POSITIVE OUTLIERS SERIES

California's Positive Outliers

Districts Beating the Odds

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Executive Summary

The explosion of knowledge and the growing complexity of modern life are changing expectations for what young people need to learn and be able to do. Success in the 21st century does not depend solely on what people know, but also on what they can do with what they know. Thus, young people need to be able to think critically, collaborate effectively, communicate clearly, solve complex problems, and continue to learn independently throughout their lives. To equip the next generation of Californians with these skills, the state adopted new learning standards and assessments that require all students to engage in higher order thinking and problem-solving. Around the same time, California implemented a new funding and accountability system, the Local Control Funding Formula, which allocated funds based on pupil needs and removed most categorical restrictions on spending.

These shifts to more challenging standards revealed even wider achievement gaps in many districts on the new statewide assessments. Despite wide achievement gaps across the state between students from different racial and socioeconomic backgrounds, some California school districts have excelled at supporting the learning of all students in this new era of deeper learning. We refer to these California school districts as "positive outliers" because their students are beating the odds. In these districts, students of color, as well as White students, consistently achieve at higher than expected levels, performing better than students of similar racial/ethnic backgrounds from families of similar income and education levels in most other California districts. Positive outlier districts appear to have leveraged the state's updated educational standards, funding, and accountability systems to support students in meeting the more rigorous academic standards.

In this report, we summarize the results of a quantitative analysis that identifies districts in which students of color, as well as their White peers, have demonstrated extraordinary levels of academic achievement, measured by California's new assessments in English language arts and mathematics, taking into account race and family income and education levels. These results show, for the first time, which California districts and communities appear to have best supported the academic achievement of students in the first 3 years of the new assessments, controlling for the socioeconomic status of families in each district. We also examine some of the factors associated with their success.

We find that, aside from socioeconomic status, a major predictor of student achievement is the preparedness of teachers. The proportion of teachers holding less than a full credential (i.e., an intern credential, temporary or short-term permit, or waiver for their teaching position) shows a strong negative association with student achievement for all student groups. In addition, teachers' average experience levels are positively associated with achievement for African American and Hispanic students. We recognize that these teacher qualifications are also associated with other variables that influence staff recruitment and retention and may signal broader differentials in teaching and learning conditions. California districts that have been able to find and keep fully prepared teachers have supported stronger student achievement for African American and Hispanic students as well as for White students.

Introduction

The rapid explosion of knowledge and the growing complexity of modern life are changing expectations for what young people need to learn and be able to do. Success in the 21st century does not depend solely on what people know, but also on what they can do with what they know to solve complex problems and continue to learn independently throughout their lives. To respond to these new realities, California adopted the Common Core State Standards and the Next Generation of Science Standards, which require all students to engage in the kind of higher order thinking and problem-solving once reserved for a small minority. Implementing the standards requires principals and teachers to shift instructional practices from those geared to recalling information to those aimed at applying knowledge to complex problems and using evidence, inquiry, and multiple modes of communication.

In response to the updated learning standards, California developed new assessments in English language arts and mathematics through the Smarter Balanced Assessment Consortium, a multistate collaborative. Now called the California Assessment of Student Performance and Progress (CAASPP), these assessments, like the standards, focus on higher order thinking and performance skills and include open-ended items as well as inquiry-based performance tasks in both subject areas; these require young people to research a critical issue or take up a complex problem and write extended explanations of their analysis and conclusions.

These standards and assessments are significantly different from the earlier standards and multiple-choice tests that were used to guide instruction. They now allow the state to assess the kind of deeper learning that is a prerequisite to success in today's knowledge-based society and economy.

Around the same time as the implementation of Common Core and CAASPP, California implemented a new funding and accountability system, the Local Control Funding Formula (LCFF). LCFF gave districts more autonomy to decide how to allocate their state funding, while providing increased funding on behalf of high-need students (i.e., English learners, students from low-income families, and foster youth).

Although these changes were in part motivated by the desire to improve the achievement of historically underserved students, achievement gaps in many districts have widened on statewide assessments. The more advanced skills now measured in the new assessments have often been reserved for the most advantaged learners—a tendency that was exacerbated in the earlier era of accountability, which focused on lower level skills and test preparation aimed at multiple-choice tests rather than the inquiry, writing, and problem-solving now encouraged. Studies found that instruction in districts serving high-need students, where sanctions were most often threatened, emphasized lower level skills at the expense of a broader curriculum.[1]

Despite wide achievement gaps across the state between students from different racial and socioeconomic backgrounds,[2] some California school districts have excelled at supporting the learning of all students in this new era of deeper learning. We refer to these California school districts as "positive outliers" because their students are beating the odds relative to the socioeconomic conditions in their communities. In these districts, students of color, as well as White students, consistently achieve at higher than expected levels, performing better than students of similar racial/ethnic backgrounds from families of similar income and education levels in most other California districts. Positive outlier districts appear to have leveraged the state's updated educational standards, funding, and accountability systems to support students of color in meeting the more rigorous academic standards.

> Despite wide achievement gaps across the state between students from different racial and socioeconomic backgrounds, students in some districts are beating the odds relative to the socioeconomic conditions in their communities. We refer to these California school districts as "positive outliers."

In this paper, we summarize the results of a quantitative analysis that identifies districts in which students of color, as well as their White peers, have demonstrated extraordinary levels of academic achievement, measured by California's new assessments in English language arts and mathematics, taking into account race, family income, and education levels. Acknowledging that students' achievements may be a result of school, community, and/or family factors, we have conducted an analysis of school district inputs and resources associated with this higher than predicted achievement. These results show, for the first time, which California districts and communities appear to have best supported the academic achievement of students in the first 3 years of the new assessments, controlling for the socioeconomic status (SES) of families in each district. We also examine some of the factors associated with their success.

Our analysis proceeds in two parts. In the first part, we identify the California districts that have been particularly successful at supporting the achievement of African American, Hispanic, and White students.[3] The second part of our analysis examines the factors that predict student achievement for African American, Hispanic, and White students at the district level. We describe our methods for each of these analyses below.

Part I: Identification of Positive Outlier Districts

Methodology

Data and variables

To estimate student achievement, we use district-level mathematics and English language arts (ELA) results from the CAASPP. We use the CAASPP results for all students and for three racial/ethnic subgroups (African American, Hispanic, and White) for 2015, 2016, and 2017. In our analyses, we exclude districts in which fewer than 200 African American or Hispanic students and 200 White students were tested, so that the estimates of socioeconomic characteristics for each group are sufficiently reliable. Consequently, our initial analyses include 435 California districts. These districts account for approximately 42% of the districts in California and for 86% of California's public school students, including 88% of Hispanic, 91% of African American, and 81% of White public school students in the state.

Mean test scores by year, subject, and grade level for all students and for these racial subgroups (African American, Hispanic, and White) in 2015, 2016, and 2017 are standardized using the year-grade-subject specific state mean and standard deviation.

We supplement California Department of Education data with additional information about each school district. To estimate the socioeconomic conditions of students from each racial/ethnic group, within each school district, we use six measures of socioeconomic characteristics for families with children attending public school. These measures are from the American Community Survey's (ACS) Education Demographic and Geographic Estimates (EDGE). These socioeconomic variables are available by racial/ethnic subgroup as well. The six measures include each district's

- median income;
- unemployment rate;
- proportion of households who participate in the Supplemental Nutrition Assistance Program (SNAP), formerly the Food Stamp Program;
- proportion of parents with a bachelor's degree or higher;
- proportion of households with children age 5 to 17 in poverty; and
- proportion of households headed by single mothers.

We also include a measure of the proportion of socioeconomically disadvantaged students by race tested in each school district, as reported by the California Department of Education. To be considered socioeconomically disadvantaged, students must meet at least one of the two criteria: neither of their parents received a high school diploma, or they are eligible to receive free or reduced-price lunch. Data also include the total number of students enrolled as well as the number of students tested in each district, grade, subgroup, and subject. The names and urbanicity of districts come from the Common Core of Data.

We use a two-level precision-weighted hierarchical linear model to identify the districts whose students in each racial/ethnic group (African American, Hispanic, and White) are performing better on CAASPP than one would predict based on the SES of the families each district serves. We use a multilevel model because we observe average test scores in multiple grades, years, and subjects in each district; thus, the model accounts for the nesting of grade-year-subject cells within districts.

The precision weighting gives more weight in the estimation to cells whose mean test scores are more precisely estimated (that is, it gives more weight to observations based on larger numbers of students).

The models tell us the difference between the actual average performance of a district's students in a given racial subgroup and what one would predict the performance to be of the district's students in the given subgroup based on the district's socioeconomic characteristics—a calculation known as the residual. In all cases, a larger positive residual means a district performed better than expected for students of a given racial/ethnic group, controlling for the SES of families of that group in the district. A larger negative residual means a district performed worse than expected. Figure 1 illustrates the basic model for calculating residuals. We rank districts based on their value of the residual.

For a more detailed explanation of the methodology, see Appendix A.

Figure 1
Understanding Residuals

Actual Student Subgroup Achievement	–	Predicted Student Subgroup Achievement Based on District SES	=	Student Subgroup Residual

Results

Significant variation in California student achievement

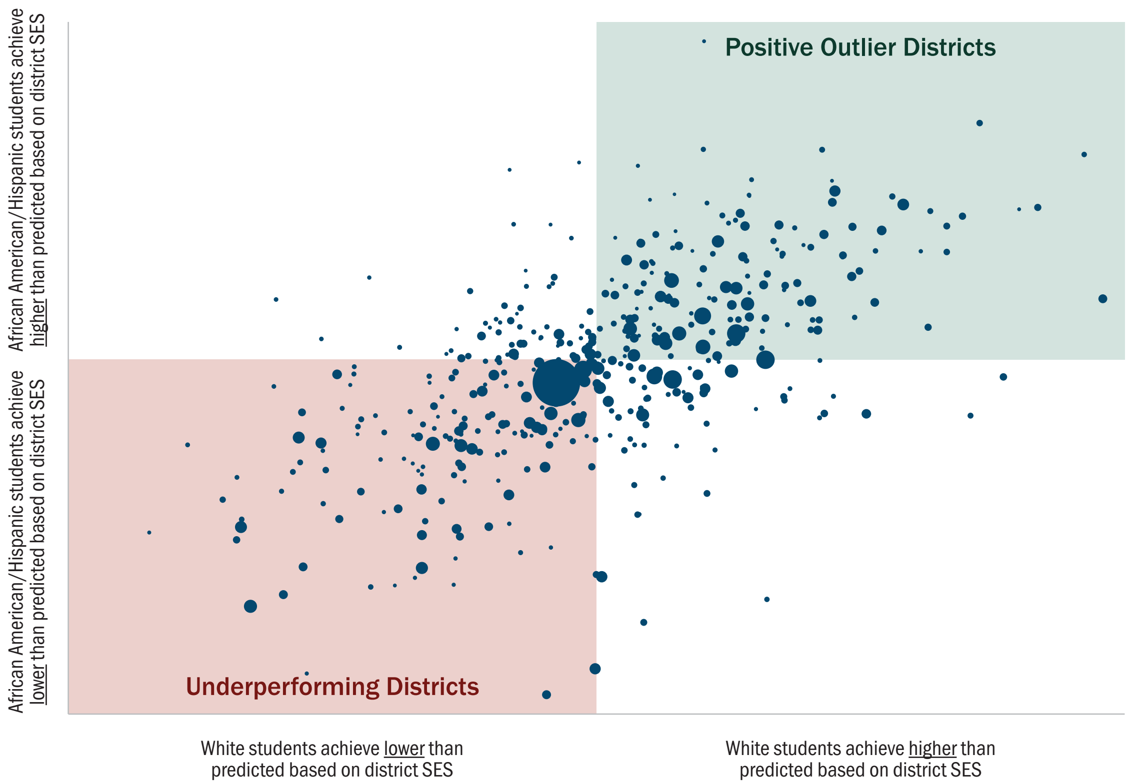
In many districts across the state, African American, Hispanic, and White students are achieving ELA and math scores that are higher than expected given the socioeconomic conditions for each of those groups in their communities. Figure 2 shows the variation in student achievement across California's 435 districts with at least 200 African American or Hispanic students and 200 White students. Observations in the top right quadrant of Figure 2 are considered positive outlier districts because African American and Hispanic students, as well as White students, achieve at higher than predicted levels based on their socioeconomic status. California has 156 districts in which students achieve at much higher than expected levels. In contrast, districts in the lower left quadrant are underperforming because students of all racial/ethnic groups achieve at lower levels than predicted by their socioeconomic status.

In Figure 2, positive observations along the x-axis show how many standard deviations higher White students in the district achieve than would be predicted based on the SES of White families in the district. Negative observations along the x-axis show how many standard deviations lower White students in the district achieve than would be predicted based on White families' SES in the district. Similarly, positive observations along the y-axis show how many standard deviations higher African American and Hispanic students in the district achieve than would be predicted based on the SES of African American and Hispanic families in the district.

In this plot, we average each subgroup's performance across subjects (i.e., math and ELA), tested grades (i.e., grades 3 through 8 and 11), and years (i.e., 2015, 2016, and 2017). Because some California districts have limited grades of students (e.g., elementary districts only have tested students in grades 3 through 8), we average the performance across the available grades for each district. We also combine the African American and Hispanic subgroup results, weighted by the number of African American versus Hispanic students in the district, to reflect the achievement of students of color in the district.

In addition, we find that positive outlier districts tend to appear as top districts across years and subjects fairly consistently. The correlation between district residuals across subjects and years for African American students is approximately .70. For Hispanic students, the correlation is approximately .90. Moreover, our estimates are highly reliable; that is, the standard errors of our estimates are limited. Thus, we trust that our results capture real differences across districts. (See Appendix A for more detail.)

Figure 2
Student Achievement in California Districts
Average African American/Hispanic and White achievement by district averaged across subjects, grades, and years (2015, 2016, and 2017)



Notes: Figure includes districts with at least 200 African American or Hispanic students and 200 White students. The size of the marker is weighted by the number of African American and Hispanic students tested in the district. Achievement is measured by residuals in standard deviations. The origin (0,0) represents districts in which African American and Hispanic and White students perform as predicted based on the SES conditions in their district.

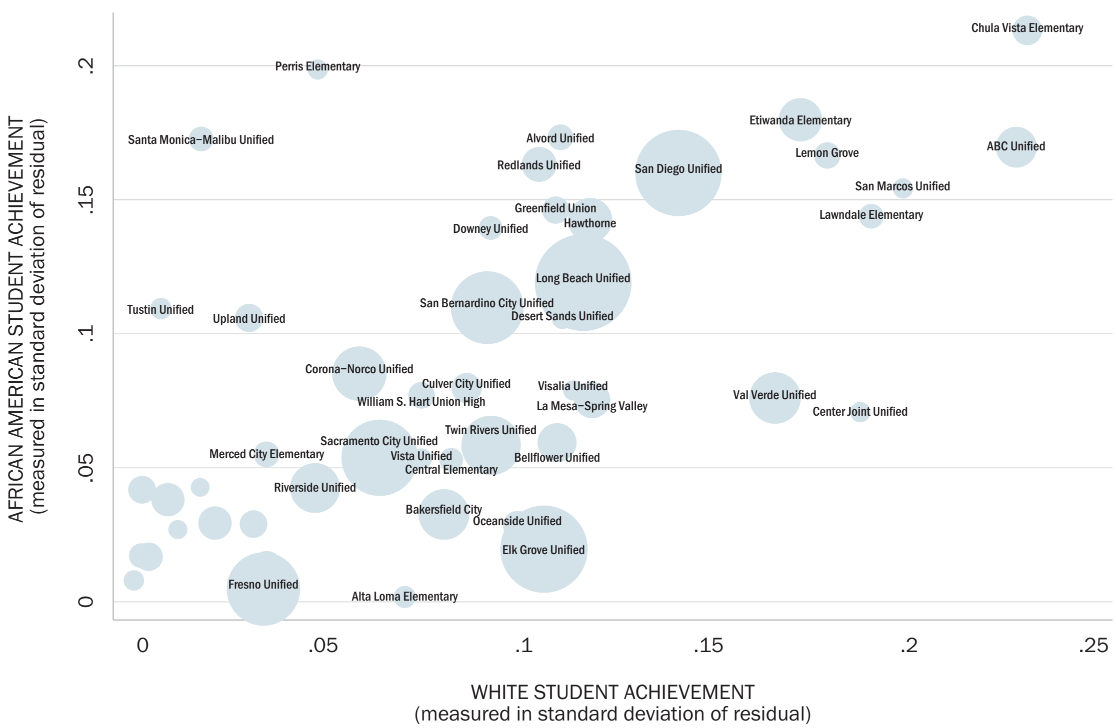
Data sources: California Department of Education. (n.d.). California Assessment of Student Performance and Progress (CAASPP) results. https://caaspp.cde.ca.gov (accessed 01/05/18); National Center for Education Statistics. (n.d.). Education demographic and geographic estimates. https://nces.ed.gov/programs/edge (accessed 01/05/18).

Some California districts have especially strong African American student achievement on the first 3 years of CAASPP, while others have especially strong Hispanic student achievement. Many districts in California serve a much larger population of one of these groups than the other (typically Hispanic). Figure 3 includes the results of zooming in to the top right quadrant of a figure such as Figure 2, which includes just African American students. We identify the 48 districts in which both African American and White students achieve on average at higher than predicted levels. The x-axis shows how many standard deviations higher White students in the district achieve than would be predicted based on the SES of White families in the district. Similarly, the y-axis shows how many standard deviations higher African American students achieve than would be predicted based on the SES of African American families in the district. As in Figure 2, we average each subgroup's performance across subjects (i.e., math and ELA), grades (i.e., grades 3 through 8 and 11), and years (i.e., 2015, 2016, and 2017).

On our measure, Chula Vista Elementary District is the top district in which both White and African American students perform higher than predicted, with several other elementary districts right behind. San Diego Unified and Long Beach Unified are the largest districts in which both groups outperform expectations by more than .10 standard deviations. See Appendix B for a list of all the districts and their residuals in Figure 3.

Figure 3
Districts With Higher Than Predicted African American and White Student Achievement

Average African American and White residuals by district averaged across subjects, grades, and years (2015, 2016, and 2017)



Note: Size of marker is weighted by number of African American students tested in the district.

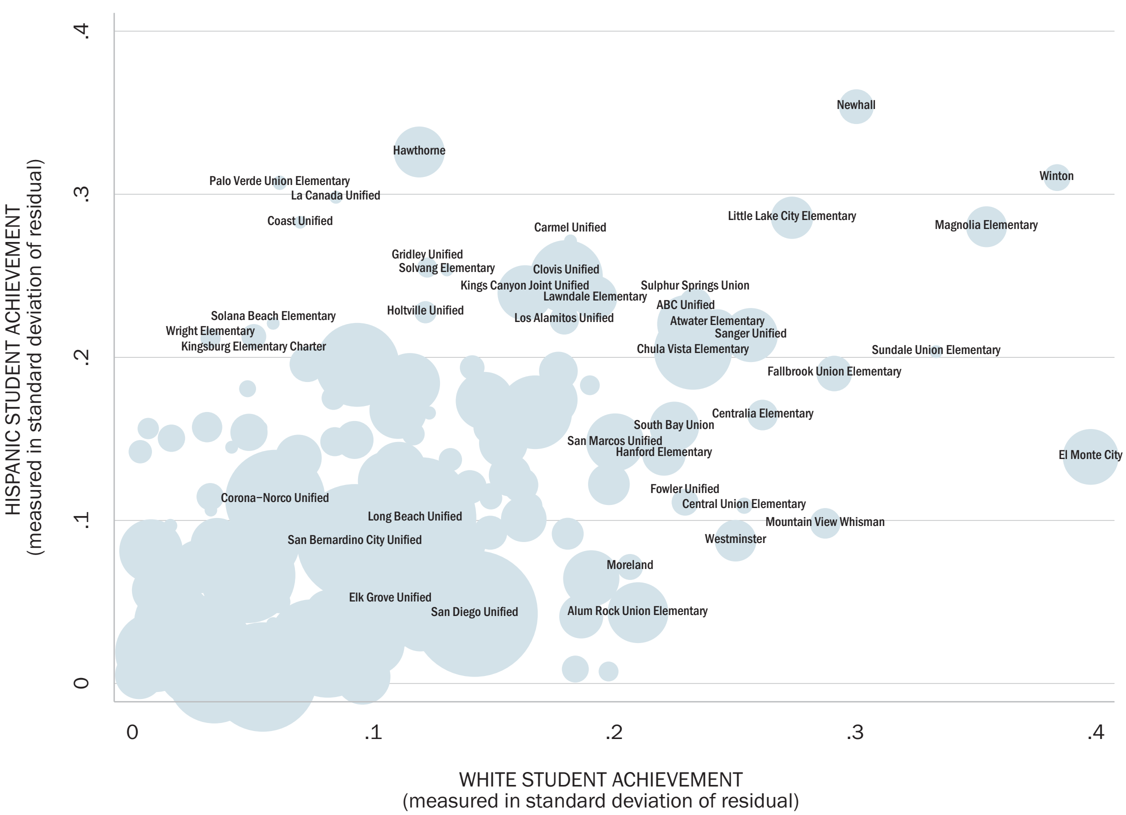
Data sources: California Department of Education. (n.d.). California Assessment of Student Performance and Progress (CAASPP) results. https://caaspp.cde.ca.gov (accessed 01/05/18); National Center for Education Statistics. (n.d.). Education demographic and geographic estimates. https://nces.ed.gov/programs/edge (accessed 01/05/18).

Approximately 167 California districts have had Hispanic and White students consistently achieve on average at higher than predicted levels on the first 3 years of CAASPP. Figure 4 shows the results of zooming in to the top right quadrant of a figure such as Figure 2, which includes just Hispanic and White students. As in Figure 3, the x-axis shows how many standard deviations higher White students in the district achieve than would be predicted based on the SES of White families in the district. Similarly, the y-axis shows how many standard deviations higher Hispanic students achieve than would be predicted based on the SES of Hispanic families in the district. As in Figures 2 and 3, we averaged each subgroup's performance across subjects (i.e., math and ELA), grades (i.e., grades 3 through 8 and 11), and years (i.e., 2015, 2016, and 2017). Due to space constraints, we only label districts in which either Hispanic students or White students achieved at least 0.20 standard deviations higher than predicted. The small districts of Newhall, Magnolia Elementary, and Winton are highest performing for both groups. Hawthorne is high performing for Hispanics. Chula Vista makes the list once again, as do the larger districts of Long Beach and San Diego. See Appendix B for a list of all the districts and their residuals in Figure 4.

Figure 4

Districts With Higher Than Predicted Hispanic and White Student Achievement

Average Hispanic and White residuals by district averaged across subjects, grades, and years (2015, 2016, and 2017)



Notes: Size of marker is weighted by number of Hispanic students tested in the district. Due to space constraints, we only label districts with over 25,000 students or districts in which either Hispanic students or White students achieved at least 0.20 standard deviations higher than predicted.

Data sources: California Department of Education. (n.d.). California Assessment of Student Performance and Progress (CAASPP) results. https://caaspp.cde.ca.gov (accessed 01/05/18); National Center for Education Statistics. (n.d.). Education demographic and geographic estimates. https://nces.ed.gov/programs/edge (accessed 01/05/18).

Students of color in over 50 larger California districts consistently beat the odds

In which California districts have students of color consistently achieved much higher than predicted? We identify 54 districts of significant size in which this is the case (see Table 1). To identify these districts, we apply a series of filters. First, we limit the sample to districts with at least 2,000 students to ensure that our estimates are sufficiently reliable.[4] Next, we require that the district appear as one of the top 50 California districts having higher than predicted achievement given the SES of the subgroup in the district in at least 50% of the observations for each eligible year, subject, and race combination for African American or Hispanic students. For example, if a district has over 200 African American students and 200 Hispanic students, we require that the district appear as a top 50 California district in at least six of the 12 possible observations. In this case, the 12 possible observations include, for African American students, (1) 2015 ELA, (2) 2015 math, (3) 2016 ELA, (4) 2016 math, (5) 2017 ELA, and (6) 2017 math, and, for Hispanic students, (7) 2015 ELA, (8) 2015 math, (9) 2016 ELA, (10) 2016 math, (11) 2017 ELA, and (12) 2017 math.

Table 1
California Positive Outlier Districts

District Name	Urbanicity	Student Enrollment	African American Enrollment	% African American Enrollment	Hispanic Enrollment	% Hispanic Enrollment	High-Achieving Group *AA = African American; H = Hispanic; W = White*
ABC Unified	Suburb: Large	20,998	1,846	9%	9,428	45%	AA, H, W
Alvord Unified	City: Large	19,390	756	4%	15,220	78%	AA, W
Atwater Elementary	Suburb: Midsize	4,855	112	2%	3,390	70%	H, W
Bassett Unified	Suburb: Large	3,959	25	1%	3,731	94%	H, W
Carlsbad Unified	City: Midsize	11,049	189	2%	2,904	26%	H, W
Carmel Unified	Suburb: Midsize	2,492	13	1%	457	18%	H, W
Centralia Elementary	Suburb: Large	4,491	140	3%	2,422	54%	H, W
Chula Vista Elementary	Suburb: Large	29,806	1,051	4%	20,594	69%	AA, H, W
Clovis Unified	Suburb: Large	41,169	1,313	3%	14,372	35%	AA, H, W
Desert Sands Unified	Suburb: Large	28,999	493	2%	20,949	72%	AA, H, W
Downey Unified	Suburb: Large	22,698	650	3%	20,002	88%	AA, H, W
Duarte Unified	Suburb: Large	3,896	204	5%	2,958	76%	H, W
East Whittier City Elementary	Suburb: Large	9,064	88	1%	7,470	82%	H, W

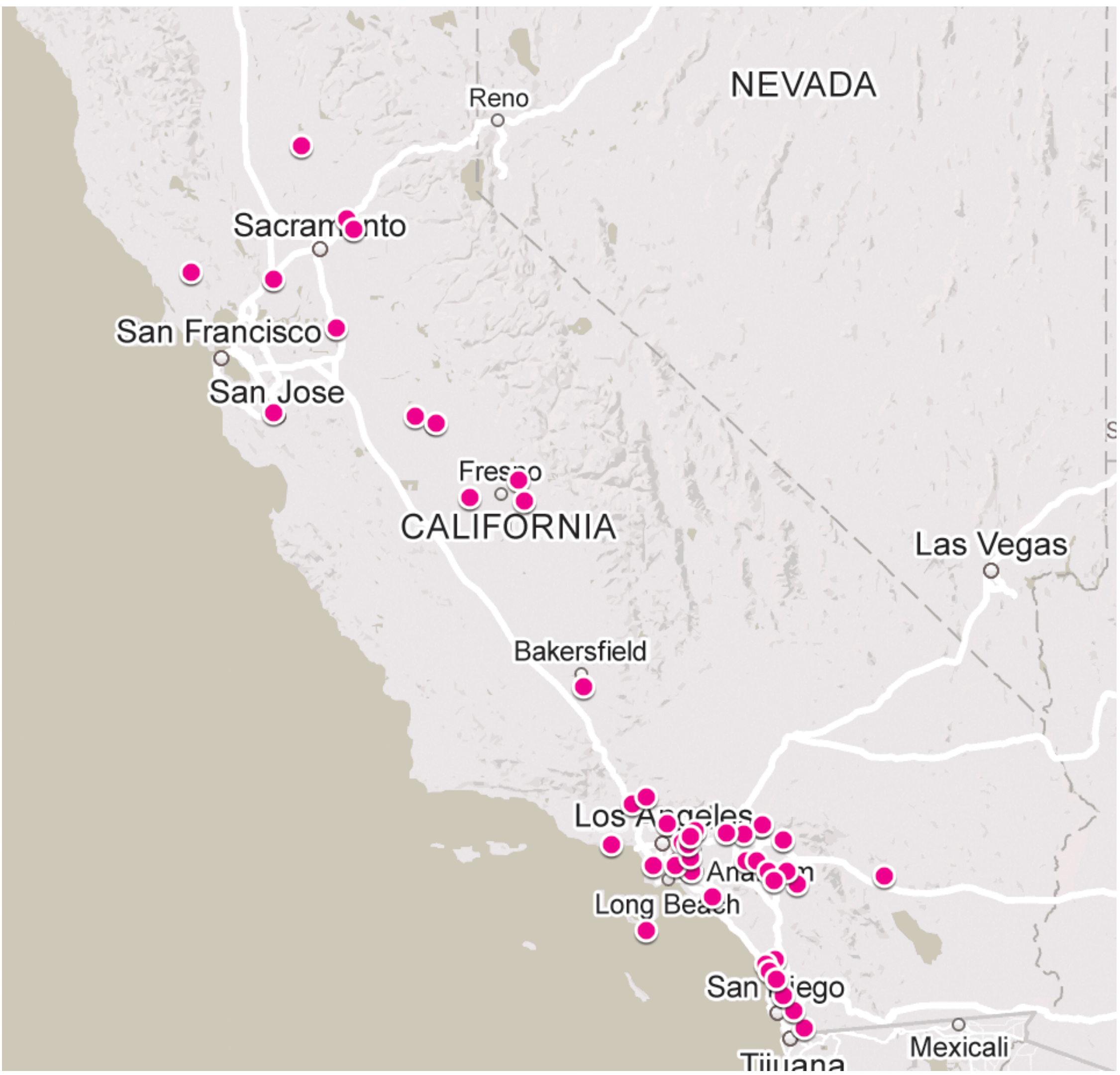
District Name	Urbanicity	Student Enrollment	African American Enrollment	% African American Enrollment	Hispanic Enrollment	% Hispanic Enrollment	High-Achieving Group *AA = African American; H = Hispanic; W = White*
El Monte City	Suburb: Large	9,031	27	0%	7,217	80%	H, W
Encinitas Union Elementary	Suburb: Large	5,445	46	1%	1,136	21%	H, W
Etiwanda Elementary	Suburb: Large	13,652	1,454	11%	6,023	44%	AA, H, W
Eureka Union	Suburb: Large	3,338	45	1%	335	10%	H
Fruitvale Elementary	City: Large	3,259	104	3%	1,165	36%	H, W
Greenfield Union	City: Large	9,345	697	7%	7,564	81%	AA, H, W
Gridley Unified	Town: Distant	2,051	9	0%	1,170	57%	H, W
Hawthorne	Suburb: Large	8,809	1,843	21%	6,255	71%	AA, H, W
Irvine Unified	City: Midsize	31,392	662	2%	3,341	11%	AA, W
Kerman Unified	Town: Fringe	4,997	25	1%	4,178	84%	H, W
Kings Canyon Joint Unified	Town: Distant	9,775	17	0%	8,486	87%	H, W
La Canada Unified	Suburb: Large	4,058	28	1%	468	12%	H, W
La Mesa-Spring Valley	Suburb: Large	12,144	1,158	10%	5,867	48%	AA, W
Lawndale Elementary	Suburb: Large	6,300	620	10%	4,736	75%	AA, H, W
Lemon Grove	Suburb: Large	3,922	635	16%	2,404	61%	AA, W
Lincoln Unified	City: Large	9,277	1,130	12%	4,109	44%	AA, W
Little Lake City Elementary	Suburb: Large	4,512	79	2%	4,061	90%	H, W
Long Beach Unified	City: Large	79,709	11,446	14%	44,170	55%	AA, W
Magnolia Elementary	City: Large	6,403	175	3%	4,552	71%	H, W
Monrovia Unified	Suburb: Large	5,903	425	7%	3,649	62%	AA, H, W
Newhall	Suburb: Large	6,739	154	2%	3,174	47%	H, W
Nuview Union	Suburb: Large	2,894	347	12%	1,962	68%	H, W

District Name	Urbanicity	Student Enrollment	African American Enrollment	% African American Enrollment	Hispanic Enrollment	% Hispanic Enrollment	High-Achieving Group *AA = African American; H = Hispanic; W = White*
Paramount Unified	Suburb: Large	15,681	1,314	8%	13,760	88%	AA, H, W
Perris Elementary	Suburb: Large	5,821	369	6%	5,036	87%	AA, H, W
Redlands Unified	City: Small	21,326	1,323	6%	9,998	47%	AA, W
Riverside Unified	City: Large	42,339	2,980	7%	25,669	61%	AA, W
Rocklin Unified	Suburb: Large	12,738	192	2%	1,736	14%	H, W
Roseland	Suburb: Large	2,755	14	1%	2,520	91%	H
Rosemead Elementary	Suburb: Large	2,668	18	1%	1,150	43%	H
San Bernardino City Unified	City: Midsize	53,365	7,113	13%	39,291	74%	AA, W
San Diego Unified	City: Large	129,779	12,085	9%	60,884	47%	AA, W
San Marcos Unified	Suburb: Large	20,452	455	2%	9,365	46%	AA, H, W
Sanger Unified	Town: Fringe	11,204	172	2%	7,796	70%	H, W
Santa Clara Unified	City: Midsize	15,298	504	3%	5,577	36%	AA
Santa Monica-Malibu Unified	City: Small	11,289	729	6%	3,341	30%	AA, W
Solana Beach Elementary	City: Large	3,146	16	1%	429	14%	H, W
Sulphur Springs Union	Suburb: Large	5,437	329	6%	2,778	51%	AA, H, W
Upland Unified	Suburb: Large	11,380	935	8%	6,135	54%	AA, W
Vacaville Unified	Suburb: Small	12,837	805	6%	4,462	35%	AA
Val Verde Unified	Suburb: Large	19,841	2,889	15%	14,607	74%	AA, H, W
Weaver Union	City: Small	2,796	145	5%	1,803	64%	H, W

Data sources: California Department of Education. (n.d.). California Assessment of Student Performance and Progress (CAASPP) results. https://caaspp.cde.ca.gov (accessed 01/05/18); National Center for Education Statistics. (n.d.). Education demographic and geographic estimates. https://nces.ed.gov/programs/edge (accessed 01/05/18).

The 54 positive outlier districts are scattered throughout the state. Figure 5 includes a map of these districts. The magenta dots on the map represent positive outlier school districts, and the white dots represent major cities for reference. Because we limit our analysis to districts with over 2,000 students, a restriction that removed many districts in less populated communities, a larger proportion of positive outlier districts are in urban and suburban areas than in rural and town areas. In addition, few positive outlier districts are in Northern California or in the Bay Area relative to the total number of districts in these areas. Instead, positive outlier districts are disproportionately concentrated in Southern California. One reason for the higher concentration in Southern California is that this region includes more districts with over 2,000 students.

Figure 5
Map of 54 Positive Outlier Districts



Data sources: California Department of Education. (n.d.). California Assessment of Student Performance and Progress (CAASPP) results. https://caaspp.cde.ca.gov (accessed 01/05/18); National Center for Education Statistics. (n.d.). Education demographic and geographic estimates. https://nces.ed.gov/programs/edge (accessed 01/05/18).

Part II. Predictors of Student Achievement

Methodology

In Part II of our analysis, we use the same two-level hierarchical linear model used in Part I to identify the factors most strongly associated with African American, Hispanic, and White student achievement. As in Part I, we measure achievement of students using 3 years of CAASPP scores averaged across subjects. (See Appendix A for details about the model.) To improve the reliability of our estimates, we only include districts with at least 200 African American or Hispanic students and 200 White students, so our sample includes 435 California districts. Using publicly available data, we develop three models to predict how well a district's students achieve on the first 3 years of CAASPP, controlling for the SES conditions in the district. Table 2 includes the descriptive statistics for each variable in our analysis. When we run our analysis, we center the variables in Table 2 so they have a mean of zero and the same standard deviation that is reported in Table 2. Selected results from our analyses are included in Table 3 and discussed in detail below. See Appendix A for the full results from our analysis and more information about our methodology.

Table 2
Descriptive Statistics

Variable	Mean	Standard Deviation	Data Source
African American & Hispanic Score	−0.219	0.273	California Department of Education CAASPP Results for 2015–2017
White Score	0.220	0.362	California Department of Education CAASPP Results for 2015–2017
SES: Percent of Parents With Bachelor's or Above	0.229	0.157	National Center for Education Statistics Education Demographic and Geographic Estimates for 2006–2013
SES: Poverty Rate of Head of Household With 5- to 17-Year-Olds	0.189	0.142	National Center for Education Statistics Education Demographic and Geographic Estimates for 2006–2013
SES: Percent Using SNAP Benefits	0.153	0.118	National Center for Education Statistics Education Demographic and Geographic Estimates for 2006–2013
SES: Percent of Households Headed by a Single Mother	0.324	0.124	National Center for Education Statistics Education Demographic and Geographic Estimates for 2006–2013
SES: Unemployment Rate	0.076	0.032	National Center for Education Statistics Education Demographic and Geographic Estimates for 2006–2013
SES: Median Income ($)	69,650	33,139	National Center for Education Statistics Education Demographic and Geographic Estimates for 2006–2013
SES: Percent Economically Disadvantaged	0.525	0.277	California Department of Education Enrollment by School for 2015–2017
# of Students (Logged)	8.818	1.040	National Center for Education Statistics Common Core of Data for 2015

Variable	Mean	Standard Deviation	Data Source
Student-Teacher Ratio	23.788	2.283	National Center for Education Statistics Common Core of Data for 2015
Teacher Salary at BA + 60, Adjusted for Cost of Living (Logged)	10.805	0.173	California Commission on Teacher Credentialing Teacher Supply Data for 2016
Avg. Years Teaching Experience in District	11.341	2.095	California Department of Education Staff Demographic Data for 2016
Percent Teachers With Intern Credentials, Temporary or Short-Term Permits, or Waivers	0.033	0.034	California Commission on Teacher Credentialing Teacher Supply Data for 2016
Total Per-Pupil Expenditures (Logged)	9.229	0.118	United States Census Bureau Annual Survey of School System Finances for 2015
Percent Spending on Instruction	0.620	0.058	United States Census Bureau Annual Survey of School System Finances for 2015

Model 1: District characteristics

Our first model examines the relationship between student achievement and a district's size and student characteristics. In this model, we include the six SES variables described above that account for the SES characteristics for families of a given racial/ethnic group in each district. As in Part I, we also include a measure of the proportion of socioeconomically disadvantaged students by race who were tested in each school district, as reported by the California Department of Education. In addition, we include a measure of district size in the model, with a variable representing the number of students enrolled in each district (in log form) as reported by the federal National Center for Education Statistics Common Core of Data.[5]

Model 2: District and teacher characteristics

Model 2 adds to the variables in Model 1 by including measures of teaching characteristics in each district, such as the number of students per teacher, as well as teachers' compensation, experience, and training.

As they make hiring decisions, districts balance the quantity and quality of teachers. Quality is often influenced by teachers' education, training, and experience,[6] which are recognized in the compensation system; thus, hiring a greater quality of teachers with a given level of dollars may mean hiring a smaller quantity of teachers. To examine teacher quantity, we include each district's average student-to-teacher ratio as reported by the federal National Center for Education Statistics Common Core of Data.

To estimate compensation, we include a measure of each district's average salary for teachers with a bachelor's degree and 60 semester units or hours of additional education (in log form). This allows us to reflect districts' salary schedules in a comparable way, benchmarking salaries for similarly educated teachers across districts, without confounding our wage estimate by the very different average years of teacher experience across districts. The BA + 60 benchmark captures the salary many mid-career teachers would earn. In California, most teachers are trained in postbaccalaureate programs, so they come into teaching with a BA + 30 units (or 45 if they have earned a master's degree), and they then incrementally acquire additional credits through professional development experiences to move up the salary scale in the succeeding years. These salary data are voluntarily reported to the California Department of Education, so we do not have salary data for all California districts. Consequently, we use the statewide mean salary at this education level for districts with missing salary values. We also include a dummy variable indicating whether or not districts publicly reported their salary data. For districts with salary data, we adjust salaries for the cost of living in each district using the 2013 comparable wage index.[7]

In addition, we include a variable reported by the California Department of Education in our model to measure the average years of teaching experience within the district for teachers in each district.

To estimate teachers' training, we include a variable that measures the percent of teachers with substandard credentials (i.e., intern credentials, temporary or short-term permits, or waivers) in each district as reported by California's Commission on Teacher Credentialing for the 2015–16 school year. This measure indicates the percentage of teachers who have not yet completed a teacher preparation program nor met the standards for a full teaching credential in California. During the ongoing teacher shortages in California, the Teacher Credentialing Commission has issued a growing number of such authorizations. In 2015–16, more than 10,000 substandard credentials were issued, about half of all credentials issued in that year.[8]

Model 3: District, teacher, and financial characteristics

Model 3 adds to the variables included in Models 1 and 2 by including measures of financial allocations in the district. Using the most recent federally available school finance data reported by the United States Census Bureau from the 2014–15 school year (the most recent year available), we create two measures of district resource allocations. The first measure is a variable of the average per-pupil expenditures in a district (in log form). We also include the average percentage of expenditures districts allocate toward instruction, which includes the amounts districts spend on teachers' salaries and their non-retirement benefits, as well as instructional books and resources.

Table 3
Results for Correlates of California Student Achievement

	Model 1		Model 2		Model 3	
	African American and Hispanic Score	White Score	African American and Hispanic Score	White Score	African American and Hispanic Score	White Score
SES: Percent of Parents With Bachelor's or Above	0.847***	0.916***	0.866***	0.946***	0.876***	0.907***
	(0.115)	(0.073)	(0.112)	(0.073)	(0.114)	(0.080)
SES: Poverty Rate of Head of Household With 5- to 17-Year-Olds	-0.148	0.081	-0.122	0.079	-0.108	0.073
	(0.086)	(0.106)	(0.081)	(0.103)	(0.082)	(0.103)
SES: Percent Using SNAP Benefits	-0.047	-0.106	-0.039	-0.048	-0.051	-0.068
	(0.095)	(0.127)	(0.091)	(0.124)	(0.091)	(0.125)

	Model 1		Model 2		Model 3	
	African American and Hispanic Score	White Score	African American and Hispanic Score	White Score	African American and Hispanic Score	White Score
SES: Percent of Households With Single Mother Head	-0.039	-0.140	-0.021	-0.119	-0.017	-0.123
	(0.072)	(0.081)	(0.069)	(0.079)	(0.068)	(0.079)
SES: Unemployment Rate	-0.162	-0.054	0.031	-0.103	0.013	-0.186
	(0.237)	(0.351)	(0.229)	(0.348)	(0.228)	(0.347)
SES: Median Income	0.014	0.003	0.020	0.002	0.017	0.002
	(0.030)	(0.033)	(0.029)	(0.032)	(0.029)	(0.032)
SES: Percent Economically Disadvantaged	-0.539***	-0.788***	-0.506***	-0.783***	-0.493***	-0.778***
	(0.062)	(0.059)	(0.060)	(0.057)	(0.061)	(0.061)
# of Students (Logged)	0.002	0.009	-0.014	-0.003	-0.013	-0.003
	(0.008)	(0.007)	(0.008)	(0.007)	(0.008)	(0.007)
Student-Teacher Ratio			0.005	0.004	0.003	0.005
			(0.003)	(0.003)	(0.004)	(0.004)
Teacher Salary at BA + 60, Adjusted for Cost of Living (Logged)			0.033	0.053	0.036	0.042
			(0.039)	(0.036)	(0.039)	(0.037)
Average Years Teaching Experience in District			0.008*	0.006	0.008*	0.006
			(0.004)	(0.003)	(0.004)	(0.003)
Percent Teachers With Intern Credentials, Temporary or Short-Term Permits, or Waivers			-0.919***	-0.727***	-0.884***	-0.677**
			(0.224)	(0.220)	(0.224)	(0.220)
Total Per-Pupil Expenditures (Logged)					-0.075	0.076
					(0.069)	(0.068)
Percent Spending on Instruction					0.163	0.285*
					(0.121)	(0.114)
District Observations	435	435	435	435	435	435
R-Squared	0.668	0.855	0.703	0.867	0.706	0.869

Note: Standard errors in parentheses: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Data sources: California Commission on Teacher Credentialing. (n.d.). Teacher supply: Credentials. https://www.ctc.ca.gov/commission/reports/data/edu-supl-landing (accessed 01/05/18); California Department of Education. (n.d.). California Assessment of Student Performance and Progress (CAASPP) results. https://caaspp.cde.ca.gov (accessed 01/05/18); California Department of Education. (n.d.). Enrollment by school. https://www.cde.ca.gov/ds/sd/sd/filesenr.asp (accessed 12/29/17); California Department of Education. (n.d.). Staff demographic data. https://www.cde.ca.gov/ds/sd/df/filesstaff-demo.asp (accessed 01/05/18); National Center for Education Statistics. (n.d.). Common Core of Data. https://nces.ed.gov/ccd (accessed 01/05/18); National Center for Education Statistics. (n.d.). Education demographic and geographic estimates. https://nces.ed.gov/programs/edge (accessed 01/05/18); United States Census Bureau. (n.d.). Annual survey of school system finances. https://www.census.gov/programs-surveys/school-finances.html (accessed 01/05/18).

Results

Model 1: District characteristics

Our first model is informed by research showing that district socioeconomic characteristics are strongly associated with student achievement.[9] For example, beginning in 1966, the Coleman Report famously highlighted the significant relationship between family socioeconomic status and student achievement. Countless studies have confirmed that the socioeconomic status of students' parents is one of the strongest predictors of their educational achievement.[10] In addition, numerous studies have found that schools with smaller student enrollments are associated with improved student achievement, and some have suggested that districts with smaller student enrollments have stronger performance, although the evidence on this score is more mixed.[11] Some studies have found that smaller schools and districts are especially beneficial for students from low-income families.[12]

The results of Model 1 in Table 3 show that the average socioeconomic status of families, as measured by their educational attainment, as well as the district's percent of students from low-income families, is indeed significantly associated with student achievement. In addition, we do not find a significant relationship between the number of students enrolled in a district and student achievement.

Model 2: District and teacher characteristics

> The percent of teachers holding substandard credentials is significantly and negatively associated with student achievement.

Our analyses confirm the widespread finding that teachers play an important role in contributing to student achievement. Teachers are often considered to be the most important within-school contributors to student achievement.[13] We examine several characteristics suggested by other research to be predictive of teacher effectiveness: student-teacher ratio,[14] the level of the teacher salary scale,[15] average teaching experience,[16] and full certification as a measure of teacher qualifications.[17] These variables are also at least modestly correlated with each other. For example, teachers teaching on substandard credentials (i.e., intern, permit, or waiver credentials), are often more likely to be found in relatively lower paying districts, and they tend to be the least experienced and effective.[18]

In Model 2, we find that the extent of preparation as reflected by teacher certification status has a strong association with average achievement for all students. After controlling for salaries and experience, the percent of teachers holding substandard credentials is significantly and negatively associated with student achievement. In these districts, for every 10% increase in the percent of teachers working on emergency permits, waivers, or intern credentials, the average achievement for students of color is lower, on average, by almost 0.10 standard deviations. For White students, every 10% increase in the percent of teachers teaching on substandard credentials is associated with achievement that is nearly .07 standard deviations lower.

In addition, we find that for African American and Hispanic students, average teacher experience is positively associated with student achievement. Although we do not find that teacher salary levels have a direct association with achievement in this model, salary levels are often associated with the qualifications of teachers, which are, in turn, associated with student achievement.[19]

When interpreting the results from this model, we note that higher percentages of teachers with substandard credentials may be a symptom of districts with a weaker labor market or with weaker teaching and learning conditions. For example, districts in rural areas with less proximity to schools of education and many amenities struggle to recruit and retain teachers, as do under-resourced communities, which often struggle as well to retain strong principals and provide sufficient teaching resources. These places that are difficult for teachers to work in and students to learn in may feel they need to hire more teachers on substandard credentials because relatively few teachers want to work in the district.[20] It is also true that districts are differentially focused on recruiting and retaining staff, and that some spend more of their money and effort to recruit and retain a strong teaching staff than others.[21]

Whatever the sources of substandard credentials, this finding highlights the importance of teacher characteristics as indicators of both the teaching and learning conditions within a district and as correlates of student achievement.

Model 3: District, teacher, and financial characteristics

Model 3 adds to the variables included in Models 1 and 2 by including measures of financial allocations in the district. In some other studies, higher per-pupil spending has been found to be associated with improved student achievement.[22] In addition, increased district expenditures allocated toward instruction[23] and investments in teacher quality[24] have been found to be especially effective at raising student achievement.

In our analysis, after controlling for student-teacher ratios, teacher salary levels, and teacher qualifications, total school spending does not have a statistically significant association with student achievement. This is not surprising, as these variables capture the major elements of total expenditures. Beyond overall spending, the percent of spending on instruction is moderately associated with the achievement of White students.

Interestingly, the significant association between underprepared teachers and the achievement of both students of color and White students remains in this model, as does the association between teacher experience and achievement for students of color. This confirms the well-documented role of teachers in supporting the achievement of all students, especially students of color.

Conclusions

These initial analyses indicate that a substantial number of districts in California are outperforming expectations for their students' achievement on the state's new, more rigorous assessments measuring deeper learning, and that these positive outliers are visible in large and small districts in urban and rural settings throughout the state.

> Districts that have been able to avoid the effects of the widespread teacher shortages by recruiting and retaining fully prepared teachers are much more likely to produce strong student achievement for African American and Hispanic students as well as for White students.

The analyses also show that, aside from socioeconomic status, a major predictor of student achievement is the preparedness of teachers. In our analyses, we used credentialing and experience as proxies for this knowledge and skill base (i.e., whether teachers hold a full credential, rather than an intern credential, temporary or short-term permit, or waiver for their teaching position). We recognize that a concentration of such teachers is also a sign of difficulty recruiting and retaining staff, which may signal broader differentials in teaching and learning conditions as well as teacher quality. Districts that have been able to avoid the effects of the widespread teacher shortages by recruiting and retaining fully prepared teachers are much more likely to produce strong student achievement for African American and Hispanic students as well as for White students.

To shed light on the practices that support student achievement, the Learning Policy Institute investigated a set of positive outlier districts during the 2017–18 school year to better understand how they support student achievement, especially the achievement of students of color. This study used in-depth interviews and observations in seven positive outlier school districts from across the state—Chula Vista Elementary, Clovis Unified, Gridley Unified, Hawthorne Unified, Long Beach Unified, San Diego Unified, and Sanger Unified—to identify factors that contribute to student success as reflected in state assessments and other outcome data, such as low suspension rates and high graduation rates. The case studies are published as a separate report identifying the instructional and other policies and practices found in common across these positive outliers.

Appendix A: Methodology

Constructing District-Level Socioeconomic Variables

To calculate district-level socioeconomic status (SES) in both Part I and Part II of our analysis, we include a measure of the number of socioeconomically disadvantaged students tested by race in each school district, as reported by the California Department of Education. To be considered socioeconomically disadvantaged, students must meet at least one of the two criteria: neither of their parents received a high school diploma, or they are eligible to receive free or reduced-price lunch.

We also include another six district SES measures constructed from publicly available American Community Survey's (ACS) Education Demographic and Geographic Estimates (EDGE) data. We use three data sets to construct the measures: (1) socioeconomic characteristics of the total population residing in each district, averaged over 2006–10; (2) socioeconomic characteristics of the families living in the district who have children enrolled in public school, averaged over 2006–10; and (3) socioeconomic characteristics of the total population residing in each district, averaged over 2009–13.

Ideally, we would like measures of the socioeconomic characteristics of families whose children were enrolled in public schools in each district in 2015–17, as those are the years that correspond to the populations taking the California Assessment of Student Performance and Progress (CAASPP) tests in our data. However, the ACS only provides small area EDGE estimates for 5-year windows, the most recent of which is 2009–13. Moreover, the only ACS tabulations in 2009–13 describe the total population in each district, rather than the population of families with children in public school, which is the population of interest. That population only has ACS EDGE data from 2006–10.

In order to construct estimates of the socioeconomic characteristics of families with children in public schools in 2009–13 (the closest years we can get to the 2015–17 CAASPP testing years), we do the following:

1. We first estimate the relationship between the SES measures in the total population and of the children in a district in the 2006–10 sample with the following regression:

$$SES\ Child_d^{0610} = \left[\boldsymbol{SES\ Total_d^{0610}}\right]\mathrm{B} + \ e_d$$

where $SES\ Child_d^{0610}$ is one of the six child socioeconomic variables measured in 2006–10, $\left[\boldsymbol{SES\ Total_d^{0610}}\right]$ is a vector of all six socioeconomic variables of the total population in the district, measured in 2006–10. We then capture the values of $\widehat{\mathrm{B}}$ and $\hat{e}_d$.

2. Next, we predict the socioeconomic characteristics of the families with children enrolled in public school in 2009–13, using the following equation:

$$\widehat{SES\ Child}_d^{0913} = \left[\boldsymbol{SES\ Total_d^{0913}}\right]\widehat{\mathrm{B}} + \ \hat{e}_d$$

where $\widehat{SES\ Child}_d^{0913}$ is the predicted value of one of the six child variables in 2009–13, $\left[\boldsymbol{SES\ Total_d^{0913}}\right]$ is a vector of the six socioeconomic variables of the total population in 2009–13, and $\widehat{\mathrm{B}}$ and $\hat{e}_d$ are the fitted coefficients and residuals from the regression above.

With this method, we assume that the relationship between the SES of the total population and the population of public school children in a district, as well as the deviation from that predicted relationship, is the same between the 2006–10 and 2009–13 samples.

Model and Parameters

We use a two-level, precision-weighted hierarchical linear model to identify the districts that are performing better on CAASPP than one would predict based on the SES of the families each district serves. We use a multilevel model because we observe average test scores in multiple grades, years, and subjects in each district; thus, the model accounts for the nesting of grade-year-subject cells within districts. The precision weighting gives more weight in the estimation to cells whose mean test scores are more precisely estimated (that is, it gives more weight to observations based on larger numbers of students). The model can be written as follows:

$$\hat{Y}_{gd} = \alpha_{0d} + \alpha_{1d}\,(grade - G) + e_{gd} + r_{gd}$$

$$\alpha_{0d} = \beta_{00} + \beta_{01}\widehat{SES}_d + u_{0d}$$

$$\alpha_{1d} = \beta_{10} + \beta_{11}\widehat{SES}_d + u_{1d}$$

$$r_{gd} \sim N;\left[0, \omega_{gd}^2\right];\; e_{gd} \sim N[0, \sigma^2];\; \binom{u_{0d}}{u_{1d}} \sim MVN[0, \tau^2].$$

In this model,

- $\hat{Y}_{gd}$ is the estimated average English language arts or math score for a particular district, grade, year, and subgroup, standardized with the state mean and standard deviation.
- α_{0d} is a random district-specific intercept that indicates the average test scores in district d and grade G (where the linear grade term is centered on grade G). For districts serving grades 3–8, we center the grade at 5.5. For districts serving grades 3–8 and 11, we center the grade at 7. In this way, the intercept estimates the district's performance at its "average" grade. α_{0d} has a mean of β_{00} and a variance of τ_{00}^2, both of which must be estimated.
- α_{1d} is a district-specific grade slope; it indicates the linear trends in average test scores across grades within district d. α_{1d} has a mean of β_{10} and a variance of τ_{11}^2, both of which must be estimated.
- r_{gd} is the sampling error of $\hat{Y}_{gd}$. We assume it is normally distributed with mean zero and variance $\omega_{gd}^2 = 1/N_{gd}$, where N_{gd} is the number of students tested.
- e_{gd} is the level 1 error (the deviation of the true value of Y_{gd} from the linear trend in Y across grades in district d), which we also assume to be normally distributed with a mean of 0 and a variance, σ^2, to be estimated.

Parameters

The parameters of interest are as follows:

We rank districts based on their value of u_{0d}^{*}, the empirical Bayes "shrunken" estimate of u_{0d}. This tells us the difference between a district's actual average performance and what one would predict the performance of the district to be based on its socioeconomic characteristics. In all cases, a larger positive residual means a district performed better than expected for students of a given racial/ethnic group controlling for their families' socioeconomic status. (A larger negative residual means a district performed worse than expected.) We also provide the standard error of this residual and calculate the 95% confidence interval.

We also include a fitted value of the average district performance. We calculate this value as follows:

$$Fitted\ Value_d = \hat{\beta}_{00} + \hat{\beta}_{01}\widehat{SES}_d$$

This is a district's predicted average performance of the district based solely on its socioeconomic variables. We add this estimate so that it is clear how well a district was predicted to perform, and one can easily compare that to how the district actually performed.

Finally, we include an empirical Bayes "shrunken" estimate of the average achievement in the district, denoted $\alpha_{0d}^{*} = \hat{\beta}_{00} + \hat{u}_{0d}^{*}$. This parameter is estimated from a two-level model that is identical to the one above, but without the SES measures. This provides a "shrunken" estimate of the average performance in each district (shrunken so that small districts with imprecise estimates get discounted).

Reliability of estimates

We include reliability estimates in 2015 for the intercepts $\hat{\alpha}_{0d}$. The rankings are only informative if we can reliably calculate the parameters of interest. As shown in Table A1, the reliabilities of the intercept from models that include socioeconomic variables and from which we obtain the residuals range from a high of 0.911 to a low of 0.766. The reliabilities of the district means that come from models that do not include SES range from a high of 0.978 to a low of 0.876. The vast majority of parameters are therefore estimated with a high reliability.

Table A1
Reliability of Estimates

Subgroup	Subject	Reliability of Average District Performance (SES adjusted models)	Reliability of Average District Performance (unadjusted models)
All	ELA	0.911	0.978
	Math	0.904	0.977
African American	ELA	0.789	0.884
	Math	0.766	0.876
Hispanic	ELA	0.871	0.941
	Math	0.844	0.931

Data sources: California Department of Education. (n.d.). California Assessment of Student Performance and Progress (CAASPP) results. https://caaspp.cde.ca.gov (accessed 01/05/18); National Center for Education Statistics. (n.d.). Education demographic and geographic estimates. https://nces.ed.gov/programs/edge (accessed 01/05/18).

Analysis

For our Part II analysis of achievement predictors, we add measures of district, teacher, and financial characteristics to the hierarchical linear models described above. We include these district-level measures on the second level in our model. For these analyses, we center all of the variables, except the dummy variables. To calculate the socioeconomic variables for the African American and Hispanic combined group, we estimate the weighted average for each socioeconomic variable by grade and year and then take the average of these estimates to calculate the district-level socioeconomic variable. We include our full results in Table A2 below.

The full results of the analysis include three key additions to what is noted in the body of this report. First, the full results include the intercept of the model. The intercept can be thought of as the average test score in the average grade (in this case approximately grade 6 because we centered grade) in the "average" district.

Second, the results include grade-level slopes of the variables in our analysis. The coefficient on "Grade" can be thought of as the average change in test scores, per grade, relative to the statewide average. Because the test scores are standardized within each grade and year and subject, a value of 0 represents average growth; positive values indicate above-average improvement rates; negative values indicate below-average improvement. The coefficients on the interaction terms with grade (covariate_×_grade terms) can be interpreted as the relationship between the covariate and the rate of average test score improvement across grades. For example, the negative coefficient on # Students_×_Grade indicates that districts with larger student enrollments have lower average test score improvement per grade than do smaller districts.

Third, we include several variables to examine potential confounding relationships. To address the issue of districts with large enrollments biasing our results, we include a dummy variable for Los Angeles Unified School District (in addition to using the logged variable for student enrollment). We also include the percentage of students receiving special education services in our models. For the teacher salary data, we include a dummy variable for whether a district was missing salary data, because not all districts report these data. We find that there is not a relationship between the districts missing salary data and White student achievement, and only a modest association between districts missing salary data and African American and Hispanic achievement. This suggests that our approach to imputing missing values with average salary data does not significantly bias our results.

Table A2
Full Results of Hierarchical Linear Model Analysis of Correlates of Student Achievement

	Model 1		Model 2		Model 3	
	African American and Hispanic Score	White Score	African American and Hispanic Score	White Score	African American and Hispanic Score	White Score
Intercept	-0.217***	0.207***	-0.213***	0.208***	-0.212***	0.210***
	(0.007)	(0.006)	(0.007)	(0.006)	(0.007)	(0.006)
SES: Percent of Parents With Bachelor's or Above	0.847***	0.916***	0.866***	0.946***	0.876***	0.907***
	(0.115)	(0.073)	(0.112)	(0.073)	(0.114)	(0.080)
SES: Poverty Rate of Head of Household With 5- to 17–Year-Olds	-0.148	0.081	-0.122	0.079	-0.108	0.073
	(0.086)	(0.106)	(0.081)	(0.103)	(0.082)	(0.103)
SES: Percent Using SNAP Benefits	-0.047	-0.106	-0.039	-0.048	-0.051	-0.068
	(0.095)	(0.127)	(0.091)	(0.124)	(0.091)	(0.125)
SES: Percent of Households With Single Mother Head	-0.039	-0.140	-0.021	-0.119	-0.017	-0.123
	(0.072)	(0.081)	(0.069)	(0.079)	(0.068)	(0.079)
SES: Unemployment Rate	-0.162	-0.054	0.031	-0.103	0.013	-0.186
	(0.237)	(0.351)	(0.229)	(0.348)	(0.228)	(0.347)
SES: Median Income	0.014	0.003	0.020	0.002	0.017	0.002
	(0.030)	(0.033)	(0.029)	(0.032)	(0.029)	(0.032)
SES: Percent Economically Disadvantaged	-0.539***	-0.788***	-0.506***	-0.783***	-0.493***	-0.778***
	(0.062)	(0.059)	(0.060)	(0.057)	(0.061)	(0.061)
# of Students (Logged)	0.002	0.009	-0.014	-0.003	-0.013	-0.003
	(0.008)	(0.007)	(0.008)	(0.007)	(0.008)	(0.007)
Dummy for LAUSD	0.013	-0.088	0.069	-0.042	0.076	-0.041
	(0.146)	(0.133)	(0.139)	(0.128)	(0.139)	(0.127)
Student-Teacher Ratio			0.005	0.004	0.003	0.005
			(0.003)	(0.003)	(0.004)	(0.004)
Percent Students With Special Needs			-0.848**	-0.525	-0.822**	-0.659*
			(0.284)	(0.270)	(0.291)	(0.276)
Teacher Salary at BA + 60, Adjusted for Cost of Living (Logged)			0.033	0.053	0.036	0.042
			(0.039)	(0.036)	(0.039)	(0.037)

	Model 1		Model 2		Model 3	
	African American and Hispanic Score	White Score	African American and Hispanic Score	White Score	African American and Hispanic Score	White Score
Missing Salary Data			-0.058*	-0.018	-0.078*	-0.048
			(0.028)	(0.026)	(0.031)	(0.029)
Avg. Years Teaching Experience in District			0.008*	0.006	0.008*	0.006
			(0.004)	(0.003)	(0.004)	(0.003)
Percent Teachers With Intern Credentials, Temporary or Short-Term Permits, or Waivers			-0.919***	-0.727***	-0.884***	-0.677**
			(0.224)	(0.220)	(0.224)	(0.220)
Total Per-Pupil Expenditures (Logged)					-0.075	0.076
					(0.069)	(0.068)
Percent Spending on Instruction					0.163	0.285*
					(0.121)	(0.114)
Grade	0.001	-0.005***	0.001	-0.005***	0.001	-0.004**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
BA_×_Grade	-0.015	-0.019	-0.012	-0.011	-0.020	-0.016
	(0.021)	(0.016)	(0.021)	(0.016)	(0.022)	(0.018)
Poverty_×_Grade	0.030	0.011	0.034*	0.011	0.034*	0.008
	(0.016)	(0.025)	(0.016)	(0.025)	(0.016)	(0.025)
SNAP_×_Grade	-0.011	0.002	-0.011	0.002	-0.009	0.002
	(0.018)	(0.029)	(0.018)	(0.030)	(0.018)	(0.030)
Single_×_Grade	-0.009	-0.031	-0.010	-0.028	-0.010	-0.029
	(0.013)	(0.019)	(0.013)	(0.019)	(0.013)	(0.019)
Unemployment_×_Grade	0.042	0.105	0.056	0.130	0.051	0.119
	(0.043)	(0.079)	(0.044)	(0.080)	(0.044)	(0.081)
Median Income_×_Grade	-0.001	0.010	-0.001	0.009	0.000	0.009
	(0.006)	(0.008)	(0.006)	(0.009)	(0.006)	(0.009)
Percent Poor_×_Grade	0.008	0.027	0.011	0.026	0.009	0.027
	(0.011)	(0.014)	(0.011)	(0.014)	(0.012)	(0.015)
LAUSD_×_Grade	0.022	-0.020	0.027	-0.018	0.026	-0.018
	(0.023)	(0.024)	(0.023)	(0.024)	(0.023)	(0.024)
# Students_×_Grade	-0.004**	-0.004*	-0.006***	-0.005**	-0.006***	-0.005**
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)
Student-Teacher Ratio_×_Grade			0.001	0.001	0.001	0.001
			(0.001)	(0.001)	(0.001)	(0.001)

	Model 1		Model 2		Model 3	
	African American and Hispanic Score	White Score	African American and Hispanic Score	White Score	African American and Hispanic Score	White Score
Percent Special Needs_×_Grade			0.010	-0.072	-0.006	-0.088
			(0.055)	(0.060)	(0.056)	(0.062)
Teacher Salary_×_Grade			0.001	0.003	-0.000	0.002
			(0.007)	(0.008)	(0.007)	(0.008)
Missing Salary_×_Grade			-0.001	-0.003	-0.006	-0.006
			(0.006)	(0.006)	(0.006)	(0.006)
Teaching Experience_×_Grade			0.001	0.001	0.001	0.001
			(0.001)	(0.001)	(0.001)	(0.001)
Teacher Credentials_×_Grade			-0.054	0.010	-0.045	0.015
			(0.041)	(0.048)	(0.041)	(0.048)
Per-Pupil Expenditures_×_Grade					0.013	0.011
					(0.013)	(0.015)
Spending Instruction_×_Grade					0.058*	0.034
					(0.026)	(0.026)
N_1	8216	7922	8216	7922	8216	7922
N_2	2758	2713	2758	2713	2758	2713
N_3	435	435	435	435	435	435
R-Squared	0.668	0.855	0.703	0.867	0.706	0.869

Note: Standard errors in parentheses: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Data sources: California Commission on Teacher Credentialing. (n.d.). Teacher supply: Credentials. https://www.ctc.ca.gov/commission/reports/data/edu-supl-landing (accessed 01/05/18); California Department of Education. (n.d.). California Assessment of Student Performance and Progress (CAASPP) results. https://caaspp.cde.ca.gov (accessed 01/05/18); California Department of Education. (n.d.). Enrollment by school. https://www.cde.ca.gov/ds/sd/sd/filesenr.asp (accessed 12/29/17); California Department of Education. (n.d.). Staff demographic data. https://www.cde.ca.gov/ds/sd/df/filesstaffdemo.asp (accessed 01/05/18); National Center for Education Statistics. (n.d.). Common Core of Data. https://nces.ed.gov/ccd (accessed 01/05/18); National Center for Education Statistics. (n.d.). Education demographic and geographic estimates. https://nces.ed.gov/programs/edge (accessed 01/15/18); United States Census Bureau. (n.d.). Annual survey of school system finances. https://www.census.gov/programs-surveys/school-finances.html (accessed 01/15/18).

Appendix B: List of Positive Outlier Districts for African American and Hispanic Students

The two tables below list positive outlier districts, which are ranked according to the size of their residual for African American and Hispanic students, respectively. Districts with the largest residual—where African American and Hispanic students achieve much higher than predicted—are listed first. The district residuals are averaged by subjects, grades, and across years (i.e., 2015–17).

Table B1
List of Positive Outlier Districts for African American Students

As Presented in Figure 3

District Name	African American Student Residual	White Student Residual
Chula Vista Elementary	0.213	0.233
Perris Elementary	0.199	0.048
Etiwanda Elementary	0.180	0.174
Alvord Unified	0.173	0.111
Santa Monica-Malibu Unified	0.173	0.018
ABC Unified	0.170	0.230
Lemon Grove	0.167	0.181
Redlands Unified	0.163	0.106
San Diego Unified	0.160	0.142
San Marcos Unified	0.154	0.200
Greenfield Union	0.146	0.110
Lawndale Elementary	0.144	0.192
Hawthorne	0.142	0.119
Downey Unified	0.140	0.093
Long Beach Unified	0.119	0.117
San Bernardino City Unified	0.110	0.092
Tustin Unified	0.109	0.008
Upland Unified	0.106	0.031
Desert Sands Unified	0.106	0.112
Corona-Norco Unified	0.085	0.059
Culver City Unified	0.080	0.087

District Name	African American Student Residual	White Student Residual
Visalia Unified	0.079	0.115
William S. Hart Union High	0.077	0.075
Val Verde Unified	0.076	0.167
La Mesa-Spring Valley	0.075	0.120
Center Joint Unified	0.071	0.189
Bellflower Unified	0.059	0.111
Twin Rivers Unified	0.058	0.093
Merced City Elementary	0.055	0.035
Sacramento City Unified	0.054	0.064
Vista Unified	0.053	0.075
Central Elementary	0.053	0.083
Dry Creek Joint Elementary	0.043	0.018
Riverside Unified	0.042	0.048
Torrance Unified	0.042	0.003
Palm Springs Unified	0.038	0.009
Bakersfield City	0.033	0.081
Apple Valley Unified	0.029	0.022
Fremont Unified	0.029	0.032
Oceanside Unified	0.029	0.100
Grossmont Union High	0.027	0.012
Elk Grove Unified	0.020	0.107
Anaheim Union High	0.017	0.003
Brentwood Union Elementary	0.017	0.005
Murrieta Valley Unified	0.013	0.035
Cucamonga Elementary	0.008	0.001
Fresno Unified	0.005	0.034
Alta Loma Elementary	0.002	0.071

Data sources: California Department of Education. (n.d.). California Assessment of Student Performance and Progress (CAASPP) results. https://caaspp.cde.ca.gov (accessed 01/05/18); National Center for Education Statistics. (n.d.). Education demographic and geographic estimates. https://nces.ed.gov/programs/edge (accessed 01/05/18).

Table B2
List of Positive Outlier Districts for Hispanic Students

As Presented in Figure 4

District Name	Hispanic Student Residual	White Student Residual
Newhall	0.354	0.300
Hawthorne	0.326	0.119
Winton	0.310	0.384
Palo Verde Union Elementary	0.307	0.061
La Canada Unified	0.298	0.084
Little Lake City Elementary	0.286	0.274
Coast Unified	0.283	0.070
Magnolia Elementary	0.280	0.354
Carmel Unified	0.271	0.182
Gridley Unified	0.255	0.122
Solvang Elementary	0.254	0.131
Clovis Unified	0.249	0.180
Kings Canyon Joint Unified	0.240	0.163
Lawndale Elementary	0.236	0.192
Sulphur Springs Union	0.233	0.234
Holtville Unified	0.228	0.122
Los Alamitos Unified	0.223	0.179
Solana Beach Elementary	0.221	0.058
ABC Unified	0.220	0.230
Atwater Elementary	0.218	0.243
Sanger Unified	0.214	0.257
Kingsburg Elementary Charter	0.213	0.050
Wright Elementary	0.212	0.032
Chula Vista Elementary	0.204	0.233

District Name	Hispanic Student Residual	White Student Residual
Sundale Union Elementary	0.203	0.334
Caruthers Unified	0.197	0.093
Bassett Unified	0.196	0.073
Downey Unified	0.195	0.093
Nuview Union	0.194	0.141
Kerman Unified	0.191	0.177
Fallbrook Union Elementary	0.190	0.291
Placentia-Yorba Linda Unified	0.184	0.115
Live Oak Unified	0.183	0.190
Encinitas Union Elementary	0.181	0.048
Rocklin Unified	0.175	0.083
Etiwanda Elementary	0.174	0.174
East Whittier City Elementary	0.173	0.146
Greenfield Union	0.167	0.110
Val Verde Unified	0.166	0.167
Del Mar Union Elementary	0.166	0.123
Centralia Elementary	0.165	0.262
North County Joint Union Elementary	0.164	0.141
South Bay Union	0.157	0.225
Duarte Unified	0.157	0.031
Mother Lode Union Elementary	0.157	0.053
Carlsbad Unified	0.157	0.148
Riverdale Joint Unified	0.156	0.007
Perris Elementary	0.154	0.048
McCabe Union Elementary	0.153	0.117
Firebaugh-Las Deltas Unified	0.150	0.016
Ocean View	0.149	0.092

District Name	Hispanic Student Residual	White Student Residual
Delhi Unified	0.148	0.084
San Marcos Unified	0.148	0.200
West Covina Unified	0.147	0.154
Mesa Union Elementary	0.145	0.041
Central Union High	0.142	0.003
Hanford Elementary	0.141	0.221
El Monte City	0.139	0.398
Antelope Valley Union High	0.138	0.069
Fruitvale Elementary	0.137	0.132
Carpinteria Unified	0.133	0.060
Bellflower Unified	0.132	0.111
Saint Helena Unified	0.131	0.053
Weaver Union	0.129	0.100
Whittier Union High	0.128	0.157
Redlands Unified	0.124	0.106
National Elementary	0.122	0.198
Monrovia Unified	0.122	0.161
Glendora Unified	0.121	0.140
Oak Valley Union Elementary	0.119	0.135
South Pasadena Unified	0.116	0.148
Brea–Olinda Unified	0.115	0.032
Savanna Elementary	0.114	0.149
Desert Sands Unified	0.113	0.112
Corona-Norco Unified	0.113	0.059
Covina-Valley Unified	0.112	0.123
Fowler Unified	0.111	0.229
Garden Grove Unified	0.110	0.120

District Name	Hispanic Student Residual	White Student Residual
Huntington Beach City Elementary	0.109	0.165
Central Union Elementary	0.109	0.254
Ceres Unified	0.107	0.064
Lakeport Unified	0.106	0.033
Burlingame Elementary	0.105	0.163
Waterford Unified	0.104	0.135
Fountain Valley Elementary	0.102	0.093
Long Beach Unified	0.101	0.117
Selma Unified	0.101	0.162
Snowline Joint Unified	0.099	0.111
Mountain View Whisman	0.098	0.288
Hart-Ransom Union Elementary	0.097	0.016
William S. Hart Union High	0.096	0.075
Los Altos Elementary	0.095	0.083
Pioneer Union Elementary	0.094	0.060
Imperial Unified	0.092	0.148
Cypress Elementary	0.092	0.042
Lemon Grove	0.092	0.181
Keyes Union	0.091	0.097
Central Elementary	0.090	0.083
Bonita Unified	0.090	0.077
Westminster	0.088	0.250
Glendale Unified	0.087	0.135
Lemoore Union Elementary	0.087	0.056
San Bernardino City Unified	0.087	0.092
Porterville Unified	0.087	0.091
Chino Valley Unified	0.086	0.054

District Name	Hispanic Student Residual	White Student Residual
Murrieta Valley Unified	0.085	0.035
Red Bluff Union Elementary	0.083	0.143
Tustin Unified	0.081	0.008
Santee	0.074	0.122
Gilroy Unified	0.072	0.028
Moreland	0.072	0.207
Visalia Unified	0.070	0.115
El Centro Elementary	0.068	0.049
Riverside Unified	0.066	0.048
Tahoe-Truckee Unified	0.065	0.020
Palo Alto Unified	0.065	0.052
Colusa Unified	0.065	0.053
Rowland Unified	0.064	0.190
Lowell Joint	0.063	0.145
Alvord Unified	0.063	0.111
Galt Joint Union Elementary	0.063	0.044
Alhambra Unified	0.057	0.010
Santa Monica-Malibu Unified	0.055	0.018
Beardsley Elementary	0.054	0.050
McSwain Union Elementary	0.052	0.036
Pleasanton Unified	0.050	0.061
Arcadia Unified	0.049	0.096
Albany City Unified	0.048	0.028
Culver City Unified	0.047	0.087
Salida Union Elementary	0.045	0.041
Elk Grove Unified	0.045	0.107
Alum Rock Union Elementary	0.043	0.210

District Name	Hispanic Student Residual	White Student Residual
Lompoc Unified	0.043	0.081
San Diego Unified	0.043	0.142
Moorpark Unified	0.043	0.078
Wilsona Elementary	0.041	0.182
San Ysidro Elementary	0.041	0.186
Grossmont Union High	0.040	0.012
Upland Unified	0.039	0.031
Palmdale Elementary	0.038	0.017
Redding Elementary	0.036	0.059
Empire Union Elementary	0.036	0.025
La Mesa-Spring Valley	0.035	0.120
Golden Valley Unified	0.034	0.061
Roseville City Elementary	0.032	0.068
Rescue Union Elementary	0.030	0.021
Fullerton Elementary	0.028	0.030
Goleta Union Elementary	0.027	0.130
Temecula Valley Unified	0.027	0.037
Pomona Unified	0.025	0.074
Oceanside Unified	0.024	0.100
Placerville Union Elementary	0.023	0.035
Bakersfield City	0.022	0.081
Palm Springs Unified	0.019	0.009
Orcutt Union Elementary	0.013	0.051
Hacienda La Puente Unified	0.013	0.054
Strathmore Union Elementary	0.013	0.007
Milpitas Unified	0.009	0.184
Norwalk-La Mirada Unified	0.009	0.025

District Name	Hispanic Student Residual	White Student Residual
Robla Elementary	0.007	0.198
Torrance Unified	0.005	0.003
Victor Elementary	0.005	0.068
Sweetwater Union High	0.004	0.034
Ventura Unified	0.004	0.095
Livingston Union	0.004	0.056
Fontana Unified	0.004	0.054
Taft City	0.003	0.072

Data sources: California Department of Education. (n.d.). California Assessment of Student Performance and Progress (CAASPP) results. https://caaspp.cde.ca.gov (accessed 01/05/18); National Center for Education Statistics. (n.d.). Education demographic and geographic estimates. https://nces.ed.gov/programs/edge (accessed 01/05/18).

Endnotes

1. Darling-Hammond, L. (2011). "Testing, No Child Left Behind, and Educational Equity" in Stulberg, L. M., & Lawner Weinberg, S. (Eds.). *Diversity and Higher Education* (pp. 36–48). New York, NY: Routledge; Sunderman, G., & Kim, J. (2004). *Inspiring vision, disappointing results: Four studies on implementing the No Child Left Behind Act*. Cambridge, MA: Harvard Civil Rights Project.

2. See, e.g., Darling-Hammond, L., & Sutcher, L. (2016, September 19). Equity gaps in California: What the new test scores tell us. *EdSource*. https://edsource.org/2016/equity-gap-in-california-what-the-new-test-scores-tell-us/569435; Tucker, J. (2017, September 27). California releases annual test scores—stagnant results, persistent gaps. *SFGate*. http://www.sfgate.com/education/article/California-releases-annual-test-scores-12232610.php.

3. We focus on African American, Hispanic, and White California students because African American and Hispanic students have, on average, scored well below White and Asian American students in mathematics and English language arts for many years. See: Cano, R. (2018, October 2). California's test scores are so stagnant, it could take a generation to close the achievement gap. *CALmatters*. https://calmatters.org/articles/california-achievement-gap-persists-in-test-scores.

4. Because the controls we use for the SES for each racial/ethnic group in the district are drawn from a small share of households in the American Community Survey (i.e., approximately 10% of households in the district), a large enough sample, in this case at least 200 students from each racial/ethnic group subject to analysis, is necessary to ensure to ensure the stability of these estimates. We also use a sample of at least 2,000 students in the district as a whole.

5. To ensure that the large student enrollment of Los Angeles Unified School District does not bias our estimates, our models include a dummy variable for LAUSD.

6. Kini, T., & Podolsky, A. (2016). *Does teaching experience increase teacher effectiveness? A review of the research.* Palo Alto, CA: Learning Policy Institute; Podolsky, A., Kini, T., Bishop, J., & Darling-Hammond, L. (2016). *Solving the teacher shortage: How to attract and retain excellent educators.* Palo Alto, CA: Learning Policy Institute.

7. Taylor, L. (2013). Extending the NCES CWO. Bush School of Government & Public Service. http://bush.tamu.edu/research/faculty/Taylor_CWI.

8. Carver-Thomas, D., & Darling-Hammond, L. (2017). *Addressing California's growing teacher shortage: 2017 update.* Palo Alto, CA: Learning Policy Institute.

9. Reardon, S. F. (2011). "The Widening Academic Achievement Gap Between the Rich and the Poor: New Evidence and Possible Explanations" in Duncan, G. J., & Murnane, R. J. (Eds.). *Whither Opportunity? Rising Inequality, Schools, and Children's Life Chances* (pp. 91–116). New York, NY: Russell Sage Foundation.

10. See, for example: Bowles, S., & Gintis, H. (1976). *Schooling in Capitalist America: Educational Reform and the Contradictions of Economic Life*. New York: Basic Books; Bowles, S., & Gintis, H. (2002). The inheritance of inequality. *Journal of Economic Perspectives, 16*(3), 3–30; Brooks-Gunn, J., & Duncan, G. (1997). The effects of poverty on children. *Future of Children, 7*(2), 55–71; Duncan, G. J., Brooks-Gunn, J., & Klebanov, P. K. (1994). Economic deprivation and early childhood development. *Child Development, 65*(2), 296–318; Reardon, S. F. (2011). "The Widening Academic Achievement Gap Between the Rich and the Poor: New Evidence and Possible Explanations" in Duncan, G. J., & Murnane, R. J. (Eds.). *Whither Opportunity? Rising Inequality, Schools, and Children's Life Chances* (pp. 91–116). New York, NY: Russell Sage Foundation; Reardon, S. F. (2016). *School district socioeconomic status, race, and academic achievement.* (Working paper). Stanford, CA: Stanford Center for Educational Policy Analysis.

11. See, for example: Howley, C. (1989). Synthesis of the effects of school and district size: What the research says about achievement in small schools and school districts. *Journal of Rural and Small Schools, 4*(1), 2–12; Howley, C. (1996). Compounding disadvantage: The effects of school and district size on student achievement in West Virginia. *Journal of Research in Rural Education, 12*(1), 25–32; Lewis, A. (2008). Doing more with less. *Phi Delta Kappan, 89*(8), 547; Sirin, S. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of Educational Research, 75*(3), 417–453.

12. Howley, C. (1996). Compounding disadvantage: The effects of school and district size on student achievement in West Virginia. *Journal of Research in Rural Education, 12*(1), 25–32; Bickel, R., & Howley, C. (2000). The influence of scale on school performance: A multi-level extension of the Matthew Principle. *Education Policy Analysis Archives, 8*(22).

13. Chetty, R., Friedman, J. N., & Rockoff, J. E. (2014). Measuring the impacts of teachers II: Teacher value-added and student outcomes in adulthood. *American Economic Review, 104*(9), 2633–2679; Rivkin, S. G., Hanushek, E. A., & Kain, J. F. (2005). Teachers, schools, and academic achievement. *Econometrica, 73*, 417–458; Rockoff, J. (2004). The impact of individual teachers on student achievement: Evidence from panel data. *American Economic Review, 94*, 247–252.

14. Glass, G. V., & Smith, M. (1979). Meta-analysis of class size and achievement. *Educational Evaluation and Policy Analysis, 1*(1), 2–16; Kim, J. (2007). The relative influence of research on class-size policy. *Brookings Papers on Education Policy 2006/2007* (pp. 273–295). Washington, DC: Brookings Institute Press; Mosteller, F. (1995). The Tennessee study of class size in the early school grades. *The Future of Children*, *5*(2), 113–127; Nye, B., Hedges, L. V., and Konstantopoulos, S. (1999). The long-term effects of small classes: A five-year follow-up of the Tennessee class-size experiment. *Evaluation and Policy Analysis, 21*(2), 127–142.

15. Adamson, F., & Darling-Hammond, L. (2012). Funding disparities and the inequitable distribution of teachers: Evaluating sources and solutions. *Education Policy Analysis Archives, 20*(7), 1–46; Grissom, J. A., Viano, S. L., & Selin, J. L. (2015). Understanding employee turnover in the public sector: Insights from research on teacher mobility. *Public Administration Review, 76*(2), 241–251; Loeb, S., Darling-Hammond, L., & Luczak, J. (2005). How teaching conditions predict teacher turnover. *Peabody Journal of Education, 80*(3), 44–70.

16. For a review, see: Podolsky, A., Kini, T., & Darling-Hammond, L. Does teaching experience increase teacher effectiveness? A review of the research. *Journal of Professional Capital & Community.* (Forthcoming).

17. Boyd, D., Lankford, H., Loeb, S., Rockoff, J., & Wyckoff, J. (2008). The narrowing gap in New York City teacher qualifications and its implications for student achievement in high-poverty schools. *Journal of Policy Analysis and Management*, (4), 793–818; Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2010). Teacher credentials and student achievement in high school: A cross-subject analysis with student fixed effects. *Journal of Human Resources, 45*(3), 655–681; Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2007). Teacher credentials and student achievement: Longitudinal analysis with student fixed effects. *Economics of Education Review, 26*(6), 673–682; Darling-Hammond, L., Holtzman, D. J., Gatlin, S. J., & Heilig, J. V. (2005). Does teacher preparation matter? Evidence about teacher certification, Teach for America, and teacher effectiveness. *Education Policy Analysis Archives, 13*, 42.

18. Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2010). Teacher credentials and student achievement in high school a cross-subject analysis with student fixed effects. *Journal of Human Resources, 45*(3), 655–681.

19. Adamson, F., & Darling-Hammond, L. (2012). Funding disparities and the inequitable distribution of teachers: Evaluating sources and solutions. *Education Policy Analysis Archives, 20*(37). http://epaa.asu.edu/ojs/article/view/1053.

20. Podolsky, A., Kini, T., Bishop, J., & Darling-Hammond, L. (2016). *Solving the teacher shortage: How to attract and retain excellent educators*. Palo Alto, CA: Learning Policy Institute.

21. Podolsky, A., Kini, T., Bishop, J., & Darling-Hammond, L. (2016). *Solving the teacher shortage: How to attract and retain excellent educators*. Palo Alto, CA: Learning Policy Institute.

22. Baker, B. D. (2001). Can flexible non-linear modeling tell us anything new about educational productivity? *Economics of Education Review, 20*(1), 81–92; Figlio, D. N. (1999). Functional form and the estimated effects of school resources. *Economics of Education Review, 18*(2), 242–252; Dewey, G., Husted, T., & Kenny, L. (2000). The ineffectiveness of school inputs: A product of misspecification. *Economics of Education Review, 19*(2), 27–45; Greenwald, R., Hedges, L., & Laine, R. (1996). The effect of school resources on student achievement. *Review of Educational Research, 66*(3), 361–396; Taylor, C. (1998). "Does Money Matter? An Empirical Study Introducing Resource Costs and Student Needs Into Educational Production Function Analysis," in Fowler, W. J., Jr. (Ed.). *Developments in School Finance 1997* (pp. 75–97). Washington, DC: U.S. Department of Education, National Center for Education Statistics. http://nces.ed.gov/pubs98/98212.pdf#page=83.

23. Wenglinsky, H. (1997). How money matters: The effect of school district spending on academic achievement. *Sociology of Education, 70*(3), 221–237.

24. Ferguson, R. (1991). Paying for public education: New evidence on how and why money matters. *Harvard Journal on Legislation, 28*, 465–498.

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