.
Discipline Environment	Teachers give students a chance to explain when they do something wrong.
Discipline Environment	My teachers will first try to help students who break class rules, instead of punishing them.

Table A.2 Fifth-Grade Survey Items by Topic

Culture and Linguistic Competence	Adults working at this school treat **all** students respectfully.
Culture and Linguistic Competence	Teachers at this school accept me for who I am.
Culture and Linguistic Competence	Students like to have friends who are different from themselves (for example, boys and girls, rich and poor, or classmates of different color).
Culture and Linguistic Competence	I read books **in class** that include people who are similar to me (for example, we look the same, speak the same, or live in similar neighborhoods).
Relationships	Students at my school get along well with each other.
Relationships	Students respect each other in school.
Relationships	My teachers care about me as a person.
Participation	I get the chance to take part in school events (for example, science fairs, art or music shows)
Participation	My teachers use my ideas to help my classmates learn.
Participation	My teachers will explain things in different ways until I understand.
Participation	When I need help, my teachers use my interests to help me learn.
Participation	My teachers ask me to share what I have learned in a lesson.
Participation	When I am stuck, my teachers want me to try again before they help me.
Participation	My classmates behave the way my teachers want them to.
Emotional Safety	Teachers support (help) students who come to class upset.
Emotional Safety	I am happy to be at our school.
Emotional Safety	I feel comfortable talking to my teacher(s) about something that is bothering me.
Emotional Safety	Students will help other students if they are upset, even if they are not close friends.
Physical Safety	I feel safe at our school.
Physical Safety	I have seen **more than one** fight at my school in the last month.
Bullying/Cyber-bullying	If I tell a teacher or other adult that someone is being bullied, the teacher/adult will do something to help.
Bullying/Cyber-bullying	I have been punched or shoved by other students **more than once** in the school or on the playground.
Bullying/Cyber-bullying	Teachers don't let students tease each other.
Bullying/Cyber-bullying	Students at school try to stop bullying when they see it happening.
Bullying/Cyber-bullying	Teachers, students, and the principal work together in our school to prevent (stop) bullying.
Bullying/Cyber-bullying	In my school, older students scare or pick on younger students.
Bullying/Cyber-bullying	In my school, groups of students tease or pick on one student.
Instructional Environment	Students help each other learn without having to be asked by the teacher.
Instructional Environment	My teachers are proud of me when I work hard in school.
Instructional Environment	My teachers help me succeed with my schoolwork when I need help.
Instructional Environment	My schoolwork is hard but not too hard.
Instructional Environment	My teachers support me even when my work is not my best.

Instructional Environment	When I am home, I like to learn more about the things we are learning school.
Instructional Environment	In this class, other students take the time to listen to my ideas.
Mental Health Environment	In school, I learn how to manage (control) my feelings when I am angry or upset.
Mental Health Environment	At our school, students learn to care about other students' feelings.
Discipline Environment	Students have a voice in deciding school rules.
Discipline Environment	School rules are fair for all students.
Discipline Environment	Teachers give students a chance to explain their behavior when they do something wrong.
Discipline Environment	My teachers will first try to help students who break class rules, instead of punishing them.

Table A.3 Eighth-Grade Survey Items by Topic

Culture and Linguistic Competence	Adults working at this school treat **all** students respectfully, regardless of a student's race, culture, family income, religion, sex, or sexual orientation.
Culture and Linguistic Competence	My textbooks or class materials include people and examples that reflect my race, cultural background, and/or identity.
Culture and Linguistic Competence	Students from different backgrounds respect each other in our school, regardless of their race, culture, family income, religion, sex, or sexual orientation.
Culture and Linguistic Competence	Students are open to having friends who come from different backgrounds (for example, friends from different races, cultures, family incomes, religions, different sex, or sexual orientation).
Relationships	Students respect one another.
Relationships	Teachers are available when I need to talk with them.
Relationships	Adults at our school are respectful of student ideas, even if the ideas expressed are different from their own.
Relationships	My teachers promote respect among students.
Participation	My teachers use my ideas to help my classmates learn.
Participation	My parents feel respected when they participate at our school (e.g., at parent-teacher conferences, open houses).
Participation	I have a choice in how I show my learning (e.g., write a paper, prepare a presentation, make a video).
Participation	In my classes, my teachers use students' interests to plan class activities.
Participation	My classmates behave the way my teachers want them to.
Emotional Safety	Teachers support (help) students who come to class upset.
Emotional Safety	Students will help other students if they are upset, even if they are not close friends.
Emotional Safety	I feel comfortable reaching out to teachers/counselors for emotional support if I need it.
Emotional Safety	Because I worry about my grades, it is hard for me to enjoy school.
Physical Safety	Students at school damage and/or steal other students' property.
Physical Safety	I have seen students with weapons at our school.
Bullying/Cyber-bullying	If I tell a teacher or other adult that someone is being bullied, the teacher/adult will do something to help.
Bullying/Cyber-bullying	Teachers don't let students pick on other students in class or in the hallways.
Bullying/Cyber-bullying	Students at school try to stop bullying when they see it happening.
Bullying/Cyber-bullying	Teachers, students, and the principal work together in our school to prevent (stop) bullying.
Bullying/Cyber-bullying	Students have spread rumors or lies about me **more than once** on social media.
Bullying/Cyber-bullying	In my school, groups of students tease or pick on one student.
Bullying/Cyber-bullying	I have been called names or made fun of by other students **more than once** in school.
Bullying/Cyber-bullying	In my school, bigger students taunt or pick on smaller students.

Instructional Environment	Students help each other learn without having to be asked by the teacher.
Instructional Environment	My teachers are proud of me when I work hard in school.
Instructional Environment	My schoolwork is challenging (hard) but not too difficult.
Instructional Environment	My teachers support me even when my work is not my best.
Instructional Environment	My teachers set high expectations for my work.
Instructional Environment	My teachers believe that **all** students can do well in their learning.
Instructional Environment	The things I am learning in school are relevant (important) to me.
Mental Health Environment	Our school offers guidance to students on how to mediate (settle) conflicts (e.g., arguments, fights) by themselves.
Mental Health Environment	If I need help with my emotions (feelings), **effective** help is available at my school.
Discipline Environment	Students have a voice in deciding school rules.
Discipline Environment	Teachers give students a chance to explain their behavior when they do something wrong.
Discipline Environment	School staff are consistent when enforcing school rules.
Discipline Environment	My teachers will first try to help (guide) students who break class rules, instead of punishing them.

Table A.4 Tenth-Grade Survey Items by Topic

Culture and Linguistic Competence	Adults working at this school treat **all** students respectfully, regardless of a student's race, culture, family income, religion, sex, or sexual orientation.
Culture and Linguistic Competence	Students from different backgrounds respect each other in our school, regardless of their race, culture, family income, religion, sex, or sexual orientation.
Culture and Linguistic Competence	Students are open to having friends who come from different backgrounds (for example, friends from different races, cultures, family incomes, or religions, different sex, or sexual orientation).
Culture and Linguistic Competence	Within school, I am encouraged to take upper-level courses (honors, AP).
Relationships	Students respect one another.
Relationships	Teachers are available when I need to talk with them.
Relationships	Adults at our school are respectful of student ideas, even if the ideas expressed are different from their own.
Relationships	My teachers promote respect among students.
Participation	My teachers use my ideas to help my classmates learn.
Participation	I feel welcome to participate in extracurricular activities offered through my school, such as school clubs or organizations, musical groups, sports teams, student council.
Participation	In at least two of my academic classes, I can work on assignments that interest me personally.
Participation	If I finish my work early, I have an opportunity to do more challenging work.
Participation	In at least two of my academic classes, students are asked to teach a lesson or part of a lesson.
Emotional Safety	Teachers support (help) students who come to class upset.
Emotional Safety	Because I worry about my grades, it is hard for me to enjoy school.
Emotional Safety	I have a group of friends I can rely on to help me when I feel down (sad).
Emotional Safety	I feel as though I belong in my school community.
Emotional Safety	Students at school try to work out their problems with other students in a respectful way.
Physical Safety	I have stayed at home (or avoided school) because I did not feel safe at my school.
Physical Safety	Students are sexually harassed at my school (for example, bothered by unwanted touching and/or indecent name-calling).
Bullying/Cyber-bullying	If I tell a teacher or other adult that someone is being bullied, the teacher/adult will do something to help.
Bullying/Cyber-bullying	Teachers don't let students pick on other students in class or in the hallways.
Bullying/Cyber-bullying	Students at school try to stop bullying when they see it happening.
Bullying/Cyber-bullying	Teachers, students, and the principal work together in our school to prevent (stop) bullying.
Bullying/Cyber-bullying	In my school, groups of students tease or pick on one student.
Bullying/Cyber-bullying	I have been teased or picked on **more than once** because of my real or perceived (imagined) sexual orientation.
Bullying/Cyber-bullying	I have been teased or picked on **more than once** because of my race or ethnicity.
Bullying/Cyber-bullying	Students with learning or physical difficulties are teased or picked on at my school.
Instructional Environment	Students help each other learn without having to be asked by the teacher.
Instructional Environment	My teachers support me even when my work is not my best.

Instructional Environment	My teachers set high expectations for my work.
Instructional Environment	The things I am learning in school are relevant (important) to me.
Instructional Environment	Teachers ask students for feedback on their classroom instruction.
Instructional Environment	My teachers inspire confidence in my ability to be ready for college or a career.
Mental Health Environment	I have access to **effective** help at school if I am struggling emotionally or mentally.
Mental Health Environment	The level of pressure I feel at school to perform well is unhealthy.
Discipline Environment	Students have a voice in deciding school rules.
Discipline Environment	Teachers give students a chance to explain their behavior when they do something wrong.
Discipline Environment	The consequences for the **same** inappropriate behavior (e.g., disrupting the class) are the same, no matter who the student is.
Discipline Environment	My teachers will first try to help (guide) students who break class rules, instead of punishing them.

Table A.5 Summary Statistics for Survey Samples

	(1) Excluded Observations			(2) Included Observations		
	Mean	SD	N	Mean	SD	N
Leave-out climate VA	-0.058	0.787	151733	0.052	0.651	387259
Lag math test	-0.043	0.912	555085	0.053	0.879	387259
Lag ELA test	-0.053	0.902	555085	0.029	0.871	387259
Lag retention	0.006	0.078	555085	0.001	0.031	387259
Lag log absences	1.806	0.904	555085	1.759	0.868	387259
Lag log days suspended	0.047	0.265	555085	0.037	0.231	387259
Limited English proficient	0.098	0.297	555085	0.046	0.210	387259
Male	0.508	0.500	555085	0.502	0.500	387259
Free or reduced-price lunch	0.387	0.487	555085	0.279	0.448	387259
Full inclusion special education	0.136	0.343	555085	0.120	0.325	387259
Partial inclusion special education	0.024	0.152	555085	0.015	0.120	387259
Substantially separate special education	0.009	0.092	555085	0.002	0.045	387259
Asian student	0.097	0.295	555085	0.090	0.286	387259
Black student	0.146	0.353	555085	0.099	0.299	387259
Pacific Islander student	0.009	0.095	555085	0.007	0.086	387259
Hispanic student	0.258	0.437	555085	0.166	0.372	387259
American Indian student	0.037	0.189	555085	0.024	0.152	387259
Imputed math test	0.072	0.259	555085	0.049	0.216	387259
Imputed ELA test	0.075	0.263	555085	0.050	0.218	387259
Imputed retention	0.030	0.172	555085	0.021	0.142	387259
Imputed absence	0.033	0.179	555085	0.023	0.150	387259
Imputed days suspended	0.030	0.172	555085	0.021	0.142	387259

Notes: Samples for analysis of teacher climate effects on survey outcomes. Base sample includes all students in linked student-teacher data in 2018 and 2019 in grades 4, 5, 8, and 10. The inclusion criteria are: students with non-missing VOCAL survey data, students with non-missing teacher climate VA, and students in school-grade-year cells with at least two teachers with non-missing climate data.

Table A.6 Summary Statistics for Student Outcome Samples

	(1)			(2)		
	Excluded Observations			Included Observations		
	Mean	SD	N	Mean	SD	N
Leave-out climate VA	-0.017	0.816	559901	0.048	0.683	1717715
Lag math test	-0.074	0.934	2162137	0.047	0.904	1717715
Lag ELA test	-0.083	0.933	2154416	0.037	0.904	1717715
Lag retention	0.008	0.089	2307558	0.001	0.031	1717715
Lag log absences	1.819	0.861	2295173	1.753	0.831	1717715
Lag log days suspended	0.045	0.264	2307567	0.033	0.222	1717715
Limited English proficient	0.086	0.281	2414218	0.034	0.181	1717715
Male	0.506	0.500	2414218	0.502	0.500	1717715
Free or reduced-price lunch	0.399	0.490	2414218	0.298	0.457	1717715
Full inclusion special education	0.121	0.326	2414218	0.118	0.322	1717715
Partial inclusion special education	0.027	0.161	2414218	0.018	0.133	1717715
Substantially separate special education	0.009	0.096	2414218	0.003	0.053	1717715
Asian student	0.086	0.281	2414218	0.086	0.281	1717715
Black student	0.139	0.346	2414218	0.091	0.287	1717715
Pacific Islander student	0.010	0.101	2414218	0.008	0.086	1717715
Hispanic student	0.226	0.418	2414218	0.147	0.354	1717715
American Indian student	0.034	0.181	2414218	0.024	0.153	1717715
Math/ELA test	-0.082	0.934	2310540	0.067	0.887	1717715
Nontest index	0.006	0.962	2412857	0.101	0.830	1717715
Retained	0.006	0.076	2414218	0.003	0.057	1717715
Log absences	1.874	0.878	2412857	1.823	0.840	1717715
Log days suspended	0.059	0.306	2414218	0.045	0.264	1717715
Grade point average	2.809	0.960	1029987	2.973	0.857	884433
Course grade	2.640	1.122	980819	2.799	1.022	865079

Notes: Samples for analysis of teacher climate effects on student academic outcomes. Base sample includes all students in linked student-teacher data in 2012–2019 in grades 4, 5, 8, and 10. The inclusion criteria are: students with non-missing academic outcomes and lagged values, students with non-missing teacher climate VA, and students in school-grade-year cells with at least two teachers with non-missing climate data.

Appendix B. Construction of Empirical Bayes Predictions

We form leave-out empirical Bayes predictions of teacher quality to use as regressors following prior work (Chetty et al., 2014a; Kane & Staiger, 2008). The construction of the empirical Bayes estimates proceeds in two steps. Following Kane & Staiger (2008), we decompose the variance of the residuals from Eq. (1) into components attributable to teachers, classrooms, and students using the following empirical model of the regression residuals:

$$\hat{\epsilon}_{ijst} = \theta_j + \mu_{jt} + \eta_{jist}$$

In the above, θ_j is a teacher effect, μ_{jt} is a teacher-year (classroom) effect, and η is a student error term. Following Chetty et al. (2014a), more recent research typically estimates variance components models with "drift" in teacher effectiveness, where the covariance in teacher effects across time depends on the number of elapsed years. This is not possible with only 2 years of data. Because we use the VOCAL residuals to predict teacher effectiveness for each year between 2012 and 2019, regression models estimated using the resulting predictions will tend to be somewhat attenuated relative to the set of infeasible predictions incorporating drift in teaching effectiveness.[16]

We estimate the variance of the teacher component using the covariance between mean teacher residuals, weighted by the number of students, across the 2 years of data:

$$\hat{\sigma}_{\theta}^2 = cov(\hat{\theta}_{j,2018}, \hat{\theta}_{j,2019}).$$

We then estimate the variance of the student component using the within-classroom variance of the student residuals and accounting for the number of coefficients in the first-stage value-added regression and estimated classroom means in the degrees of freedom calculation:

$$\hat{\sigma}_{\eta}^2 = \frac{N-1}{N-K-C+1} var(\hat{\epsilon}_{ijst} - \hat{\theta}_{jt}).$$

[16] In practice, we use the Stata program by Stepner (2013) to construct the empirical Bayes teacher value added.

We then estimate the classroom component as the remaining variance using the residual mean square error from Eq. (1), $\hat{\sigma}_{\epsilon}^2$, as an estimate of the total residual variance:

$$\hat{\sigma}_{\mu}^2 = \hat{\sigma}_{\epsilon}^2 - \hat{\sigma}_{\theta}^2 - \hat{\sigma}_{\eta}^2.$$

Finally, we construct the empirical Bayes predictions as

$$\hat{\theta}_{j,-t} = \Omega_{jt}\hat{\mu}_{j-t}$$

where Ω_{jt} is a vector of weights as described in Chetty et al. (2014a). The empirical Bayes prediction weights each estimate of teacher effectiveness inversely with the precision of the estimate. When regressing student outcomes on the teacher effects, the empirical Bayes shrinkage factor approximates the attenuation bias resulting from the use of noisy estimates of VA. Finally, we standardize the climate value-added estimates against the distribution of teaching effectiveness using $\hat{\sigma}_{\theta}^2$ as an estimate of the variability of teacher effects.

We follow the approach outlined in Mulhern and Opper (2022) to construct joint empirical Bayes predictions of climate VA using reports for white student and students of color. In practice, this involves two additional steps. As before, we estimate the variance in teacher effects using the covariance in mean teacher residuals between 2018 and 2019. We estimate the covariance in stable teacher effects across student groups analogously so that our estimate of the stable variance in teacher effects depends on the three cross-year covariances. We next construct an estimate of the average student portion of the error term as

$$\hat{\Sigma}_{\eta} = \frac{1}{J}\sum_{j=1}^{J}\begin{bmatrix} \sigma_0^2/n_{0j} & 0 \\ 0 & \sigma_1^2/n_{1j} \end{bmatrix}.$$

where n_{0j} and n_{1j} are the number of students in each group in classroom j and the variance of the student components, σ_0^2 and σ_1^2, are estimated using within-classroom deviations as before. We construct the estimated covariance matrix of the classroom errors as

$$\hat{\Sigma}_{\mu} = \hat{\Sigma}_{\bar{\epsilon}} - \hat{\Sigma}_{\theta} - \hat{\Sigma}_{\eta}$$

where $\hat{\Sigma}_{\theta}$ is the estimate of the covariance in the stable component and $\hat{\Sigma}_{\bar{\epsilon}}$ is the sample covariance of the teacher-year mean residuals. Finally, we construct the empirical Bayes predictions

$$\hat{\theta}_{j,-t} = \Omega_{jt}\hat{\mu}_{j-t}$$

using the weight matrix in Mulhern and Opper (2022). The weighting matrix uses data from both measures to construct the EB prediction for each of the teacher effects.