Student Achievement Gains and California's Residency-Prepared Teachers

Technical Supplement

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LEARNING POLICY INSTITUTE

OCTOBER 2026

Acknowledgments

The authors thank the California Commission on Teacher Credentialing and the California Department of Education for facilitating our access to the data underlying these analyses and offering guidance in using it. We are especially grateful to Mary Vixie Sandy and Juliet Wahleithner at the California Commission on Teacher Credentialing and Sela Fessehaie and Jonathan Isler at the California Department of Education for their feedback. In addition, we thank our Learning Policy Institute (LPI) colleagues Nicole Arshan, Dion Burns, Linda Darling-Hammond, Tara Kini, Stacy Loewe, and Lucy Sorensen for their feedback and data support. We thank the members of the LPI Communications team for their invaluable support in designing, producing, and disseminating this information.

This research was supported by the Gates Foundation. Core operating support for LPI is provided by the Heising-Simons Foundation, William and Flora Hewlett Foundation, Raikes Foundation, Sandler Foundation, Skyline Foundation, and MacKenzie Scott. We are grateful to them for their generous support. The ideas voiced here are those of the authors and not those of our funders.

External Reviewers

The accompanying brief benefited from the insights and expertise of two external reviewers: Emily Penner, Associate Professor in the School of Education at the University of California, Irvine, and Matthew Ronfeldt, Professor in the Marshal Family School of Education at the University of Michigan. We thank them for the care and attention they gave the brief.

Suggested citation: Suggested citation: Patrick, S. K., & Tan, T. S. (2026). *Student achievement gains and California's residency-prepared teachers* [Technical supplement]. Learning Policy Institute. https://learningpolicyinstitute.org/media/5084/download?inline&file=CA_Student_Achievement_Gains_Residency_Prepared_Teachers_SUPPLEMENT.pdf

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Document last revised October 30, 2026

Table of Contents

Introduction **1**

Data on Preparation and Credentialing **2**

Data on Students, Staffing, and Schools **3**

California Assessment of Student Performance and Progress Data 3

Course Data 3

Enrollment Data 4

School and District Data 4

Study Sample **5**

Methods **12**

Analytical Models 12

Limitations 13

Endnotes **20**

List of Figures and Tables

Table S1 Sample Characteristics for Math Achievement Growth Analyses, by New Teacher Pathway ... 6

Table S2 Sample Characteristics for ELA Achievement Growth Analyses, by New Teacher Pathway ... 9

Table S3 Math Achievement Growth Regression Results 14

Table S4 ELA Achievement Growth Regression Results 15

Table S5 Math Achievement Growth Regression Models, by Pathway and Type of Credential 16

Table S6 ELA Achievement Growth Regression Models, by Pathway and Type of Credential 17

Table S7 Math Achievement Growth Regression Models, by Pathway and Grade Band 18

Table S8 ELA Achievement Growth Regression Models, by Pathway and Grade Band 19

Introduction

This Technical Supplement describes the data and methodological approach used in *Student Achievement Gains and California's Residency-Prepared Teachers*. These analyses used multiple statewide administrative data sources provided by the California Commission on Teacher Credentialing (CTC) and the California Department of Education (CDE). Both the CTC and CDE data use identifiers to uniquely differentiate educators working in California, and we used these identifiers to link teacher-level data across sources.

These analyses build off research done as part of a companion report, *Teacher Residencies in California: Enrollment, Preparation, and Outcomes of Residency-Prepared Teachers*. The technical appendix in that report offers detailed information on how we analyzed and cleaned each teacher-level data source. In this study, we incorporated additional student-level data sources, which are detailed below.

In this supplement, we first discuss CTC data on preparation and credentialing. We then describe CDE data on student courses, enrollment, test scores, staffing assignments, teacher demographics, and school characteristics. Finally, we explain our methodological approach, describe its limitations, and offer the full set of regression results.

Data on Preparation and Credentialing

The CTC gathers information on teaching candidates and approved teacher preparation programs, and these data can typically be linked with the credential database that captures all credentials, waivers, and permits issued by the CTC. We used the credential database to identify the first teaching credential awarded to each individual, which is key for identifying their pathway into teaching. The credential data can be used to create four pathway categories: (1) student teaching or residency program, (2) internship, (3) emergency permit, and (4) out-of-state prepared.

Additional data were needed to differentiate between student teachers and residents. We used the four data sources that capture data separately for residency programs, residency candidates, and residency completers: (1) the Accreditation Data System, (2) Preparation Program Completer surveys, (3) California Teaching Performance Assessment data, and (4) institution-specific data. For more information on how we analyzed and cleaned each data source, see the technical appendix in *Teacher Residencies in California*.

In California, there are more than 100 state-approved preparation institutions, including institutions of higher education and local education agencies (i.e., school districts and county offices of education). While some institutions offer programs across pathways (e.g., residency programs and student teaching programs), others offer only one pathway (e.g., only residency or only student teaching). Due to data limitations, there were certain institutions—including multiple California State University campuses with large enrollments—that did not have data that could differentiate residents from student teachers (for these institutions, residents are placed in the student teaching category). The companion report *Teacher Residencies in California* further describes the institutions offering residency programs, as well as the data limitations.

Taken together, the four data sources listed above allowed us to distinguish five pathways into the profession, which we describe in the California's Pathways Into Teaching section in the accompanying brief. In addition to pathway, we captured the credential area for each type of document: Multiple Subject, Single Subject, or Education Specialist. Multiple Subject documents allow teachers to teach core subjects across grade levels and are typically used for elementary schools and certain middle school settings. Single Subject documents allow teachers to teach specific subjects (teachers get authorizations in certain content areas) across grade levels. Single Subject credentials are typically used in secondary schools but can be used in certain elementary schools (e.g., teaching math in a departmentalized elementary grade or teaching a specialized subject like art). Education Specialist documents allow teachers to work with students with disabilities. A fourth credential type, the PK–3 Early Childhood Education credential, was introduced in California in 2024, but this credential was not yet in use during the years of these analyses.

Importantly, we merged this credential information with CDE staffing data described below to characterize new teachers of record (i.e., those who are observed as teachers for the first time in California public schools) by pathway. As a result, residents and student teachers were observed after they had completed preparation and received their preliminary credential. In contrast, those entering on intern credentials or emergency permits had not completed preparation or fulfilled the requirements for a preliminary credential.

Data on Students, Staffing, and Schools

We linked the preparation and credential data sources described above with multiple datasets provided by the CDE. These CDE data allowed us to follow teaching candidates into the classroom, identify their teaching positions and students, and describe the school and district contexts in which they work. Most importantly for these analyses, these student-level data enabled us to estimate students' achievement growth and compare growth across students based on their teacher's preparation pathway and credentials. In the section below, we describe these data, along with the analyses we conducted.

California Assessment of Student Performance and Progress Data

California students take the Smarter Balanced assessments in English language arts (ELA) and math in 3rd through 8th grades as part of the California Assessment of Student Performance and Progress (CAASPP) system. For these analyses, we used data from all tested students in the 2021–22 through 2024–25 school years. We first used rules established by CDE to only include students with assessments that were considered complete for state accountability purposes. As the key dependent variables for these analyses, we used ELA and math assessment scores, which were standardized by subject area, grade level, and testing year across all students in the state. We also included standardized assessment scores from the prior year as a covariate in our analyses, allowing us to interpret the outcome as a growth measure.

The CAASPP data also include key student demographic variables used by the state in accountability reporting. We used the following student-level variables from the CAASPP file: student race/ethnicity; student gender; indicator for socioeconomic disadvantage (indicating the student was eligible for free or reduced price meals in the National School Lunch Program, enrolled in another social benefits program, had two parents without high school diplomas, or identified as foster youth or homeless); indicator for English learners (students with another primary language other than English on the state-approved Home Language Survey and who had been determined as an English learner through state-approved oral language assessment procedures); and indicator for whether a student has an identified disability (students receiving special education services).

Course Data

All California districts must annually submit information on students' and teachers' course assignments. These data include unique identifiers for students and teachers, as well as specific course information (e.g., school identifier, state course codes, and unique course section numbers). We used these data to identify students' ELA and math courses for a given year and connect students to their teachers in those courses. Course data used for these analyses are collected annually in October, and they do not capture changes that may occur in course assignments if students transfer across schools. As a result, we used the enrollment data described below to remove students who likely transferred out of these courses during the school year.

Enrollment Data

California districts must report students' enrollment spells for each school year by school, and we used these enrollment data to check enrollment details for the schools in which students appeared in the course data and the CAASPP data.

School and District Data

To better understand the context in which students are learning and teachers are working, we also included school-by-year variables provided by the CDE or created using CDE data. First, we included variables capturing the percentages of students in a given school and year who were identified as English learners, students with disabilities, economically disadvantaged,[1] and being in specific racial or ethnic groups.[2] We also included a variable capturing schools' charter status.

We then merged additional school-level characteristics into the dataset using the County-District-School code. First, we added the school-level locale categories provided by the National Center for Education Statistics and collapsed them into three categories: urban, suburban, and rural or town.[3] Next, we added school-level expenditure data that capture per-pupil expenditures for each school within a county office of education or school district, including locally funded charter schools.[4] Finally, we added teacher salary information capturing the average entry-level salary for teachers with a bachelor's degree plus 30 hours at the district-by-year level.[5] We used the Consumer Price Index[6] to adjust both per-pupil expenditures and entry-level salaries for changing costs over time and used the Comparable Wage Index for Teachers[7] to adjust for differences in labor costs geographically across districts.

Study Sample

To build our two analytic samples (one for ELA and one for math), we began with all students in California who took the Smarter Balanced assessments in ELA or math in the 2022–23, 2023–24, and 2024–25 school years. We then examined whether students had a test score in a given subject from the prior year (adding 2021–22 for this purpose) and only kept student observations with a current-year and prior-year score in a given subject. Since the course data (described above) only capture course assignments as of October of each year and Smarter Balanced assessments are taken in the spring of each year, we only included students whose school in the course data file matched their school in the assessment file. We also examined the enrollment data to ensure that students had been enrolled in their school of course assignment and assessment for at least 85% of the year (dropping 6% of the sample). Thus, our sample underrepresents mobile students who switched schools throughout the year.

We created two distinct samples: one for ELA and one for math. For each sample, we merged the annual assessment data with the annual course-taking data so that we could identify the teacher assigned to each student each year in ELA or math. Finally, we limited each sample only to students who were taught by new teachers. Teachers were tagged as first-year teachers if it was their first year as a teacher of record in California public schools (i.e., they were the teacher legally responsible for students' learning and appeared in the course data as the teacher). We specifically included anyone identified in the CDE data as a teacher or an itinerant or pull-out/push-in teacher.

We provide two tables describing sample characteristics below. Table S1 includes information on the student, classroom, teacher, and school/district characteristics of the math sample, while Table S2 has the same information for the ELA sample. The first column of each table provides information on all student observations with new teachers; the subsequent columns offer the same information for students based on the entry pathway of their new teacher.

Notably, only about 5% of all student observations with ELA or math assessments across these years were taught by new teachers. Many California districts did not have any new teachers assigned to teach tested subjects in grades 4–8 over the 3-year period of this study. In the ELA assessment data, there were 940 California districts and 203 districts (22%) that never had any tested students with new teachers over this 3-year period. Similarly, 23% of districts never had tested students with new teachers in math.

Many new teachers did not teach grades 4–8 ELA or math, so their students were not included in these analyses. Across the 3 years of this study, 12% of new teachers taught in these tested grades and subjects. There were very similar shares of new teachers across each pathway, with 13% of all new residency-prepared teachers teaching grades 4–8 ELA and 12% teaching grades 4–8 math.

Not surprisingly, California students taught by new teachers systematically differed from all California students. Aligned with prior research on the inequitable distribution of teachers by experience, larger shares of economically disadvantaged students and Latino/a students were taught by new teachers compared to all tested California students.[8] Students taught by first-year teachers also had lower average prior-year assessment scores (0.14 standard deviations below the state average in ELA and 0.19 standard deviations below the state average in math).

The student, classroom, teacher, and school characteristics also varied across pathways, as illustrated in Table S1 and Table S2. Overall, residency-prepared new teachers taught students and worked in schools that looked more similar to those of teachers entering on internships and emergency permits than other pathways. New teachers prepared through student teaching and entering after out-of-state preparation taught slightly more advantaged students, on average, compared to other new teachers. These differences underscore the importance of accounting for a broad set of control variables when comparing achievement growth across pathways, as described in the next section.

Table S1. Sample Characteristics for Math Achievement Growth Analyses, by New Teacher Pathway

Variables	All new teachers	Residency	Student teaching	Internship	Emergency permit	Out-of-state prepared
Student performance (mean)						
Prior-year mathematics score (standardized)	-0.19	-0.32	-0.06	-0.32	-0.32	-0.10
Student characteristics (%)						
Asian	10.0%	8.5%	12.2%	8.2%	7.8%	10.8%
Black	5.2%	5.8%	4.4%	5.5%	6.0%	5.1%
Latino/a of any race	62.4%	71.2%	60.2%	67.0%	65.0%	53.9%
Multiracial	4.7%	3.5%	5.0%	4.0%	4.3%	6.2%
Native American	0.5%	0.4%	0.4%	0.5%	0.8%	0.7%
Pacific Islander	0.4%	0.4%	0.4%	0.4%	0.4%	0.5%
White	16.8%	10.4%	17.6%	14.4%	15.8%	22.9%
Female	48.7%	49.4%	49.3%	47.5%	48.3%	49.0%
Male	51.2%	50.5%	50.7%	52.5%	51.7%	50.9%
Gender missing	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%
Socioeconomically disadvantaged	68.0%	77.0%	64.4%	73.4%	72.3%	58.9%
Student with disabilities	13.8%	14.1%	12.1%	16.9%	14.5%	14.6%
English learner	19.0%	22.4%	18.0%	20.0%	20.3%	16.5%
Grade 4	18.7%	18.3%	20.5%	16.6%	17.4%	17.7%
Grade 5	20.2%	20.4%	21.1%	18.6%	20.0%	18.5%
Grade 6	20.2%	18.9%	18.7%	19.8%	23.0%	18.3%
Grade 7	22.4%	25.0%	21.1%	24.5%	22.6%	23.4%
Grade 8	18.6%	17.5%	18.5%	20.5%	17.1%	22.2%

Variables	All new teachers	Residency	Student teaching	Internship	Emergency permit	Out-of-state prepared
Classroom characteristics (mean)						
Class size (number of students)	25.10	24.23	25.76	24.22	24.66	25.22
Class prior-year mathematics score (standardized)	-0.27	-0.37	-0.14	-0.40	-0.40	-0.17
Teacher characteristics (%)						
Asian	10.9%	11.5%	12.8%	10.0%	6.7%	17.3%
Black	3.7%	4.2%	1.9%	4.1%	6.0%	3.1%
Latino/a of any race	35.7%	44.0%	35.4%	41.2%	39.2%	15.0%
Multiracial	1.9%	0.9%	2.6%	1.2%	1.6%	1.0%
Native American	0.5%	0.3%	0.3%	0.2%	0.9%	0.3%
Pacific Islander	0.2%	0.2%	0.1%	0.2%	0.2%	0.3%
White	36.6%	24.8%	37.6%	34.2%	33.8%	49.7%
Race/ethnicity missing	10.6%	14.1%	9.4%	9.0%	11.6%	13.4%
Female	72.2%	75.2%	75.3%	67.1%	68.4%	75.9%
Male	27.5%	24.5%	24.5%	32.4%	31.4%	23.2%
Non-binary	0.3%	0.3%	0.2%	0.5%	0.1%	0.9%
Gender missing	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Multiple subject credential	57.6%	66.7%	57.2%	53.7%	59.5%	53.8%
Single subject credential	37.0%	26.8%	41.6%	33.4%	31.1%	45.6%
Education specialist credential	4.2%	5.8%	2.4%	7.7%	5.3%	3.3%
School composition (mean)						
Percentage Asian in school	8.2	7.2	10.3	6.5	5.9	8.8
Percentage Black in school	5.5	6.4	4.7	6.1	6.3	5.5
Percentage Latino/a in school	60.2	69.0	57.9	64.3	63.0	52.0
Percentage White in school	17.2	11.3	17.9	15.1	16.2	23.2
Percentage economically disadvantaged in school	70.4	80.9	66.6	75.8	74.6	62.2
Percentage students with disabilities in school	15.1	14.8	15.2	15.2	15.1	15.4
Percentage English learners in school	22.1	24.9	21.4	22.5	23.4	19.0

Variables	All new teachers	Residency	Student teaching	Internship	Emergency permit	Out-of-state prepared
School or district characteristics (%)						
Charter	3.5%	5.7%	3.5%	3.1%	2.7%	5.3%
City	43.8%	56.3%	45.9%	42.4%	41.2%	38.9%
Suburb	44.3%	36.2%	47.7%	42.3%	40.9%	46.6%
Town/Rural	11.5%	4.7%	6.1%	14.9%	17.7%	13.9%
Locale missing	0.5%	2.8%	0.3%	0.5%	0.3%	0.6%
Average beginning salary, 1st (lowest) quartile	20.7%	10.8%	20.5%	17.4%	22.3%	24.8%
Average beginning salary, 2nd quartile	20.7%	9.9%	23.3%	20.2%	17.9%	24.1%
Average beginning salary, 3rd quartile	27.4%	31.2%	27.2%	27.5%	26.8%	28.5%
Average beginning salary, 4th (highest) quartile	28.3%	45.2%	26.6%	32.7%	29.1%	19.4%
Average beginning salary, missing	2.9%	3.0%	2.4%	2.1%	3.8%	3.2%
Average per pupil spending, 1st (lowest) quartile	20.5%	10.9%	20.3%	16.9%	20.1%	31.2%
Average per pupil spending, 2nd quartile	22.3%	15.5%	23.5%	18.7%	22.0%	25.9%
Average per pupil spending, 3rd quartile	24.4%	30.3%	20.8%	31.3%	27.9%	17.5%
Average per pupil spending, 4th quartile	25.8%	37.2%	29.4%	27.4%	21.0%	18.5%
Average per pupil spending, missing	7.0%	6.1%	6.0%	5.8%	9.0%	7.0%
Total student observations	**243,188**	**11,242**	**101,893**	**29,897**	**76,025**	**24,131**

Notes: This table shows the sample characteristics of students in our math achievement growth models who were taught by first-year teachers by pathway. We combined data across 3 academic years, 2022–23 to 2024–25.

Source: Learning Policy Institute analyses of dataset linking credential data provided by the California Commission on Teacher Credentialing to student and teacher data provided by the California Department of Education. (2026).

Table S2. Sample Characteristics for ELA Achievement Growth Analyses, by New Teacher Pathway

Variables	All new teachers	Residency	Student teaching	Internship	Emergency permit	Out-of-state prepared
Student performance (mean)						
Prior-year ELA score (standardized)	-0.14	-0.25	-0.02	-0.27	-0.27	-0.05
Student characteristics (%)						
Asian	10.4%	9.3%	11.9%	8.5%	8.5%	12.3%
Black	5.2%	4.7%	4.6%	5.4%	6.0%	5.4%
Latino/a of any race	61.8%	70.6%	60.4%	65.6%	63.7%	53.7%
Multiracial	4.8%	3.5%	5.0%	4.2%	4.3%	6.4%
Native American	0.5%	0.3%	0.3%	0.4%	0.7%	0.6%
Pacific Islander	0.4%	0.3%	0.4%	0.4%	0.5%	0.5%
White	17.0%	11.2%	17.5%	15.5%	16.3%	21.0%
Female	48.3%	47.7%	48.8%	47.8%	47.8%	48.6%
Male	51.6%	52.2%	51.2%	52.2%	52.1%	51.4%
Gender missing	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Socioeconomically disadvantaged	67.0%	74.1%	63.4%	73.4%	71.6%	58.9%
Student with disabilities	13.2%	14.5%	11.3%	16.6%	14.3%	14.1%
English learner	17.9%	22.3%	16.9%	18.7%	19.4%	15.6%
Grade 4	17.3%	19.5%	18.0%	15.8%	17.0%	16.3%
Grade 5	18.6%	22.3%	18.4%	17.6%	19.4%	16.9%
Grade 6	20.0%	21.2%	18.6%	20.2%	22.7%	17.1%
Grade 7	24.4%	23.1%	25.1%	24.3%	23.3%	25.2%
Grade 8	19.7%	14.0%	20.0%	22.1%	17.6%	24.5%
Classroom characteristics (mean)						
Class size (number of students)	25.22	24.39	25.87	24.15	24.75	25.32
Class average prior-year ELA score (standardized)	-0.20	-0.30	-0.09	-0.34	-0.32	-0.10
Teacher characteristics (%)						
Asian	7.5%	4.0%	8.7%	6.2%	4.3%	14.0%
Black	4.2%	2.1%	2.5%	4.4%	6.9%	4.1%
Latino/a of any race	33.7%	44.5%	32.1%	35.8%	39.8%	15.3%

Variables	All new teachers	Residency	Student teaching	Internship	Emergency permit	Out-of-state prepared
Multiracial	2.2%	1.1%	2.7%	1.6%	2.2%	1.0%
Native American	0.6%	0.3%	0.7%	0.2%	0.7%	0.9%
Pacific Islander	0.2%	0.2%	0.1%	0.5%	0.1%	0.7%
White	41.2%	33.4%	43.3%	42.7%	33.9%	55.1%
Race/ethnicity missing	10.5%	14.5%	9.9%	8.5%	12.0%	9.0%
Female	76.4%	77.8%	79.1%	70.9%	73.6%	79.3%
Male	23.0%	21.9%	20.4%	28.3%	26.0%	20.0%
Non-binary	0.5%	0.3%	0.6%	0.8%	0.4%	0.7%
Gender missing	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Multiple subject credential	54.3%	58.5%	51.8%	50.3%	61.6%	47.1%
Single subject credential	41.8%	36.9%	47.7%	39.1%	31.7%	50.7%
Education specialist credential	4.0%	6.3%	2.0%	7.2%	5.4%	3.6%
School composition (mean)						
Percentage Asian in school	8.0	7.6	9.5	6.4	6.2	9.4
Percentage Black in school	5.6	5.0	4.9	6.0	6.4	6.1
Percentage Latino/a in school	60.2	68.7	58.9	64.0	62.3	52.0
Percentage White in school	17.2	12.2	17.8	15.8	16.3	21.3
Percentage economically disadvantaged in school	70.1	77.7	66.8	75.2	74.7	61.9
Percentage students with disabilities in school	15.1	14.7	15.2	15.1	14.9	15.3
Percentage English learners in school	21.8	24.6	21.1	22.5	23.4	18.2
School or district characteristics (%)						
Charter	3.6%	3.8%	3.5%	3.2%	3.7%	4.6%
City	43.7%	51.5%	44.9%	48.7%	39.3%	42.3%
Suburb	44.3%	38.6%	49.3%	37.2%	41.7%	40.9%
Town/Rural	11.5%	7.8%	5.3%	14.1%	18.8%	15.8%
Locale missing	0.4%	2.1%	0.4%	0.0%	0.1%	1.1%
Average beginning salary, 1st (lowest) quartile	20.3%	9.8%	20.6%	17.3%	21.3%	23.7%
Average beginning salary, 2nd quartile	20.8%	14.3%	22.6%	19.8%	17.9%	24.9%

Variables	All new teachers	Residency	Student teaching	Internship	Emergency permit	Out-of-state prepared
Average beginning salary, 3rd quartile	27.7%	31.7%	29.0%	27.0%	26.3%	25.0%
Average beginning salary, 4th (highest) quartile	28.2%	39.5%	25.4%	34.1%	30.9%	20.8%
Average beginning salary, missing	3.1%	4.7%	2.5%	1.8%	3.6%	5.5%
Average per pupil spending, 1st (lowest) quartile	20.3%	12.7%	20.8%	16.0%	19.8%	27.5%
Average per pupil spending, 2nd quartile	23.1%	12.5%	24.7%	22.4%	22.6%	22.1%
Average per pupil spending, 3rd quartile	24.2%	33.8%	20.9%	29.5%	27.2%	19.9%
Average per pupil spending, 4th quartile	25.1%	33.8%	27.4%	25.4%	22.0%	19.8%
Average per pupil spending, missing	7.4%	7.2%	6.2%	6.8%	8.4%	10.7%
Total student observations	**261,564**	**10,500**	**115,800**	**31,352**	**77,785**	**26,127**

Notes: ELA = English language arts. This table shows the sample characteristics of students in our ELA achievement growth models who were taught by first-year teachers by pathway. We combined data across 3 academic years, 2022–23 to 2024–25.

Source: Learning Policy Institute analyses of a dataset linking credential data provided by the California Commission on Teacher Credentialing to student and teacher data provided by the California Department of Education. (2026).

Methods

In these analyses, we compared the achievement growth of California students taught by new teachers based on the pathway of their teacher. All analyses were conducted at the student level, and we combined 3 years of data. For our main models (shown in Table S3 for math and Table S4 for ELA), we operationalized our key teacher preparation pathway variable in two ways:

1. Residency versus non-residency: We compared the achievement growth of students taught by residency-prepared new teachers compared to students of all other new teachers (Panel A).
2. Individual pathways: We compared the achievement growth of students taught by residency-prepared new teachers to the students taught by new teachers entering through student teaching programs, internships, emergency permits, and out-of-state prepared (Panel B).

Analytical Models

As shown in all the regression results (Tables S3–S8), we estimated the differences across pathways using a series of models that added additional control variables. All models accounted for the prior-year score in that subject area, year of testing, and grade level of testing, and standard errors were always clustered at the teacher level.[9] Column 1 only adds the pathway variable. Column 2 adds the student characteristics (race/ethnicity, gender, socioeconomic disadvantage indicator, disability indicator, and English learner indicator). Column 3 adds the classroom characteristics (number of students in the class and class average prior-year score). Column 4 adds the teacher characteristics (race/ethnicity, gender, Multiple Subject credential indicator). Column 5 adds the school and district characteristics (student composition at the school level, charter indicator, geographic locale, per-pupil spending, and beginning teacher salary). The teacher preparation pathway coefficients in these models generalize to all California districts with new teachers teaching math or ELA in grades 4–8 during these years.

To better account for differences across districts that may affect teacher effectiveness and student learning, we included models with district fixed effects (Column 6) and district-by-year fixed effects (Column 7). In these models, the interpretation of the teacher preparation pathway variable changed from comparing students of new teachers across districts to comparing students of new teachers within the same district (Column 6) or within the same district and year (Column 7). These models accounted for all unobserved district-level characteristics that did not change across the 3-year period (Column 6) or within a given year (Column 7). These included contextual differences like the district's geographic region and size but could also include important district practices that affect the support new teachers and students receive. The pathway coefficient in these models generalizes to California districts that had at least two new teachers from different pathways teaching math or ELA in grades 4–8, including at least one residency-prepared new teacher. These models also included the student characteristics, classroom characteristics, teacher characteristics, school composition characteristics, and charter indicator as controls but did not include locale, per-pupil spending, and beginning teacher salary.[10] Given that these models better account for differences across districts, we included their results as the preferred models in the brief (shown in Table 2). All of the figures illustrating results in the brief use results from Model 7.

To supplement these findings, we conducted two additional subgroup analyses. First, we grouped students by the credential area of their teacher. In California, preparation programs, program standards curricula, and teaching standards all vary based on credential area. See Table S5 for math results for Single Subject credentials (Panel A) and Multiple Subject credentials (Panel B). Table S6 shows the results for ELA by credential area. Second, we examined differences in achievement growth by pathway, grouped by grade band. In California, most elementary schools serve students through grade 5, while middle schools serve grades 6–8 (some students are enrolled in schools with other grade configurations). See Table S7 for math results for grades 4–5 (Panel A) and grades 6–8 (Panel B). Table S8 shows results for ELA by grade band.

Finally, to create a comparison point for the magnitude of these findings, we also replicated the models shown in Column 7 of Table S3 and Table S4 but included all first-year and second-year teachers. In these models, we also included an indicator for years of experience, which allowed us to estimate the average achievement growth difference between students of first-year versus second-year teachers, all else equal.

Limitations

As with any research study, this study has notable limitations. As already described above, the statewide data used to differentiate residents from student teachers does not include all institutions and all years. As a result, this study may underestimate true differences between students of residency-prepared new teachers and those of new teachers prepared in student teaching programs. Next, our analyses can only speak to student achievement outcomes in tested subjects and do not include other measures of instructional effectiveness that could capture a wider range of teachers and teaching skills. Using standardized assessments like California's Smarter Balanced to measure achievement growth may be especially problematic for English learners,[11] a noteworthy issue given that about one fifth of California students are identified as English learners.

Our analyses cannot fully account for all potential sources of systemic differences in teachers across pathways. Analyses also cannot account for differences between districts in terms of which districts opt to participate in residency partnerships or hire residency-prepared new teachers. It may be the case that districts hiring residents also have different teacher recruitment practices, professional learning, and support mechanisms that could affect their teachers' instructional effectiveness, on average, compared to districts that have not hired residents. In our preferred models, we limited the comparison only to those districts that hired residency-prepared new teachers to better account for these potential selection effects. These models cannot fully account for all differences across schools within these districts, and it is possible that something about schools or principals hiring residents differentiates them from others within their districts that do not. In a separate analysis comparing whether the characteristics of schools where new teachers were employed were different, on average, than the overall characteristics of the district, we found that residency-prepared teachers taught in schools serving slightly higher shares of economically disadvantaged students than their district overall (average difference of 1.3 percentage points), slightly higher shares of English learners (average differences of 0.5 percentage points), and slightly higher shares of Latino/a students (average differences of 0.7 percentage points). There may be other differences across schools that we could not observe in our analyses, but there is not strong evidence among observable characteristics that schools hiring residents look systematically different from other schools within their district.

Despite these limitations, we believe these findings offer valuable comparisons of the achievement growth of students taught by new teachers based on the preparation pathway of those teachers and provide initial evidence on the instructional effectiveness of residency-prepared new teachers.

Table S3. Math Achievement Growth Regression Results

Variable	Outcome: Math score (standardized)						
	1	2	3	4	5	6	7
Panel A: Residency (residency as the reference group)							
All other pathways	0.000 (0.014)	-0.015 (0.013)	-0.025* (0.009)	-0.020* (0.009)	-0.012 (0.008)	-0.023* (0.009)	-0.026* (0.009)
Observations	243,188	243,188	243,188	243,188	243,188	243,180	243,163
R-squared	0.662	0.676	0.705	0.705	0.707	0.709	0.711
Panel B: Pathway (residency as the reference group)							
Student teaching	0.026† (0.014)	0.007 (0.013)	-0.026* (0.009)	-0.020* (0.009)	-0.012 (0.008)	-0.023* (0.009)	-0.027* (0.009)
Internship	-0.028† (0.015)	-0.034* (0.014)	-0.021* (0.010)	-0.017† (0.010)	-0.010 (0.009)	-0.018† (0.010)	-0.021* (0.010)
Emergency permit	-0.031* (0.014)	-0.041* (0.013)	-0.023* (0.009)	-0.021* (0.009)	-0.013 (0.008)	-0.024* (0.009)	-0.027* (0.010)
Out-of-state prepared	0.023 (0.017)	-0.001 (0.015)	-0.025* (0.010)	-0.016 (0.010)	-0.004 (0.009)	-0.020* (0.010)	-0.022* (0.011)
Observations	243,188	243,188	243,188	243,188	243,188	243,180	243,163
R-squared	0.663	0.677	0.705	0.705	0.707	0.709	0.711
Controls							
Prior-year math score	x	x	x	x	x	x	x
Year fixed effects	x	x	x	x	x	x	x
Grade fixed effects	x	x	x	x	x	x	x
Student characteristics		x	x	x	x	x	x
Classroom characteristics			x	x	x	x	x
Teacher characteristics				x	x	x	x
School/district characteristics[a]					x	x	x
District fixed effects						x	
District-by-year fixed effects							x

Notes: The table shows math achievement growth differences for students taught by residency-prepared new teachers compared to all other new teachers. We combined data across 3 academic years, 2022–23 to 2024–25. Standard errors are in parentheses. *$p < .05$. †$p < .10$. [a] Columns 6 and 7 include school composition and charter school indicators only.

Source: Learning Policy Institute analyses of dataset linking credential data provided by the California Commission on Teacher Credentialing to student and teacher data provided by the California Department of Education. (2026).

Table S4. ELA Achievement Growth Regression Results

Variable	Outcome: English language arts (ELA) score (standardized)						
	1	2	3	4	5	6	7
Panel A: Residency (residency as the reference group)							
All other pathways	0.015 (0.014)	0.001 (0.013)	-0.011 (0.008)	-0.009 (0.008)	-0.004 (0.008)	-0.003 (0.008)	-0.008 (0.009)
Observations	261,564	261,564	261,564	261,564	261,564	261,558	261,541
R-squared	0.621	0.639	0.669	0.669	0.671	0.673	0.675
Panel B: Pathway (residency as the reference group)							
Student teaching	0.035* (0.015)	0.017 (0.014)	-0.017* (0.009)	-0.014† (0.008)	-0.010 (0.008)	-0.010 (0.008)	-0.015† (0.009)
Internship	-0.023 (0.016)	-0.028† (0.015)	-0.013 (0.009)	-0.010 (0.009)	-0.005 (0.009)	-0.005 (0.009)	-0.011 (0.010)
Emergency permit	-0.004 (0.015)	-0.015 (0.014)	-0.001 (0.009)	-0.002 (0.008)	0.005 (0.008)	0.006 (0.009)	0.000 (0.009)
Out-of-state prepared	0.037* (0.017)	0.013 (0.016)	-0.015 (0.010)	-0.008 (0.010)	0.003 (0.009)	0.004 (0.010)	-0.002 (0.010)
Observations	261,564	261,564	261,564	261,564	261,564	261,558	261,541
R-squared	0.622	0.639	0.669	0.669	0.671	0.673	0.676
Controls							
Prior-year ELA score	x	x	x	x	x	x	x
Year fixed effects	x	x	x	x	x	x	x
Grade fixed effects	x	x	x	x	x	x	x
Student characteristics		x	x	x	x	x	x
Classroom characteristics			x	x	x	x	x
Teacher characteristics				x	x	x	x
School/district characteristics[a]					x	x	x
District fixed effects						x	
District-by-year fixed effects							x

Notes: ELA = English language arts. The table shows ELA achievement growth differences for students taught by residency-prepared new teachers compared to all other new teachers. We combined data across 3 academic years, 2022–23 to 2024–25. Standard errors are in parentheses. *$p < .05$. †$p < .10$. [a] Columns 6 and 7 include school composition and charter school indicators only.

Source: Learning Policy Institute analyses of dataset linking credential data provided by the California Commission on Teacher Credentialing to student and teacher data provided by the California Department of Education. (2026).

Table S5. Math Achievement Growth Regression Models, by Pathway and Type of Credential

Variable	Outcome: Math score (standardized)						
	1	2	3	4	5	6	7
Panel A: Single Subject credentials							
Pathway (residency as the reference group)							
Student teaching	0.000 (0.027)	-0.011 (0.025)	-0.025† (0.015)	-0.023 (0.015)	-0.017 (0.015)	-0.018 (0.020)	-0.037† (0.021)
Internship	-0.041 (0.030)	-0.048† (0.028)	-0.037* (0.017)	-0.036* (0.017)	-0.030† (0.016)	-0.031 (0.022)	-0.045* (0.023)
Emergency permit	-0.055* (0.028)	-0.060* (0.026)	-0.041* (0.016)	-0.039* (0.016)	-0.035* (0.015)	-0.034 (0.021)	-0.047* (0.022)
Out-of-state prepared	0.022 (0.031)	-0.005 (0.029)	-0.025 (0.017)	-0.021 (0.017)	-0.012 (0.016)	-0.015 (0.022)	-0.028 (0.023)
Observations	90,040	90,040	90,040	90,040	90,040	90,037	90,034
R-squared	0.651	0.666	0.695	0.696	0.697	0.700	0.702
Panel B: Multiple Subject credentials							
Pathway (residency as the reference group)							
Student teaching	0.026 (0.017)	0.007 (0.016)	-0.029* (0.011)	-0.027* (0.010)	-0.014 (0.010)	-0.022* (0.011)	-0.028* (0.011)
Internship	-0.021 (0.019)	-0.030† (0.018)	-0.022† (0.012)	-0.022† (0.012)	-0.014 (0.011)	-0.023† (0.012)	-0.031* (0.013)
Emergency permit	-0.027 (0.017)	-0.039* (0.016)	-0.022* (0.011)	-0.022* (0.010)	-0.011 (0.010)	-0.026* (0.011)	-0.034** (0.012)
Out-of-state prepared	0.021 (0.019)	-0.003 (0.018)	-0.023† (0.012)	-0.017 (0.012)	0.000 (0.011)	-0.020 (0.012)	-0.027* (0.013)
Observations	140,074	140,074	140,074	140,074	140,074	140,071	140,065
R-squared	0.660	0.674	0.701	0.701	0.705	0.708	0.711
Controls							
Prior-year math score	x	x	x	x	x	x	x
Year fixed effects	x	x	x	x	x	x	x
Grade fixed effects	x	x	x	x	x	x	x
Student characteristics		x	x	x	x	x	x
Classroom characteristics			x	x	x	x	x
Teacher characteristics				x	x	x	x
School/district characteristics[a]					x	x	x
District fixed effects						x	
District-by-year fixed effects							x

Notes: The table shows math achievement growth differences for students taught by residency-prepared new teachers compared to all other new teachers for teachers holding Single Subject or Multiple Subject credentials. Standard errors are in parentheses. *$p < .05$. **$p < .01$. †$p < .10$. [a] Columns 6 and 7 include school composition and charter school indicators only.

Source: Learning Policy Institute analysis of dataset linking credential data provided by the California Commission on Teacher Credentialing to student and teacher data provided by the California Department of Education. (2026).

Table S6. ELA Achievement Growth Regression Models, by Pathway and Type of Credential

Variable	Outcome: English language arts (ELA) score (standardized)						
	1	2	3	4	5	6	7
Panel A: Single Subject credentials							
Pathway (residency as the reference group)							
Student teaching	0.056† (0.029)	0.046† (0.026)	0.018 (0.014)	0.019 (0.014)	0.023 (0.014)	0.014 (0.014)	0.000 (0.019)
Internship	0.015 (0.032)	0.010 (0.029)	0.015 (0.016)	0.015 (0.016)	0.016 (0.015)	0.006 (0.016)	-0.004 (0.020)
Emergency permit	0.042 (0.030)	0.033 (0.027)	0.026† (0.015)	0.028† (0.015)	0.031* (0.015)	0.020 (0.015)	0.011 (0.019)
Out-of-state prepared	0.081* (0.032)	0.061* (0.028)	0.024 (0.016)	0.026 (0.016)	0.033* (0.016)	0.026 (0.016)	0.008 (0.020)
Observations	109,236	109,236	109,236	109,236	109,236	109,234	109,233
R-squared	0.616	0.631	0.661	0.661	0.663	0.667	0.669
Panel B: Multiple Subject credentials							
Pathway (residency as the reference group)							
Student teaching	0.011 (0.015)	-0.007 (0.015)	-0.033*** (0.010)	-0.029** (0.010)	-0.018† (0.009)	-0.015 (0.011)	-0.014 (0.012)
Internship	-0.039* (0.017)	-0.049* (0.016)	-0.034* (0.011)	-0.031* (0.011)	-0.025* (0.010)	-0.022† (0.012)	-0.023† (0.013)
Emergency permit	-0.039* (0.016)	-0.052* (0.015)	-0.025* (0.010)	-0.023* (0.010)	-0.012 (0.009)	-0.013 (0.011)	-0.014 (0.012)
Out-of-state prepared	0.005 (0.018)	-0.022 (0.017)	-0.037* (0.012)	-0.027* (0.012)	-0.008 (0.011)	-0.006 (0.013)	-0.005 (0.013)
Observations	142,028	142,028	142,028	142,028	142,028	142,025	142,019
R-squared	0.610	0.627	0.655	0.655	0.659	0.662	0.665
Controls							
Prior-year ELA score	x	x	x	x	x	x	x
Year fixed effects	x	x	x	x	x	x	x
Grade fixed effects	x	x	x	x	x	x	x
Student characteristics		x	x	x	x	x	x
Classroom characteristics			x	x	x	x	x
Teacher characteristics				x	x	x	x
School/district characteristics[a]					x	x	x
District fixed effects						x	
District-by-year fixed effects							x

Notes: ELA = English language arts. The table shows ELA achievement growth differences for students taught by residency-prepared new teachers compared to all other new teachers for teachers holding Single Subject or Multiple Subject credentials. We combined data across 3 academic years, 2022–23 to 2024–25. Standard errors are in parentheses. *$p < .05$. **$p < .01$. ***$p < .001$. †$p < .10$. [a] Columns 6 and 7 include school composition and charter school indicators only.

Source: Learning Policy Institute analyses of dataset linking credential data provided by the California Commission on Teacher Credentialing to student and teacher data provided by the California Department of Education. (2026).

Table S7. Math Achievement Growth Regression Models, by Pathway and Grade Band

Variable	Outcome: Math score (standardized)						
	1	2	3	4	5	6	7
Panel A: Grades 4–5							
Pathway (residency as the reference group)							
Student teaching	0.033* (0.016)	0.014 (0.016)	-0.032* (0.011)	-0.027* (0.011)	-0.018† (0.011)	-0.017 (0.013)	-0.018 (0.014)
Internship	-0.039* (0.019)	-0.044* (0.018)	-0.025† (0.013)	-0.023† (0.013)	-0.016 (0.012)	-0.010 (0.014)	-0.016 (0.015)
Emergency permit	-0.030† (0.016)	-0.040* (0.016)	-0.017 (0.011)	-0.017 (0.011)	-0.009 (0.011)	-0.012 (0.013)	-0.016 (0.014)
Out-of-state prepared	0.018 (0.020)	-0.007 (0.019)	-0.036* (0.013)	-0.029* (0.013)	-0.016 (0.012)	-0.027† (0.015)	-0.030† (0.016)
Observations	94,429	94,429	94,429	94,429	94,429	94,418	94,403
R-squared	0.686	0.699	0.725	0.726	0.729	0.733	0.736
Panel B: Grades 6-8							
Pathway (residency as the reference group)							
Student teaching	0.020 (0.021)	0.002 (0.019)	-0.024† (0.013)	-0.012 (0.012)	-0.006 (0.012)	-0.024† (0.013)	-0.035* (0.014)
Internship	-0.022 (0.022)	-0.028 (0.020)	-0.018 (0.013)	-0.011 (0.013)	-0.004 (0.012)	-0.017 (0.014)	-0.025† (0.015)
Emergency permit	-0.032 (0.021)	-0.042* (0.019)	-0.026* (0.013)	-0.021† (0.012)	-0.014 (0.012)	-0.032* (0.013)	-0.037* (0.014)
Out-of-state prepared	0.026 (0.024)	0.002 (0.022)	-0.019 (0.014)	-0.008 (0.014)	0.002 (0.013)	-0.016 (0.015)	-0.023 (0.016)
Observations	148,759	148,759	148,759	148,759	148,759	148,752	148,737
R-squared	0.646	0.661	0.691	0.692	0.693	0.696	0.699
Controls							
Prior-year math score	x	x	x	x	x	x	x
Year fixed effects	x	x	x	x	x	x	x
Grade fixed effects	x	x	x	x	x	x	x
Student characteristics		x	x	x	x	x	x
Classroom characteristics			x	x	x	x	x
Teacher characteristics				x	x	x	x
School/district characteristics[a]					x	x	x
District fixed effects						x	
District-by-year fixed effects							x

Notes: The table shows math achievement growth differences for students taught by residency-prepared new teachers compared to all other new teachers for teachers of students in grades 4–5 or grades 6–8. Standard errors are in parentheses. *$p < .05$. †$p < .10$. [a] Columns 6 and 7 include school composition and charter school indicators only.

Sources: Learning Policy Institute analysis of dataset linking credential data provided by the California Commission on Teacher Credentialing to student and teacher data provided by the California Department of Education. (2026).

Table S8. ELA Achievement Growth Regression Models, by Pathway and Grade Band

Variable	Outcome: English language arts (ELA) score (standardized)						
	1	2	3	4	5	6	7
Panel A: Grades 4–5							
Pathway (residency as the reference group)							
Student teaching	0.038* (0.017)	0.017 (0.016)	-0.029* (0.011)	-0.024* (0.011)	-0.016 (0.010)	-0.024* (0.012)	-0.026* (0.013)
Internship	-0.046* (0.019)	-0.049* (0.018)	-0.026* (0.012)	-0.024* (0.012)	-0.017 (0.011)	-0.020 (0.013)	-0.025 (0.014)
Emergency permit	-0.026 (0.017)	-0.035* (0.016)	-0.013 (0.011)	-0.012 (0.011)	-0.005 (0.010)	-0.013 (0.012)	-0.019 (0.013)
Out-of-state prepared	0.025 (0.020)	-0.002 (0.019)	-0.033* (0.013)	-0.026* (0.013)	-0.010 (0.012)	-0.023† (0.014)	-0.027† (0.014)
Observations	93,966	93,966	93,966	93,966	93,966	93,955	93,941
R-squared	0.614	0.633	0.661	0.662	0.665	0.669	0.672
Panel B: Grades 6–8							
Pathway (residency as the reference group)							
Student teaching	0.035 (0.022)	0.019 (0.020)	-0.009 (0.012)	-0.005 (0.011)	-0.003 (0.011)	0.003 (0.011)	-0.009 (0.013)
Internship	-0.010 (0.023)	-0.015 (0.022)	-0.004 (0.013)	-0.002 (0.013)	0.002 (0.012)	0.009 (0.012)	-0.004 (0.014)
Emergency permit	0.009 (0.022)	-0.002 (0.020)	0.008 (0.012)	0.004 (0.012)	0.011 (0.011)	0.016 (0.012)	0.009 (0.013)
Out-of-state prepared	0.046† (0.024)	0.023 (0.023)	-0.004 (0.014)	0.002 (0.013)	0.011 (0.013)	0.019 (0.013)	0.005 (0.015)
Observations	167,598	167,598	167,598	167,598	167,598	167,589	167,574
R-squared	0.626	0.643	0.673	0.673	0.676	0.679	0.681
Controls							
Prior-year ELA score	x	x	x	x	x	x	x
Year fixed effects	x	x	x	x	x	x	x
Grade fixed effects	x	x	x	x	x	x	x
Student characteristics		x	x	x	x	x	x
Classroom characteristics			x	x	x	x	x
Teacher characteristics				x	x	x	x
School/district characteristics[a]					x	x	x
District fixed effects						x	
District-by-year fixed effects							x

Notes: ELA = English language arts. The table shows ELA achievement growth differences for students taught by residency-prepared new teachers compared to all other new teachers for teachers of students in grades 4–5 or grades 6–8. Standard errors are in parentheses. *$p < .05$. †$p < .10$. [a] Columns 6 and 7 include school composition and charter school indicators only.

Source: Learning Policy Institute analyses of dataset linking credential data provided by the California Commission on Teacher Credentialing to student and teacher data provided by the California Department of Education. (2026).

Endnotes

1. In the school-level CDE data, students who are eligible for free or reduced-price meals in the National School Lunch Program are identified as economically disadvantaged. In the CAASPP data, or student-level data, students who are eligible for free or reduced-price meals in the National School Lunch Program, enrolled in another social benefits program, had two parents without high school diplomas, or identified as foster youth or homeless are identified as socioeconomically disadvantaged.
2. In California, the four largest racial/ethnic student groups are Asian, Black, Latino/a, and White. The percentage of Latino/a students in a school is strongly correlated with the percentage of White students in a school. In our final regression models, we included the percentage of Asian students, percentage Black students, and percentage Latino/a students.
3. National Center for Education Statistics. (n.d.). *Locale definitions: National Center for Education Statistics (NCES) locale classifications and criteria*. https://nces.ed.gov/surveys/annualreports/topical-studies/locale/definitions (accessed 08/10/2026).
4. California Department of Education. (2025). *ESSA per-pupil expenditure data files*. https://www.cde.ca.gov/fg/ac/es/essappedata.asp
5. California Department of Education. (2026). *Certificated salaries and benefits*. https://www.cde.ca.gov/ds/fd/cs/
6. The Consumer Price Index measures changes over time in prices for consumer goods and services. For more on the Consumer Price Index, see: U.S. Bureau of Labor Statistics. (n.d.). *Consumer Price Index*. https://www.bls.gov/cpi/
7. The Comparable Wage Index for Teachers (CWIFT) measures regional variation in wages and salaries of college graduates who are not educators as a proxy for differences in cost of living. We used the 2022 CWIFT data, which is the most recent year available. We used district-level CWIFT measures, and if there was not a value reported for the district, we used the county-level measure. For more on the CWIFT, see: National Center for Education Statistics. (n.d.). *Comparable Wage Index for Teachers (CWIFT)*. https://nces.ed.gov/programs/edge/economic/teacherwage
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9. As a robustness check, we also estimated the results using a three-level multilevel model that clustered students within teachers within schools. We included the same covariates that were included in Model 5 of Table S3 and Table S4, and the results were substantively similar.
10. We removed the locale, per pupil spending, and beginning teacher salary variables from the district fixed effect and district-by-year fixed effect models because these data were sometimes measured at the district level when school-level data were not available.
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