

Full-Day Kindergarten in California

Lessons from Los Angeles

Technical Appendix

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Description

These appendices provide technical information on the data, methods, and analysis used in the report, and serve as the basis for several of its figures. Appendix A describes the data collection and response rate for the survey of full-day kindergarten in California’s public schools. Appendix B details the Los Angeles Unified School District and California Department of Education data used in analyses, including descriptive statistics for the main analysis samples. Appendix C discusses the methodology underlying our estimates of the effect of full-day kindergarten, including tests performed to check the robustness of the estimates and similarity to statewide results. We then describe the interaction models used to examine variation in effects by student and school characteristics. Appendix D presents regression results for the report’s findings, including main results, robustness checks, and interaction results.

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Appendix A. California Full-Day Kindergarten Survey

This appendix describes the data collection for the PPIC Full-Day Kindergarten Survey. The survey was designed to collect information on kindergarten programs from all public schools open in the 2007–08 school year with kindergarten enrollment.¹ The survey universe was constructed from the California Department of Education, California Basic Educational Data System (CBEDS) School Information Form (SIF) data file, which contains enrollment counts for all public schools in the state. We also used the CDE Public School Directory to obtain contact information, primarily an email address, for school principals and administrators.

From the 2007–08 CBEDS SIF data, we identified a total of 5,890 elementary schools with kindergarten enrollment. We excluded 250 schools that were identified as non-public schools, special education schools, alternative/home study schools, and community day schools for a final survey universe of 5,640 elementary schools.

We developed the survey instrument with consultation from administrators from the California Department of Education, as well as from elementary school administrators. We performed a pilot test of the survey instrument with a group of 20 schools and made revisions as necessary. The print version of the final survey instrument is included at the end of this Appendix.

Primary data collection, online, occurred between November 2007 and May 2008. Using the email contact information provided in the CDE Public School Directory file, we contacted principals and school administrators to request that they complete the online kindergarten survey. All schools with valid email addresses were contacted a minimum of five times by email to request survey completion. For schools with missing or incorrect contact information, we performed extensive Internet and phone searches to obtain correct email information for school principals.² Two organizations assisted us by sending out information about our survey to their e-newsletter subscribers, the California Department of Education ElemNet Recap and the California School Boards Association Weekly News Update.

In addition to email solicitations for survey completion from individual schools, we contacted district administrators and superintendents to gather district-level information on kindergarten programs. We targeted large districts and districts where it appeared that all schools in the district had half-day kindergarten programs, based on results from the online survey. For some of the larger school districts, including Los Angeles Unified, San Diego Unified, San Francisco Unified, and others, we were able to obtain the requested information for all schools in the district with the exception of some charter schools. We also contacted school and district administrators with the assistance of the Association of California School Administrators, which sent an email and link to the online survey to all of their members on our behalf. In all, these administrator contact efforts generated completed information for more than 90 school districts.

¹ According to the CDE public school lists, 253 elementary schools closed between September 1, 2001 and September 1, 2007. These schools are not represented in our survey or included in our survey universe.

² We estimate that about 300 schools (5%) were never contacted individually due to incorrect email addresses. These schools are included in the denominator of our response rate calculations.

Finally, we made direct phone calls to schools in targeted districts to complete the survey, as well as to verify any inconsistent information.

Overall, we collected information on 4,106 public schools for a response rate of 73percent of schools representing 76 percent of all kindergarten students in the state for the 2007–08 school year. Although the survey was conducted during the 2007–08 school year, respondents were asked about full- and half-day practices dating back to the 2000–01 school year. See Tables A1 and A2 for a comparison of descriptive statistics of students and schools in our sample versus students and schools statewide. In general, our sample appears to be representative of schools and kindergarten students in the state with a few exceptions. Charter schools and rural schools appear to be underrepresented in our sample. We also examined separate regions within the state and found that the Central Coast and Other Counties regions may be somewhat less represented due to lower response rates, although they account for a small percentage of the state’s students and schools.

Table A1. Comparison of students represented by school survey responders with all California public school students

	All CA	Completed PPIC Survey		
		All	Full day	Half day
Total kindergarten students	450,013	342,223	148,704	193,519
Percentage		76.0%	43.5%	56.5%
Race-ethnicity				
White	25.5%	24.8%	20.5%	28.1%
Hispanic/Latino	52.1	52.4	58.5	47.7
African American/Black	6.2	6.5	7.3	5.8
Asian/Pacific Islander	10.7	10.9	9.4	12.0
Other	5.6	5.5	4.3	6.4
English learners	41.3	41.6	46.2	38.1
Schools with >50% ED students ^a	57.6	58.1	69.0	49.9
Schools with API state rank 9-10 ^a	19.4	19.6	13.7	24.0
Schools with API state rank 1-2 ^a	22.2	22.1	27.0	18.5
Region				
Bay Area	16.0	16.0	14.2	17.3
Central Valley	17.7	17.5	10.9	22.5
Central Coast	5.3	4.2	4.6	3.9
Inland Empire	13.6	13.6	5.6	19.7
Los Angeles County	25.3	27.1	46.2	0.1
Orange and San Diego Counties	15.6	16.0	13.5	17.9
Other Counties	6.5	5.7	5.1	6.2

NOTES: API=Academic Performance Index (rank 1= lowest to 10 = highest); ED = economically disadvantaged. Counties included in regions: Bay Area = Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Santa Cruz, Sonoma, Central Valley = Fresno, Kern, Kings, Madera, Merced, Sacramento, San Joaquin, Stanislaus, Tulare. Central Coast = Monterey, San Benito, San Luis Obispo, Santa Barbara, Ventura. Inland Empire = Riverside, San Bernardino.

^aSome schools do not have a match in the API data file and are therefore missing school-level information for this variable gathered from that file. Percentages for this row are based on 433,590 total kindergarten students and 333,482 students in the completed survey.

Table A2. Comparison of schools represented by school survey responders with all California public schools

	All CA	Completed PPIC survey		
		All	Full day	Half day
Total schools	5640	4106	1805	2301
Percentage		72.8%	44.0%	56.0%
Economically disadvantaged (school mean %) ^a	50.6	51.1	58.7	45.2
% Schools with >50% ED students ^a	53.8	54.7	64.8	46.8
Schools with API state rank 9-10 (%) ^a	20.0	20.3	14.6	24.7
Schools with API state rank 1-2 (%) ^a	20.0	19.6	23.4	16.7
Mean % teachers with full credentials	96.1	96.2	95.6	96.7
Mean % of teachers with EL authorization	68.9	70.8	72.3	69.7
Mean % of teachers with 5 or more years experience	80.2	81.2	81.3	81.2
Meal program participation (school mean %) ^a	54.5	55.1	62.9	49.0
Parent education <high school (school mean %) ^a	20.0	20.4	24.1	17.4
Region				
Bay Area	17.5	18.2	17.3	18.9
Central Valley	18.1	18.1	12.1	22.8
Central Coast	6.0	4.7	5.1	4.3
Inland Empire	11.3	11.7	5.0	17.0
Los Angeles County	22.0	23.6	38.5	11.9
Orange and San Diego Counties	14.5	15.2	13.5	16.5
Other Counties	10.6	8.6	8.5	8.7

NOTES: API = Academic Performance Index (rank 1= lowest to 10=highest); ED = economically disadvantaged; EL = English learner. Counties included in regions: Bay Area = Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Santa Cruz, Sonoma. Central Valley = Fresno, Kern, Kings, Madera, Merced, Sacramento, San Joaquin, Stanislaus, Tulare. Central Coast = Monterey, San Benito, San Luis Obispo, Santa Barbara, Ventura. Inland Empire = Riverside, San Bernardino.

^a Some schools do not have a match in the API data file and are therefore missing school-level information for this variable gathered from that file. Percentages for this row are based on 5,410 total schools and 4,018 schools in the completed survey.



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California Full-Day Kindergarten Survey

The Public Policy Institute of California (PPIC) is conducting a statewide survey of schools with kindergarten enrollment to determine the number of schools offering full-day kindergarten classes. **We appreciate your time in completing this short survey for your school.**

You will be asked to answer up to six questions, depending on what type of kindergarten programs you offer. The information provided will be matched to schools, but no individual respondents will be identified in published reports.

Please fax your completed survey to [415-291-4401](tel:415-291-4401). If you have any questions about this survey, please contact Shannon McConville at mconville@ppic.org or 415-291-4481.

SCHOOL NAME (required): _____

1. Has your school offered full-day (also called extended day) kindergarten in any class at any time between the 2000-01 school year through the current school year?

NOTE: In this survey "full day" is used to mean any class with kindergarten students with a certificated teacher where instructional minutes exceed the state's maximum time of 4 hours per day. This also includes full-day classes that begin one or two months into the school year. It does not include after-school intervention programs offered to selected students and not all students in the class.

- Yes (Skip to Question 2 on next page)
- No (Survey completed, thank you for your time.)
- School has no kindergarten enrollment during these years (Survey completed, thank you for your time.)
- Uncertain (Please complete Questions 1b and 1c below)

1b. Please describe why you are uncertain whether your school offers full-day kindergarten in the space provided below.

1c. If there is someone else we can contact to complete this survey, please provide their contact information below.

Name _____

Email or Phone number _____

2. Please indicate the school year that full-day kindergarten was first offered in at least one kindergarten class in the school.

- 1999-00 or earlier
- 2000-01
- 2001-02
- 2002-03
- 2003-04
- 2004-05
- 2005-06
- 2006-07
- Current year

3. We would like to know how many of your school's kindergarten classes are full-day. For each school year, please fill in the total number of kindergarten classes and the number of classes, if any, that were full day.

Total number of K classes	Number of full-day K classes
2000-01 _____	_____
	<input type="checkbox"/> some, not sure of exact number
2001-02 _____	_____
	<input type="checkbox"/> some, not sure of exact number
2002-03 _____	_____
	<input type="checkbox"/> some, not sure of exact number
2003-04 _____	_____
	<input type="checkbox"/> some, not sure of exact number
2004-05 _____	_____
	<input type="checkbox"/> some, not sure of exact number
2005-06 _____	_____
	<input type="checkbox"/> some, not sure of exact number
2006-07 _____	_____
	<input type="checkbox"/> some, not sure of exact number
Current year _____	_____
	<input type="checkbox"/> some, not sure of exact number

4. Please indicate the typical length of day in instructional minutes for full-day classes by school year.

	No full-day K classes	More than 4 hours but less than 5 hours (241-299 minutes)	5 or more hours but less than 6 hours (300–359 minutes)	6 or more hours (360 or more minutes)	Unsure
2000-01	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2001-02	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2002-03	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2003-04	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2004-05	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2005-06	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2006-07	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Current year	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5. Please indicate the frequency of full-day classes each week by school year.

	No full-day K classes	5 days per week	4 days per week	3 days per week	2 days per week	1 day per week
2000-01	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2001-02	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2002-03	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2003-04	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2004-05	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2005-06	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2006-07	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Current year	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6. Was one of the primary reasons your school extended the kindergarten day in order to help English-learner students?

- Yes
- No
- Unsure of primary reason.

If you have any additional comments or information about your full-day kindergarten programs, please include them here.

Thank you for your time. Please fax your completed survey to 415-291-4428 or 415-291-4401.

Appendix B. Data Description

This appendix describes the sources of data used in this report and is categorized into the data used for the analysis focusing on the Los Angeles Unified School District (LAUSD) and data used for the analysis for the state.

Data for LAUSD Analysis

The majority of data used in the analysis focused on LAUSD students are from administrative data provided by the school district with the remaining variables from the California Department of Education (CDE).¹ Focusing on public schools in Los Angeles is appropriate for this study for several reasons. In 2004, the district mandated a shift to full-day kindergarten (FDK) over a four-year period. Because of this, significant variation in schools with and without FDK over several years exists, which is critical for analytical power. Further, the data are provided at the student level, which allow for more sophisticated analytical techniques. The panel nature of the data allows us to track kindergartners through third grade or spring of 2008, if they remain in the district. We have seven cohorts of kindergartners in just over 500 schools between school years 2001–02 through 2007–08, which translates into a total of 387,964 students and 1,122,811 observations. Further, the district has implemented FDK in all classes for the same number of annual instructional minutes, so we have little measurement error in those aspects. Finally, the district’s student population is large and diverse, including many English learners (EL) and economically disadvantaged students, so results are meaningful beyond the district level. LAUSD is the largest school district in the state with the largest EL student population. The district represents about 12 percent of the state’s kindergarten population and about 16 percent of the state’s kindergarten EL population.

Given that the LAUSD data are at the student level and do not include some key school-level characteristics, we complement it with school-level data from the CDE for 2001–02 through 2007–08 school years. Specifically, we use the Academic Performance Index (API) data file, the California Basic Educational Data System (CBEDS) School Information Form data file, and the CBEDS Professional Assignment Information Form data file to construct the school-level measures used in the study. The CDE data and more information on data availability and data collection procedures are available at <http://www.cde.ca.gov/ds/>. Data for this study were downloaded in October 2008.

LAUSD Variables

The LAUSD administrative data provides information on student-level outcomes, full-day kindergarten participation, student socioeconomic characteristics, and several school-level characteristics. The majority of school-level variables are from CDE. Tables B1 and B2 outline each variable used.

We have selected outcome variables to capture the constructs of academic achievement, retention, and English proficiency. The following variables capture academic achievement:

¹ The PPIC Institutional Review Board (IRB) approved security procedures for using the student-level LAUSD data.

reading skills composite score, California Standards Test (CST)-math score, CST-math proficiency, CST-English Language Arts (ELA) score, and CST-ELA proficiency. The reading skills composite score is based on the Open Court Curriculum and administered in spring of kindergarten and first grade. To create the composite scores we included assessments that required the least subjectivity of the teacher in administration, were assessed at the end of the year, and were measured across all seven cohorts. We are not including all skills assessment measures for a given grade, providing a somewhat narrow picture that includes only a few elements of the California kindergarten and first-grade ELA standards. Reading composite scores for kindergarten include summed scores for assessments of uppercase letters, lowercase letters, matching vowels to appropriate letters, and matched consonants. The first grade composite scores include average reading fluency, reading comprehension, spelling, and word reading. We believe the first grade measures in our analysis cover more of the standards and assess more complex reading skills than the kindergarten measures. Note that we are only using scores from students who were assessed in the English language. Both of these scores are standardized with a mean of zero and standard deviation of one within grade, year, and version of Open Court Assessment.² Variables are standardized before any observations are excluded from the data (see description of analysis sample below).

CST assessments, which begin statewide in second grade, measure the California education standards for the knowledge and skills a student should have in a given grade. Only math and ELA are tested in second grade, and tests are administered in the spring. CST-math exams in second grade test the following skills: number sense (place value, addition, subtraction, multiplication, division, and fractions), algebra and functions, measurement and geometry, and statistics, data analysis, and probability. The CST-ELA exam in second grade assesses word analysis, reading comprehension, literary response and analysis, writing strategies, and writing conventions. Scores are reported as mean scale scores and as proficiency levels, and we examine both.³ We standardize the scale scores using a mean of zero and standard deviation of one. Scores are standardized within subject, grade, and year before any observations are excluded from the data. The indicator for proficiency is a binary variable equal to one if the student is considered proficient or higher and zero if he or she is not proficient.

The kindergarten and first-grade reading assessments are not directly comparable between grades and should not be directly compared to the second grade CST-ELA scores. However, they provide the only kindergarten and first-grade measures available during our time period and serve as a limited measure of student learning within those grades.

To capture retention we create a binary variable to indicate whether a student was retained anytime before second grade (i.e., in kindergarten or first grade). For this variable, a student is assigned a one if he or she has been retained by second grade and zero if not. We do not examine the variable retained by first grade because teachers may be more likely to allow students to graduate from kindergarten to first grade; however, these students may then more likely to be retained the following year when it is clear they need more help.

² Schools can administer the 2000 or 2002 version of the Open Court assessment; therefore, we standardize within version.

³ For more information on the CST scores see <http://www.cde.ca.gov/ta/tg/sr/resources.asp>.

To capture English proficiency we use the following variables: California English Language Development Test (CELDT) scores and an indicator for whether a student has been re-designated as fluent-English proficient (RFEP). Both of these variables apply to EL students only. The CELDT tests are administered to EL students annually in the fall.⁴ The CELDT examination assesses listening and speaking skills of English learners in kindergarten and first grade, and listening, speaking, reading, and writing skills in second grade. We examine the CELDT scores in first and second grades and standardize the scores with a mean of zero and standard deviation of one within grade and year before any observations are excluded (see the description of our analysis sample, below).⁵

We also examine whether a student has been reclassified as English proficient by the end of second grade. This variable is coded as one if the student has been reclassified and zero if not. The four criteria that districts may use in their decision to reclassify students are: CELDT scores, CST-ELA scores, teacher evaluation, and parent opinion and consultation. Each school district establishes its own local reclassification procedures using these criteria.

The key independent variable indicates whether the student attended full-day kindergarten or not. In this study, full-day kindergarten is defined as classes offered for more than 240 instructional daily minutes. Most full-day classes in California are offered for at least 300 instructional minutes although some schools offer extended-day kindergarten for between 241 and 299 minutes. In LAUSD, full-day classes are 320 instructional minutes for a school with 180 days.⁶ Note that we are not able to distinguish between attending half-day kindergarten in the morning versus the afternoon. However, previous studies (e.g., Cannon, Jackowitz, and Painter, 2006) indicate that the effects of attending morning versus afternoon kindergarten on student outcomes are not different.

We include several student-level socioeconomic control variables in our models that are available in the LAUSD administrative data. Please see Tables B1 and B2 for the exact specification of each of these variables in our regression models. We have information on a student's race-ethnicity, the highest academic degree attained by the mother or father, whether the student is an English learner, what their primary home language is, their age of kindergarten entry as of September 1 of a given school year, whether the child was redshirted, whether their birth country is the United States, meal program participation, whether the student changed schools within the district, whether the student repeated a prior grade, CELDT score in kindergarten, and English Language Development (ELD) level in kindergarten. All of these variables are measured during the kindergarten year with the exception of two variables that measure change: whether the student changed schools within the district and whether the

⁴ For first-time California students, it is administered within 30 days of the student entering school. Thereafter, it is administered each fall.

⁵ The CELDT scale score cut points were updated in the 2006-07 school year and are not directly comparable to earlier years. Proficiency levels and growth scores should not be used to measure student progress on the CELDT over our time period. Standardizing scores within each school year creates a common metric across different versions of the CELDT so that students are placed in comparison with other students taking the same test at the same time.

⁶ We also note that each school has professional development days. During these days, instruction is shortened to 260 minutes. A few schools with a three-track calendar have slightly fewer annual school days and thus increased minutes per day, but the annual instructional time is the same across schools (LAUSD, 2005).

student repeated a prior grade. Both of these variables are created using information from grades other than kindergarten.

Several of these control variables warrant further explanation. The variable noting highest degree attained by the parent 'is missing about 30 percent of its values; therefore, we include a category for missing parent education level. Further analysis indicates that Hispanics and African American are much more likely to be missing parent education information than whites, Asians, and other races. "Meal program participation" indicates whether the child participated in the National School Lunch Program and received a free- or reduced-price lunch. Those children residing in a household with an income at or below 185 percent of the poverty line are eligible for a free- or reduced-price lunch. "Redshirt" is a variable we created to indicate whether the student was eligible to attend kindergarten in an earlier school year but did not. California policy allows kindergarten entry for students who turn five years old on or before December 2 of the kindergarten year.

The ELD level is based on a student's performance when they enter kindergarten. A student's ELD level is based on assessments including the CELDT score and ELD standards used by the district. They are categorized with an ELD code of one to five (one is lowest and a score of one or two is generally the case for kindergartners).

We use the parent education and meal program variables to create the economically disadvantaged subgroup for analyses. We follow the same method as CDE to create a variable for whether a student is defined as economically disadvantaged – they are coded as one if they either receive a free- or reduced-price school lunch or have a parent with less than a high school education. They are coded as zero if their parent education level is high school or above and they do not participate in the meal program. A small percentage of students are left designated as missing for this variable. They do not participate in the meal program but have missing parent education information so we cannot accurately code them as economically disadvantaged or not.

The school-level characteristic included with the LAUSD administrative data is whether a school participates in the Reading First Program. This variable is binary and coded one if the child attends a Reading First school in kindergarten and zero if not. Reading First is a national program with the objective of ensuring that all children read by the end of third grade. Eligibility for the Reading First Program is limited to local education agencies with 1,000 or at least 50 percent of their second and third grade students scoring below basic or far below basic on the CST examination.

The school-level characteristics that are from CDE are the following: Academic Performance Index (API) state rank, total school enrollment, percent ELs tested at school (i.e., percent of ELs tested in grades two and above), percent of children participating in meal program at school of those tested, percent of children with parent education less than high school of those tested, percent of teachers with full credential at the school, percent of teachers with five or more years teaching experience at the school, and percent of teachers authorized to teach ELs at school. Several of these variables warrant further explanation. The Academic Performance Index represents a school's performance level and growth on statewide testing. The API score ranges from 200 to 1000 and is calculated by converting a single student's scores on statewide assessments across different content into points on the API scale. These points are

then averaged across students and all tests to create the API index. The state API ranking shows where a school's API falls on a scale of 1 to 10 with 10 the highest. We create six groups to categorize schools by their API rank: ranked one or two, ranked three or four, ranked five or six, ranked seven or eight, ranked nine or ten, and missing information on API state rank. In terms of the percent of teachers authorized to teach EL students, three different authorizations exist and we considered a teacher authorized if they had at least one of these authorizations because it is difficult to determine which of the authorizations has the greatest impact on learning.

LAUSD Analysis Sample

The final analytic sample contains information for 296,584 students and 934,411 observations. From the full sample of children, we construct an analysis sample of 296,584 students for kindergarten outcomes, 251,235 students for first grade outcomes, and 205,862 students for second grade outcomes. The criteria we employ for inclusion in the analysis sample are described below with the number of students excluded in parentheses. Students must have remained in the district through third grade or the 2007-08 school year, whichever occurs first (58,780 students / 117,274 observations excluded).⁷ Students must have a kindergarten school code (17,488 students/ 29,211 observations excluded). A student's full-day kindergarten status must be known (2,656 students/9,071 observations excluded). We also exclude a small group of students who had out of sequence grade progression or were recorded in two grades in a single school year (558 students/2,689 observations.) An additional 26,295 observations are excluded due to missing values for other control variables including student age, home language, country of birth, race-ethnicity, English Learner status, as well as school-level indicators of API rank, percent of students who are English Learners, percent of students in the free/reduced lunch program, and percent of students whose parents have less than a high school education. Note that parental education level included many missing values and we included a categorical variable in our regression models to capture them. Finally, students must have a value for at least one outcome measure (3,017 students/3,860 observations).⁸

Using two-tailed hypothesis testing and a significance level of 0.05, we have tested whether those students who were excluded from the analysis differ from those that were included and we find that they differ in several statistically significant ways. On average, the students excluded from our analysis sample appear to be somewhat more advantaged by certain measures. They are less likely to be Hispanic (71% excluded vs. 78% included), an English learner (40% vs. 58%), in the subsidized lunch program (77% vs. 79%), and in a low API rank school (mean of 3.57 vs. 3.74). The excluded students are also more likely to be African American (13% vs. 8%), redshirted (3% vs. 2%), have English as their home language (40% vs.

⁷ Students in third grade are included in the final analytic sample to perform sensitivity tests of whether full-day kindergarten affects grade retention by third grade, RFEP designation by the end of third grade, and CST and CELDT third grade scores.

⁸ Students who are retained are kept in our analysis sample through third grade or the 2007-08 school year. These students are matched to their original kindergarten cohort and measured at the time they first reach a given grade, even when that is a subsequent school year than their cohort non-retained peers. We do not include any repeated grade assessments, only the first time in grade for each student. For example, for the 2004-05 cohort of kindergartners, non-retained students are measured in second grade in 2006-07, and students retained in kindergarten or first grade are measured the first time in second grade in 2007-08.

30%), be in a charter school (6% vs. 3%), and enroll in a slightly smaller school (899 students vs. 940).

Table B1 includes key descriptive statistics of the full analysis sample. Means and standard deviations are reported for outcome variables and covariates used in analyses for all students. Statistics are reported for each kindergarten cohort and by full-day and half-day kindergarten status in years 2004–05 through 2007–08 when full-day kindergarten began district-wide (all students in our sample are in full-day classes in 2007–08). Regardless of full-day kindergarten status, the majority of LAUSD students is Hispanic, economically disadvantaged, English learner, and enrolls in low API rank schools. We find that in the first year of full-day kindergarten being phased in across the district (2004–05), the students in full-day classes are somewhat different: they are less likely to be Hispanic, economically disadvantaged, or an English learner, and they are more likely to be enrolled in a more advantaged and smaller size school. These differences are largely mitigated in the second year of full-day kindergarten implementation (2005–06), and by the third year (2006–07) when most students are in full-day classes, the small percentage who are enrolled in half-day programs appear to be more advantaged.

Table B2 shows descriptive statistics of the analysis sample for EL students, and Table B3 presents similar information for ED students. The same general patterns noted above apply to these groups, as well. This is not surprising given that a majority of all students are categorized as EL or ED as shown in Table B1.

Data for State of California Analysis

Our analyses also rely on school-level data for California. The purpose is to determine how our results from the LAUSD analysis generalize to the state of California. These data contain information on 4,106 schools over seven years. These 4,106 schools represent 73 percent of public schools open in California during the 2007–08 school year with a kindergarten enrollment. The factor that limits this sample size is response to the PPIC school survey on full- and half-day kindergarten implementation. The survey methods, including the instrument and their representativeness, are described in Appendix A. However, we have information for 73 percent of public schools open during 2007–08; therefore our school level data set for the state consists of that number of schools.

Several limitations of using these statewide data exist, which further support our preference for the LAUSD data. First, students are not matched to their kindergarten school for assessments given in later grades. Therefore, if they have changed schools since kindergarten, we don't know that. Based on what we know from our LAUSD sample, approximately 25 percent of children may have changed schools by third grade and so many of them might have the wrong full-day kindergarten status assigned to them in the statewide data. Similarly, we are not able to exclude children who entered California schools after their kindergarten year. In the school-level data, we are unable to track or include a control for an extra year of instruction for students who have been retained. Further, we have more outcome measures available with the LAUSD data as well as more student-level control variables. The school-level data also limit the methods we can use to analyze our data. We cannot include interaction variables between full-day kindergarten and student-level characteristics, and we cannot include teacher fixed effects.

Statewide Variables

In the school-level analysis for the state of California, we study the same dependent variables with the exception of the kindergarten and first grade reading assessments and retention. The key independent variable is whether the school offered full-day kindergarten in a given year. This variable is from the PPIC school survey. This portion of the analysis utilizes the same school-level control variables available from CDE that are described in the data focused on the LAUSD analysis.

Statewide Analysis Sample

The base data file includes information for all schools with any first- through third-grade assessment data from 2001–02 through 2007–08 and known full-day kindergarten status. The base analysis sample for all students consists of 4,016 public schools (56,478 observations in first through third grades). It is created by excluding schools with missing control variables (2,377 observations excluded) and those that do not have an average test score for the second grade CST-ELA or CST-math assessments (376 observations excluded). Missing CST scores is likely the case because when a school has fewer than 10 students taking the exam scores are not publicly reported.

Table B4 includes key descriptive statistics of the state analysis sample. Across all cohorts, full-day kindergarten is more likely than half-day kindergarten to be implemented in a smaller school. In the first two cohorts of schools implementing full-day kindergarten, schools otherwise did not seem to differ much depending on full-day status. However, this is not the case for later cohorts of schools. In the 2005–06 cohort, full-day kindergarten schools appear to be more disadvantaged, including having a slightly lower mean API rank and having a greater percentage of students at the school economically disadvantaged (i.e., having a parent with less than a high school education or participating in a meal program) and EL status. Table B5 includes key descriptive statistics of the analysis sample for the statewide analysis of EL students, and Table B6 includes similar statistics for economically disadvantaged students. Similar descriptive patterns are also found in these subsamples.

Table B1. Description of analysis sample for LAUSD analysis for all students

	Cohort mean descriptive statistics									
	2001-02	2002-03	2003-04	2004-05		2005-06		2006-07		2007-08
				FDK	HDK	FDK	HDK	FDK	HDK	FDK
Full-day kindergarten attendance (%)	0.01	0.01	0.01	0.30		0.77		0.94		1.00
Outcomes										
Kindergarten reading composite score (standardized)	N/A	0.04	0.04	0.12*	0.00	0.05*	-0.01	0.03*	-0.03	0.05
1st grade reading composite score (standardized)	0.03	0.03	0.03	0.15*	0.01	0.05*	0.01	0.05*	0.12	N/A
2nd grade CST - ELA score (standardized)	0.04	0.04	0.05	0.15*	0.01	0.08	0.08	N/A	N/A	N/A
2nd grade CST - ELA proficiency (%)	0.29	0.35	0.40	0.49*	0.43	0.47*	0.46	N/A	N/A	N/A
2nd grade CST - Math score (standardized)	0.04	0.04	0.05	0.11*	0.01	0.06	0.07	N/A	N/A	N/A
2nd grade CST - Math proficiency (%)	0.48	0.50	0.56	0.59*	0.55	0.58	0.57	N/A	N/A	N/A
Retained by 2nd grade	0.05	0.05	0.05	0.05	0.05	0.05	0.06	N/A	N/A	N/A
Student-level covariates										
Race-ethnicity										
Hispanic/Latino	0.80	0.79	0.79	0.71*	0.80	0.77	0.77	0.78*	0.70	0.77
Asian	0.03	0.03	0.03	0.04*	0.03	0.03*	0.05	0.03*	0.05	0.04
African American/Black	0.08	0.08	0.08	0.10*	0.07	0.09*	0.06	0.08	0.08	0.08
Filipino	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
White	0.07	0.08	0.08	0.12*	0.07	0.09*	0.09	0.08*	0.15	0.08
Other	0.01	0.01	0.01	0.01*	0.01	0.01	0.01	0.01	0.01	0.01
Parent education level										
Less than high school	0.27	0.26	0.26	0.22*	0.28	0.24*	0.26	0.26*	0.19	0.24
High school degree	0.19	0.19	0.19	0.20	0.19	0.19*	0.18	0.20*	0.15	0.19
Some college	0.11	0.11	0.12	0.17*	0.11	0.14*	0.10	0.12*	0.09	0.13
College degree	0.07	0.07	0.08	0.12*	0.08	0.09	0.09	0.09*	0.11	0.09
Graduate education	0.03	0.04	0.04	0.05*	0.04	0.04*	0.06	0.04*	0.09	0.05
Missing information	0.33	0.32	0.30	0.24*	0.30	0.30	0.30	0.29*	0.38	0.30
Kindergarten entry age as of September 1	63.17	63.17	63.17	63.21*	63.12	63.17	63.19	63.15*	63.46	63.11
Redshirt	0.02	0.02	0.02	0.02*	0.02	0.02*	0.02	0.02*	0.04	0.02
English Learner	0.66	0.63	0.56	0.44*	0.57	0.52*	0.56	0.60*	0.56	0.58
Economically Disadvantaged	0.86	0.90	0.88	0.84*	0.89	0.86*	0.83	0.86*	0.74	0.80
Primary home language										
English	0.25	0.26	0.28	0.41*	0.28	0.33*	0.30	0.32*	0.35	0.34
Spanish	0.70	0.68	0.66	0.54*	0.67	0.62*	0.64	0.63*	0.58	0.61

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Table B1. Description of analysis sample for LAUSD analysis for all students, *continued*

	Cohort mean descriptive statistics									
	2001-02	2002-03	2003-04	2004-05		2005-06		2006-07		2007-08
				FDK	HDK	FDK	HDK	FDK	HDK	FDK
Student-level covariates, cont'd.										
Other	0.05	0.05	0.05	0.06*	0.05	0.05*	0.06	0.05*	0.07	0.05
Birth country is U.S.	0.92	0.92	0.91	0.93*	0.92	0.92*	0.91	0.93*	0.91	0.94
Meal program participation	0.78	0.86	0.84	0.80*	0.86	0.80*	0.75	0.78*	0.63	0.65
Changed schools by second grade	0.17	0.19	0.21	0.20*	0.23	0.19	0.20	N/A	N/A	N/A
Repeated a grade prior to second grade	0.05	0.05	0.05	0.05	0.05	0.05	0.06	N/A	N/A	N/A
School-level covariates										
School size	1097	1086	1065	755*	1050	813*	979	781*	845	750
API rank	3.34	3.46	3.64	4.13*	3.34	3.61*	3.91	3.57*	4.70	3.69
% EL students	0.56	0.59	0.59	0.49*	0.59	0.51*	0.53	0.48*	0.39	0.47
% students in meal program	0.89	0.89	0.88	0.82*	0.89	0.82*	0.81	0.84*	0.74	0.83
% students with parent with less than HS educ.	0.39	0.40	0.40	0.34*	0.41	0.39	0.39	0.40*	0.36	0.39
% teachers with EL authorization	0.59	0.65	0.65	0.71*	0.72	0.73*	0.71	0.91*	0.87	0.91
% teachers with full credential	0.74	0.79	0.81	0.93*	0.93	0.96*	0.96	0.97*	0.97	0.97
% teachers with 5 or more years experience	0.63	0.70	0.73	0.80*	0.77	0.82*	0.80	0.84*	0.76	0.85
Reading First program school	0.00	0.00	0.00	0.43*	0.56	0.55*	0.50	0.54*	0.50	0.54
Cohort sample size	44,217	43,082	40,413	38,641		41,850		43,998		44,383

NOTES: All covariates except repeated prior grade and changed schools are measured in the kindergarten year. N/A indicates data not applicable. * indicates FDK mean is significantly different than HDK mean at 5% level. API = Academic Performance Index (1 = lowest to 10 = highest); CST = California Standards Test; EL = English learner; ELA = English-Language Arts; FDK = full-day kindergarten; HDK = half-day kindergarten; HS = high school.

Table B2. Description of analysis sample for LAUSD analysis for English learner students

	Cohort mean descriptive statistics									
	2001-02	2002-03	2003-04	2004-05		2005-06		2006-07		2007-08
				FDK	HDK	FDK	HDK	FDK	HDK	FDK
Full-day kindergarten attendance (%)	0.01	0.01	0.01	0.25		0.75		0.95		1.00
Outcomes										
Kindergarten reading composite score (standardized)	N/A	-0.02	-0.05	0.02*	-0.08	-0.00*	-0.08	0.00*	-0.08	0.03
1st grade reading composite score (standardized)	-0.08	-0.13	-0.18	-0.12*	-0.17	-0.16	-0.15	-0.10*	-0.16	N/A
2nd grade CST - ELA score (standardized)	-0.16	-0.19	-0.25	-0.19*	-0.25	-0.19	-0.19	N/A	N/A	N/A
2nd grade CST - ELA proficiency (%)	0.21	0.25	0.28	0.35*	0.32	0.35	0.34	N/A	N/A	N/A
2nd grade CST - Math score (standardized)	-0.10	-0.12	-0.16	-0.14*	-0.17	-0.14	-0.13	N/A	N/A	N/A
2nd grade CST - Math proficiency (%)	0.42	0.44	0.47	0.49*	0.48	0.50	0.49	N/A	N/A	N/A
Retained by 2nd grade	0.05	0.05	0.06	0.07	0.07	0.06	0.07	N/A	N/A	N/A
1st grade CELDT score (standardized)	0.10	0.09	0.10	0.22*	0.08	0.12*	-0.03	N/A	N/A	N/A
2nd grade CELDT score (standardized)	0.14	0.15	0.15	0.21*	0.09	0.13*	0.08	N/A	N/A	N/A
RFEP by end of 2nd grade	0.04	0.05	0.08	0.12*	0.10	0.12*	0.09	N/A	N/A	N/A
Student-level covariates										
Race-ethnicity										
Hispanic/Latino	0.94	0.94	0.95	0.92*	0.94	0.94*	0.93	0.94	0.92	0.93
Asian	0.03	0.03	0.03	0.03	0.03	0.02*	0.05	0.03	0.04	0.04
African American/Black	0.00	0.00	0.00	0.00	0.00	0.00*	0.00	0.00*	0.01	0.00
Filipino	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
White	0.02	0.02	0.02	0.03*	0.02	0.02*	0.01	0.02	0.02	0.02
Other	0.00	0.00	0.00	0.00*	0.00	0.00	0.00	0.00	0.00	0.00
Parent education level										
Less than high school	0.35	0.34	0.36	0.35*	0.37	0.34*	0.37	0.35*	0.29	0.34
High school degree	0.20	0.20	0.20	0.22*	0.19	0.20*	0.19	0.21*	0.16	0.21
Some college	0.07	0.07	0.07	0.08*	0.07	0.07*	0.06	0.07	0.06	0.08
College degree	0.04	0.04	0.04	0.06*	0.04	0.04	0.04	0.05	0.05	0.05
Graduate education	0.01	0.02	0.02	0.02	0.01	0.02	0.01	0.02*	0.03	0.02
Missing information	0.33	0.33	0.32	0.27*	0.31	0.32*	0.34	0.31*	0.41	0.31
Kindergarten entry age as of September 1	62.99	62.97	62.81	62.82	62.77	62.82	62.77	62.89	63.07	62.87
Redshirt	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01*	0.02	0.01
English Learner	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Economically Disadvantaged	0.95	0.97	0.97	0.97*	0.97	0.96*	0.94	0.94*	0.89	0.89

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Table B2. Description of analysis sample for LAUSD analysis for English learner students, *continued*

	Cohort mean descriptive statistics									
	2001–02	2002–03	2003–04	2004–05		2005–06		2006–07		2007–08
				FDK	HDK	FDK	HDK	FDK	HDK	
Student-level covariates, cont'd.										
Primary home language										
English	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Spanish	0.95	0.95	0.95	0.93*	0.94	0.95*	0.93	0.94	0.93	0.93
Other	0.05	0.05	0.05	0.07*	0.05	0.05*	0.07	0.06	0.07	0.07
Birth country is U.S.	0.90	0.89	0.87	0.87	0.88	0.88	0.87	0.90*	0.87	0.90
Meal program participation	0.87	0.95	0.95	0.95	0.95	0.92*	0.86	0.87*	0.77	0.72
Changed schools by second grade	0.16	0.17	0.21	0.19*	0.25	0.18*	0.21	N/A	N/A	N/A
Repeated a grade prior to second grade	0.05	0.05	0.06	0.07	0.07	0.06	0.07	N/A	N/A	N/A
English Language Development level in kindergarten										
Level 1	0.69	0.68	0.68	0.52*	0.68	0.55*	0.63	0.54*	0.44	0.91
Level 2	0.26	0.26	0.27	0.37*	0.28	0.39*	0.33	0.40	0.42	0.08
Level 3, 4, or 5	0.05	0.05	0.06	0.11*	0.04	0.06*	0.04	0.06*	0.14	0.02
Kindergarten initial CELDT score	-0.12	-0.19	-0.29	-0.21*	-0.31	-0.24*	-0.33	-0.20*	-0.10	-0.21
School-level covariates										
School size	1205	1197	1185	872*	1138	880*	1053	829*	914	805
API rank	2.76	2.82	2.91	3.05*	2.66	2.84*	2.97	2.94*	3.61	2.98
% EL students	0.64	0.67	0.68	0.60*	0.67	0.60*	0.63	0.55*	0.47	0.55
% students in meal program	0.96	0.96	0.95	0.92*	0.96	0.90*	0.90	0.90*	0.86	0.90
% students with parent with less than HS educ.	0.45	0.46	0.46	0.43*	0.47	0.46	0.46	0.46*	0.43	0.45
% teachers with EL authorization	0.60	0.67	0.66	0.73*	0.74	0.75*	0.73	0.92*	0.88	0.92
% teachers with full credential	0.73	0.77	0.80	0.93*	0.93	0.96	0.96	0.97*	0.96	0.97
% teachers with 5 or more years experience	0.62	0.69	0.73	0.80*	0.77	0.82*	0.79	0.83*	0.74	0.84
Reading First program school	0.00	0.00	0.00	0.53*	0.65	0.66*	0.61	0.63*	0.59	0.62
Cohort sample size	25,327	24,570	20,729	19,347		21,027		25,311		23,255

NOTES: All covariates except repeated prior grade and changed schools are measured in the kindergarten year. N/A indicates data not applicable. * indicates FDK mean is significantly different than HDK mean at 5% level. API = Academic Performance Index (1=lowest to 10=highest); CELDT = California English Language Development Test; CST = California Standards Test; EL = English learner; ELA = English-Language Arts; FDK = full-day kindergarten; HDK = half-day kindergarten; HS = high school; RFEF = Reclassified Fluent-English Proficient.

Table B3. Description of analysis sample for LAUSD analysis for economically disadvantaged students

	Cohort mean descriptive statistics									
	2001-02	2002-03	2003-04	2004-05		2005-06		2006-07		2007-08
				FDK	HDK	FDK	HDK	FDK	HDK	FDK
Full-day kindergarten attendance (%)	0.01	0.01	0.01	0.29		0.78		0.95		1.00
Outcomes										
Kindergarten reading composite score (standardized)	N/A	0.01	0.01	0.08*	-0.02	0.03*	-0.03	0.01*	-0.05	0.04
1st grade reading composite score (standardized)	-0.04	-0.06	-0.07	0.01*	-0.06	-0.05*	-0.09	-0.04*	-0.09	N/A
2nd grade CST - ELA score (standardized)	-0.10	-0.08	-0.09	0.00*	-0.10	-0.05*	-0.08	N/A	N/A	N/A
2nd grade CST - ELA proficiency (%)	0.24	0.30	0.35	0.43*	0.39	0.42*	0.40	N/A	N/A	N/A
2nd grade CST - Math score (standardized)	-0.07	-0.06	-0.06	0.03*	-0.08	-0.05	-0.06	N/A	N/A	N/A
2nd grade CST - Math proficiency (%)	0.43	0.46	0.52	0.54*	0.52	0.54*	0.53	N/A	N/A	N/A
Retained by 2nd grade	0.05	0.05	0.05	0.06	0.06	0.06	0.06	N/A	N/A	N/A
Student-level covariates										
Race-ethnicity										
Hispanic/Latino	0.87	0.87	0.87	0.81*	0.87	0.85*	0.88	0.86*	0.88	0.86
Asian	0.02	0.02	0.02	0.02	0.02	0.02*	0.03	0.02*	0.01	0.02
African American/Black	0.07	0.07	0.07	0.10*	0.07	0.09*	0.06	0.08	0.08	0.08
Filipino	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
White	0.02	0.03	0.03	0.05*	0.02	0.03*	0.02	0.03*	0.01	0.03
Other	0.00	0.00	0.00	0.01*	0.00	0.01	0.01	0.00	0.01	0.01
Parent education level										
Less than high school	0.34	0.30	0.31	0.27*	0.32	0.29*	0.34	0.32*	0.29	0.33
High school degree	0.20	0.20	0.20	0.22*	0.20	0.20	0.20	0.21*	0.16	0.20
Some college	0.09	0.10	0.10	0.15*	0.10	0.12*	0.09	0.11*	0.08	0.12
College degree	0.04	0.04	0.05	0.07*	0.05	0.05*	0.05	0.05*	0.04	0.05
Graduate education	0.02	0.02	0.02	0.03*	0.02	0.02*	0.01	0.02	0.02	0.02
Missing information	0.32	0.33	0.32	0.26*	0.31	0.31	0.31	0.29*	0.41	0.29
Kindergarten entry age as of September 1	63.14	63.11	63.12	63.13	63.07	63.12	63.09	63.11	63.21	63.07
Redshirt	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01
English Learner	0.74	0.70	0.63	0.52*	0.63	0.59*	0.64	0.67*	0.69	0.65
Economically Disadvantaged	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Primary home language										
English	0.18	0.20	0.22	0.32*	0.22	0.26*	0.22	0.25*	0.23	0.27
Spanish	0.79	0.76	0.75	0.64*	0.75	0.71*	0.75	0.71*	0.75	0.70*
Other	0.03	0.04	0.03	0.04*	0.03	0.03	0.04	0.03*	0.01	0.04

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Table B3. Description of analysis sample for LAUSD analysis for economically disadvantaged students, *continued*

	Cohort mean descriptive statistics									
	2001–02	2002–03	2003–04	2004–05		2005–06		2006–07		2007–08
				FDK	HDK	FDK	HDK	FDK	HDK	FDK
Student-level covariates, cont'd.										
Birth country is U.S.	0.91	0.91	0.91	0.92*	0.91	0.92*	0.91	0.93	0.92	0.94
Meal program participation	0.97	0.99	0.99	0.99*	0.99	0.98*	0.96	0.97*	0.94	0.91
Changed schools by second grade	0.18	0.19	0.22	0.21*	0.25	0.19*	0.21	N/A	N/A	N/A
Repeated a grade prior to second grade	0.05	0.05	0.05	0.06	0.06	0.06	0.06	N/A	N/A	N/A
School-level covariates										
School size	1158	1147	1127	803*	1096	853*	1020	800*	890	764
API rank	2.84	2.92	3.04	3.42*	2.76	3.03*	3.13	3.08*	3.44	3.20
% EL students	0.61	0.64	0.64	0.54*	0.64	0.56*	0.59	0.52*	0.48	0.50
% students in meal program	0.95	0.95	0.94	0.89*	0.95	0.88*	0.90	0.89	0.89	0.88
% students with parent with less than HS educ	0.43	0.44	0.44	0.39*	0.45	0.43*	0.44	0.43*	0.45	0.43
% teachers with EL authorization	0.59	0.66	0.65	0.71*	0.73	0.74*	0.73	0.91*	0.89	0.92
% teachers with full credential	0.72	0.77	0.80	0.93*	0.93	0.96	0.96	0.97*	0.96	0.97
% teachers with 5 or more years experience	0.62	0.69	0.72	0.79*	0.77	0.82*	0.80	0.83*	0.75	0.85
Reading First program school	0.00	0.00	0.00	0.51*	0.62	0.62*	0.57	0.61	0.63	0.60
Cohort sample size	35,498	37,350	34,496	32,757		34,062		35,143		31,840

Notes: All covariates except repeated prior grade and changed schools are measured in the kindergarten year. N/A indicates data not applicable. * indicates FDK mean is significantly different than HDK mean at 5% level. API = Academic Performance Index (1 = lowest to 10 = highest); CST = California Standards Test; EL = English learner; ELA = English-Language Arts; FDK = full-day kindergarten; HDK = half-day kindergarten; HS = high school.

Table B4. Description of school-level analysis sample for state of California analysis for all students

	Cohort mean descriptive statistics									
	2001–02		2002–03		2003–04		2004–05		2005–06	
	FDK	HDK	FDK	HDK	FDK	HDK	FDK	HDK	FDK	HDK
Full-day kindergarten attendance (%)	0.15		0.16		0.18		0.25		0.34	
Outcomes										
2nd grade CST - ELA score (standardized)	0.10*	0.01	0.05	0.04	0.03	0.04	-0.01	0.04	-0.08*	0.08
2nd grade CST - ELA proficiency (%)	0.39	0.37	0.44	0.44	0.48	0.48	0.49	0.50	0.47*	0.50
2nd grade CST - Math score (standardized)	0.08	0.01	0.13	0.02	0.10	0.03	0.04	0.03	-0.05*	0.06
2nd grade CST - Math proficiency (%)	0.54	0.53	0.60	0.58	0.61	0.60	0.61	0.60	0.59*	0.61
School-level covariates										
School size	496*	644	488*	635	478*	619	493*	606	517*	594
API rank	5.71	5.50	5.67	5.55	5.67	5.54	5.43	5.59	5.11*	5.75
% EL students	0.27	0.29	0.29	0.29	0.29	0.29	0.31*	0.30	0.34*	0.28
% students in meal program	0.56	0.55	0.56	0.54	0.56	0.54	0.60*	0.54	0.63*	0.51
% students with parent with less than HS educ.	0.20	0.21	0.20	0.21	0.20	0.21	0.22*	0.20	0.24*	0.19
% teachers with EL authorization	0.54*	0.49	0.47*	0.55	0.58*	0.61	0.69	0.70	0.73	0.71
% teachers with full credential	0.94	0.93	0.95	0.95	0.95*	0.96	0.97	0.97	0.95*	0.97
% teachers with 5 or more years exper.	0.77*	0.79	0.80	0.80	0.81	0.81	0.81	0.82	0.82	0.82
Sample size (schools)	518	2,975	583	3,095	656	3,068	938	2,844	1,313	2,575

NOTES: All covariates are measured in second grade. * indicates FDK mean is significantly different than HDK mean at 5% level. API = Academic Performance Index (1 = lowest, 10 = highest); CST=California Standards Test; EL = English learner; ELA = English-Language Arts; FDK = full-day kindergarten; HDK = half-day kindergarten; HS = high school.

Table B5. Description of school-level analysis sample for state of California analysis for English learner students

	Cohort mean descriptive statistics									
	2001–02		2002–03		2003–04		2004–05		2005–06	
	FDK	HDK	FDK	HDK	FDK	HDK	FDK	HDK	FDK	HDK
Full-day kindergarten attendance (%)	0.14		0.15		0.17		0.24		0.33	
Outcomes										
2nd grade CST - ELA score (standardized)	0.25*	0.00	0.20*	0.04	0.20*	0.00	-0.00	0.04	-0.03*	0.07
2nd grade CST - ELA proficiency (%)	0.24*	0.21	0.28*	0.26	0.33*	0.29	0.33	0.33	0.33*	0.35
2nd grade CST - Math score (standardized)	0.25*	-0.00	0.24*	0.02	0.28*	-0.01	0.08	0.00	-0.01	0.03
2nd grade CST - Math proficiency (%)	0.43*	0.40	0.49*	0.45	0.51*	0.47	0.50*	0.48	0.49	0.49
1st grade CELDT score (standardized)	0.05	0.04	0.12*	0.01	0.07	0.03	0.06	0.02	0.04	0.02
2nd grade CELDT score (standardized)	0.04	0.04	0.08	0.06	-0.02	0.06	-0.01	0.04	-0.02*	0.07
RFEP by end of 2nd grade (%)	0.05	0.06	0.04*	0.05	0.03	0.04	0.04	0.04	0.04	0.04
School-level covariates										
School size	525*	671	514*	658	504*	641	522*	626	537*	613
API rank	5.43	5.17	5.43	5.27	5.38	5.24	5.25	5.34	4.91*	5.52
% EL students	0.33	0.32	0.34	0.32	0.34*	0.32	0.36*	0.32	0.37*	0.31
% students in meal program	0.60	0.59	0.60	0.58	0.60	0.58	0.64*	0.57	0.66*	0.54
% students with parent with less than HS educ.	0.23	0.23	0.23	0.22	0.23	0.23	0.24*	0.22	0.26*	0.20
% teachers with EL authorization	0.59*	0.52	0.50*	0.57	0.62	0.63	0.72	0.71	0.75*	0.72
% teachers with full credential	0.93*	0.93	0.95	0.95	0.95*	0.96	0.97	0.97	0.95*	0.97
% teachers with 5 or more years exper.	0.77	0.78	0.80	0.80	0.81	0.81	0.81	0.81	0.81	0.81
Sample size (schools)	432	2,639	486	2,785	551	2,764	817	2,590	1,182	2,346

NOTES: All covariates are measured in second grade. * indicates FDK mean is significantly different than HDK mean at 5% level. API = Academic Performance Index (1 = lowest, 10 = highest); CELDT = California English Language Development Test; CST = California Standards Test; EL = English learner; ELA = English-Language Arts; FDK = full-day kindergarten; HDK = half-day kindergarten; HS = high school; RFEP = Reclassified Fluent-English Proficient.

Table B6. Description of school-level analysis sample for state of California analysis for economically disadvantaged students

	Cohort mean descriptive statistics									
	2001-02		2002-03		2003-04		2004-05		2005-06	
	FDK	HDK	FDK	HDK	FDK	HDK	FDK	HDK	FDK	HDK
Full-day kindergarten attendance (%)	0.15		0.16		0.18		0.26		0.35	
Outcomes										
2nd grade CST - ELA score (standardized)	0.20*	0.03	0.16*	0.03	0.15*	0.03	0.12*	0.01	0.08*	0.01
2nd grade CST - ELA proficiency (%)	0.27*	0.25	0.33*	0.31	0.37*	0.36	0.38*	0.37	0.38	0.37
2nd grade CST - Math score (standardized)	0.15*	0.03	0.23*	0.00	0.22*	0.02	0.16*	-0.02	0.10*	-0.01
2nd grade CST - Math proficiency (%)	0.44	0.43	0.52*	0.48	0.53*	0.50	0.52*	0.49	0.51	0.50
School-level covariates										
School size	514*	672	508*	657	497*	641	510*	625	532*	611
API rank	5.22*	4.85	5.26*	4.91	5.29*	4.87	5.00	4.91	4.67*	5.08
% EL students	0.31	0.33	0.33	0.33	0.33	0.33	0.35	0.34	0.37*	0.33
% students in meal program	0.62	0.63	0.62	0.62	0.62	0.62	0.66*	0.62	0.69*	0.60
% students with parent with less than HS educ.	0.23	0.25	0.23	0.24	0.23	0.24	0.24	0.24	0.27*	0.22
% teachers with EL authorization	0.57*	0.52	0.48*	0.58	0.61*	0.64	0.71	0.72	0.74	0.72
% teachers with full credential	0.94*	0.92	0.95	0.95	0.95*	0.96	0.97	0.97	0.95*	0.97
% teachers with 5 or more years exper.	0.77	0.78	0.80	0.80	0.81	0.81	0.82	0.81	0.82	0.81
Sample size (schools)	441	2,521	504	2,620	565	2,585	817	2,373	1,166	2,141

NOTES: All covariates are measured in second grade. * indicates FDK mean is significantly different than HDK mean at 5% level. API = Academic Performance Index (1 = lowest, 10 = highest); CST = California Standards Test; EL = English learner; ELA = English-Language Arts; FDK = full-day kindergarten; HDK = half-day kindergarten; HS = high school.

Appendix C. Study Methods

To estimate the impact of attending a full-day kindergarten program relative to a half-day kindergarten program on academic achievement, retention, and English proficiency, we employ a standard difference-in-differences framework. Depending on the outcome, we estimate ordinary least squares (OLS) or linear probability models as shown in Equation 1.

$$Y_{ist} = \alpha + \beta FD_{st} + \gamma ST_{ist} + \delta SC_{ist} + \mu_s + \zeta_t + \varepsilon_{ist}. \quad [1]$$

In Equation 1, Y_{ist} represents the dependent variable; FD_{st} is a dichotomous variable indicating whether the child attended full-day kindergarten; ST_{ist} is a vector of student characteristics; and SC_{ist} is a vector of school and teacher characteristics. In addition, the model includes a school fixed effect (μ_s), a time fixed effect (ζ_t) and an i.i.d. error term (ε_{ist}).

Our dependent variables include academic outcomes (math test scores, math proficiency, reading test scores, reading proficiency) and grade retention for the entire sample and English proficiency (the probability of reclassification as fluent-English proficient and performance on English language tests (CELDT)) for the sample of English learners. See Appendix B for further discussion of these variables and all the other variables included in the models. The impact of attending full-day kindergarten on academic achievement is evaluated at three points (kindergarten, first grade, and second grade), the impact on grade retention is evaluated at the beginning of second grade, the effect on reclassification of English learners is evaluated at the end of second grade, and the impact on CELDT scores is evaluated in first and second grades.¹ When examining math, reading, and CELDT scores, OLS models are estimated. Linear probability models are used for math and reading proficiency, grade retention, and reclassification. All models adjust standard errors by clustering students at the school level.

Identification for the effect of attending full day kindergarten is derived from the fact that the implementation of full-day kindergarten varies across schools, and in timing within a school. As discussed previously, the analysis will focus on the more detailed data from LAUSD. Unfortunately, the state-level data does not include student-level characteristics and does not identify individual teachers. To the extent that there is significant variation in student characteristics within cohorts within schools, our estimates of LAUSD will yield estimates with less bias.

To interpret these estimates as unbiased, we assume no differences in average potential outcomes between students who attend a school when it offers a half-day program and students who attend the same school when it offers a full-day program. We also assume that schools do not make major changes within the school at the same time that they change to full-day classes. In LAUSD, no additional teachers were needed to convert to full-day classes because teachers were already employed full time; so we do not believe that a sudden influx of new teachers (with varying quality) that might affect our estimates is plausible. However, we do not know whether existing high-quality teachers may have purposely changed schools in order to teach or to avoid a full-day kindergarten class, which would bias our estimates. Likewise, if changes

¹ We also look at the outcomes evaluated in second grade as of third grade and find similar results.

such as new principals were highly correlated with the conversion to full-day classes, that could lead to more biased estimates. However, we do not feel these are factors likely to occur at high rates in our sample. All teachers will end up with full-day classes within a few years so are unlikely to change schools solely for that purpose, nor are principal changes likely to occur non-randomly in correlation with full-day classes. We do know that the Reading First program was initiated in some schools around the time of the switch to full-day classes, and we control for that in our regressions.

Robustness Checks

The richness of the LAUSD data enables us to test a variety of specifications and samples to determine if the estimates generated by our main models are robust. First, we restricted our analysis sample to those students who stayed in the same school during the sample period instead of also including students who changed schools but remained in the district. Second, we restricted the analysis sample used in our main model to students whose teachers did not change schools during the sample period. Both of these models allow us to determine whether our results are robust to more restrictive samples that do not allow students and teachers to move between schools. The inclusion of students and teachers that change schools in our sample could bias our results if movement is related to full-day kindergarten status and outcomes of interest.

Third, we restricted the main analysis sample to students whose teachers did not change schools during the sample period and tested to see whether teacher fixed effects yielded similar estimates to school fixed effects. It is very possible that there are some fixed unobservable characteristics about teachers related to both our outcomes of interest and full-day kindergarten status that would bias our results. Including teacher fixed effects is one way to control for this.

Next, we expanded our main analysis sample to allow students to stay in our sample if they were in the district from kindergarten through the time of the outcome measurement, rather than restricting to students who stayed in the district all years, from kindergarten through third grade. Unlike the first two sensitivity analyses estimated, this test determines if our results are robust to a more inclusive sample. For example, for second grade results, a student who is in LAUSD from kindergarten through second grade but moves out of the district in third grade would be included in Model 5 but not in Model 1. Due to the nature of our data, we are not able to observe whether our three later cohorts (2005–06 through 2007–08) will stay in the district through third grade. This robustness check allows us to test whether our results are biased because students in these cohorts differ and these cohorts are mostly enrolled in full-day kindergarten classes. Our final sensitivity analysis adds contemporaneous control variables and three additional peer controls to our main specification. We include these peer covariates because the student composition of the classroom in the current year could influence outcomes measured in that year. The peer covariates are percentage of class that is Hispanic (not including the observed student); percentage of class that is English Learner (not including student); and percentage of class that is economically disadvantaged (not including student).

To determine whether results from our main model were similar to these sensitivity analyses we tested whether the coefficient of the full-day kindergarten variable from one model was statistically different from another model by comparing 95 percent confidence intervals.

Across the various specifications, all of the results were qualitatively similar to the results presented for Model 1. See Appendix Table D2 for results of the robustness checks.

As was mentioned previously, our main model is estimated on student-level data from LAUSD. However, the availability of school-level statewide data also allows us to test whether the results generated from our main model would be similar to those using school-level statewide data. To accomplish this, we estimate several different models that build on each other. These sensitivity analyses use school means rather than individual data. They include a mixture of school and individual-level covariates, depending on the model. Model 2 uses LAUSD school-level data with both student and school controls. Note that these are the same data used in Model 1 but aggregated at the school level. Model 3 uses the same LAUSD school-level data as Model 2 and only includes school controls. Switching to the data available from CDE, which is only available at the school level, Model 4 is similar to Model 3, but is estimated on the subset of LAUSD schools from the CDE data. Model 5 is the statewide analysis conducted using school mean data and a limited set of school-level covariates from CDE for schools that responded to the PPIC Full-Day Kindergarten Survey.

Across the various specifications, each subsequent model was qualitatively similar to the previous model, as determined by examining the confidence intervals around the coefficients. We conclude that results from the LAUSD individual data are qualitatively similar to results from the CDE school-level data. The differences in the statistical significance between Model 1 and Model 5 highlights the importance of using individual-level data and student-level controls, as noted in Appendix B, to gain a more unbiased picture of the effect of full-day kindergarten. See Appendix Table D3 for results of the robustness checks.

Interactions

Past research has found that benefits of attending a full-day program do not persist into third grade (Cannon, Jacknowitz, and Painter, 2006; DeCicca, 2007; Le et al., 2006; Rathbun, West & Hausken, 2004). However, this past work did not test for differences across the distribution of either student-level characteristics or indicators of school quality. Even though that work did test for differential effects among the economically disadvantaged, it could be the case that students across different parts of the distribution of disadvantage could experience differential impacts even though the average impact of attending a full-day class across all economically disadvantaged students is not large or significantly different from having attended a half-day class. For example, it may be the case that only the most disadvantaged are helped by the extra classroom time in the long run because they need the skills foundation. On the other hand, it may be the case that the students who are the least disadvantaged are positioned to take the most advantage of additional classroom time by building upon existing skills.

To begin to understand how the full-day kindergarten effect varies, we interact full-day kindergarten with each school fixed effect. Using this interaction term for each school and the coefficient on the main full-day kindergarten variable, we calculate marginal effects of full-day kindergarten for each school. We then determine what marginal effect value is associated with each quartile. This provides us with a picture of the variation in full-day effects by school.

Because of the richness of the data from LAUSD, we are also able to test for differential effects of attending full-day kindergarten across the distribution of selected student and school characteristics by estimating Equation 2 below:

$$Y_{ist} = \alpha + \beta FD_{st} + \gamma ST_{ist} + \delta SC_{ist} + \zeta FD_{st} * ST_{ist} + \lambda FD_{st} * SC_{ist} + \mu_s + \zeta_t + \varepsilon_{ist} \quad [2]$$

In this analysis, we interact the following school-level variables with full-day kindergarten: percent of students in a school that received a free or reduced price meal, the API rank of the school, and the percent of students in a school who are English Learners, contained in SC_{ist} . Each of these measures captures the relative disadvantage of the students in the school or the previous performance of the school. We predict average outcomes by kindergarten status and selected student- and school-level characteristics at the means of all other independent variables.

We interact the following student-level characteristics with full-day kindergarten: parental education, age at school entry, and kindergarten English language fluency. A further test of the impact of attending full-day kindergarten on the future performance of elementary school students involves an investigation of the role of initial aptitude entering kindergarten. We use parent education level contained in ST_{ist} to capture a proxy of home environment. Students with more educated parents generally start school with more skills (Cannon and Karoly, 2007). Additionally, there are two measures of initial aptitude contained in ST_{ist} that allow us to both test for its direct role and its interaction with attending full-day kindergarten. Even though the data do not provide initial assessments of student performance upon entering kindergarten, research suggests that the age that one enters kindergarten may positively impact future performance (Cannon and Lipscomb, 2008). In addition, anecdotal evidence from school administrators suggests that older children may be better positioned to take advantage of full-day kindergarten. For example, as noted in the survey of California schools, some schools with full-day kindergarten programs phased it in over the first few months of the academic year because of this concern. Therefore, we would expect the coefficients on the age of entry variables to be positive.

Finally, we are able to estimate how initial aptitude in English, as measured by the kindergarten CELDT score, impacts performance for English learners. We would expect the coefficient of kindergarten CELDT score to be positive because a better command of English would likely lead to better academic performance. The sign of the coefficient of the interaction term between initial aptitude and full-day kindergarten will be determined by whether students closest to the threshold of English proficiency are most helped by attending a full-day program, or students who have the worst English skills receive the greatest benefit from attending full-day kindergarten.

Appendix D. Regression Results

While Appendix C describes the study's methods, this appendix contains regression results for our main models, robustness checks, and interactions. Table D1 presents the main full-day kindergarten estimation results for the LAUSD student-level sample of students staying within the district during our time period ("matched district"). Column 1 presents coefficients and standard errors across outcomes for all students, column 2 presents results for economically disadvantaged students, and column 3 presents results for English learners. In this table, each coefficient and standard error couplet represents results from a different regression.

Table D2 presents robustness checks of the results presented in Table D1. Column 1, which we refer to as Model 1, is the main LAUSD specification from Table D1. In this paragraph, we describe how each column (i.e., model) differs from Model 1. Model 2 includes students who have stayed at the same school through third grade or spring 2008, whichever comes first. Model 3 includes students with kindergarten teachers who have stayed at the same school within the study period. Model 4 includes the same sample of students as Model 3 and uses teacher fixed effects rather than school fixed effects. Model 5 includes students who have stayed in the district through the time of the outcome measure, not through third grade. Model 6 uses contemporaneous control variables, rather than controls measured in the kindergarten year, and three additional peer controls. Similar to Table D1, each coefficient and standard error couplet represents results from a different regression.

Table D3 provides a summary of full-day kindergarten coefficients and standard errors across outcomes for different data samples and specifications as described in Appendix C. Column 1 presents our main estimation results for the LAUSD matched district student-level sample from Table D1, which we refer to as Model 1. Models 2 through 5 are sensitivity tests of the main data to determine if the main results are comparable to the state-level data available from CDE. Models 2 through 5 use school means rather than individual-level data so that LAUSD models are comparable to how data are structured in the CDE models, which do not include individual-level data. They include a mixture of school and individual-level covariates depending on the model. Model 2 uses LAUSD school-level data with both student and school controls. Model 3 uses LAUSD school-level data and only includes school controls. Model 4 is similar to Model 3, but is estimated on the subset of LAUSD schools from the CDE data. Model 5 is the statewide analysis conducted using school mean data and a limited set of school-level covariates from CDE for schools that responded to the PPIC Full-Day Kindergarten Survey. In this table, each coefficient and standard error couplet represents results from a different regression.

Table D4 presents an exemplar of the full regression results for all covariates for the main model estimating the effect of full-day kindergarten on retention outcome. Column 1 presents results for all students, column 2 presents results for economically disadvantaged students, and column 3 presents results for English Learners. Each column represents results from a separate regression model.

Tables D5 through D7 present results for regressions that interact full-day kindergarten with selected student- and school-level characteristics for all students, economically disadvantaged students, and English learners, respectively. In each table, each column represents the results from a different regression model. Results are only shown for selected variables.

**Table D1. Effect of full-day kindergarten:
Main estimation results for LAUSD matched district individual samples**

Outcome measure	All students	Economically disadvantaged	English learners
	Coef (Std er) [1]	Coef (Std er) [2]	Coef (Std er) [3]
Kindergarten reading score (standardized) N=217,842 / 176,715 / 112,419	0.109*** (0.013)	0.118*** (0.015)	0.125*** (0.021)
1st grade reading score (standardized) N=188,741 / 156,524 / 98,596	0.043*** (0.015)	0.034** (0.016)	0.001 (0.020)
2nd grade CST score - ELA (standardized) N=201,832 / 168,635 / 107,567	0.021 (0.015)	0.022 (0.016)	-0.011 (0.020)
2nd grade CST score - Math (standardized) N=201,832 / 168,639 / 107,565	0.026* (0.016)	0.019 (0.017)	-0.008 (0.022)
2nd grade CST proficiency - ELA N=201,832 / 168,635 / 107,567	0.015** (0.007)	0.014* (0.007)	0.000 (0.009)
2nd grade CST proficiency - Math N=201,832 / 168,639 / 107,565	0.012* (0.007)	0.010 (0.008)	0.000 (0.010)
Retained by 2nd grade N=208,061 / 174,043 / 110,952	-0.049*** (0.005)	-0.052*** (0.006)	-0.052*** (0.007)
<u>English proficiency</u>			
1st grade CELDT score (standardized) N=102,602			0.029 (0.024)
2nd grade CELDT score (standardized) N=102,591			0.019 (0.023)
RFEP by end of 2nd grade N=109,586			0.012 (0.008)

NOTES: Standard errors in parentheses and all models adjust standard errors by clustering at the school level. ***p<0.01, **p<0.05, *p<0.10. Models 1-3 are the main specifications for analyses and include student-level data for all LAUSD students who stay in the district K-3 or through the 2007-08 school year. All models include year and school fixed effects as well as student- and school-level controls. Appendix B has further information on covariates used in each model. CELDT = California English Language Development Test; Coef = Coefficient; CST = California Standards Test; ELA = English-Language Arts; RFEP = Reclassified Fluent-English Proficient; Std er = Standard error.

Table D2. Sensitivity tests for main estimation model

Outcome measure	LAUSD main estimation model Coef (Std er) [1]	Students staying in same school Coef (Std er) [2]	Teachers staying in same school Coef (Std er) [3]	Teachers staying in same school, teacher FE Coef (Std er) [4]	Students with varying time in district Coef (Std er) [5]	Contemporaneous and peer covariates Coef (Std er) [6]
All students						
Kindergarten reading	0.109*** (0.013)	0.097*** (0.013)	0.107*** (0.013)	0.107*** (0.013)	0.115*** (0.013)	0.113*** (0.013)
1st grade reading	0.043** (0.015)	0.054*** (0.017)	0.043*** (0.016)	0.046*** (0.016)	0.043*** (0.015)	0.040*** (0.015)
2nd CST score – ELA	0.021 (0.015)	0.023 (0.017)	0.022 (0.015)	0.019 (0.016)	0.019 (0.014)	0.008 (0.014)
2nd CST score - Math	0.026* (0.016)	0.032* (0.018)	0.022 (0.017)	0.016 (0.017)	0.025 (0.015)	0.019 (0.015)
2nd CST prof – ELA	0.015** (0.007)	0.018** (0.008)	0.015** (0.007)	0.012 (0.008)	0.014** (0.007)	0.010 (0.007)
2nd CST prof – Math	0.012* (0.007)	0.015* (0.008)	0.013* (0.007)	0.012 (0.008)	0.012* (0.007)	0.010 (0.007)
Retained by 2nd grade	-0.049*** (0.005)	-0.043*** (0.005)	-0.047*** (0.005)	-0.058*** (0.006)	-0.049*** (0.005)	-0.048*** (0.005)
Economically disadvantaged						
Kindergarten reading	0.118*** (0.015)	0.110*** (0.015)	0.117*** (0.016)	0.115*** (0.015)	0.125*** (0.015)	0.119*** (0.015)
1st grade reading	0.034** (0.016)	0.046** (0.018)	0.034** (0.017)	0.035** (0.017)	0.034** (0.016)	0.036** (0.016)
2nd CST score - ELA	0.022 (0.016)	0.025 (0.018)	0.023 (0.016)	0.014 (0.017)	0.02 (0.015)	0.012 (0.015)
2nd CST score - Math	0.019 (0.017)	0.027 (0.02)	0.017 (0.018)	0.004 (0.019)	0.018 (0.017)	0.015 (0.016)
2nd CST prof - ELA	0.014* (0.007)	0.016* (0.009)	0.013 (0.008)	0.008 (0.008)	0.012* (0.007)	0.009 (0.007)
2nd CST prof - Math	0.01 (0.008)	0.014 (0.009)	0.011 (0.008)	0.007 (0.009)	0.01 (0.008)	0.007 (0.008)
Retained by 2nd grade	-0.052*** (0.006)	-0.044*** (0.006)	-0.049*** (0.006)	-0.061*** (0.007)	-0.051*** (0.006)	-0.051*** (0.006)
English learners						
Kindergarten reading	0.125*** (0.021)	0.106*** (0.021)	0.126*** (0.022)	0.117*** (0.022)	0.125*** (0.021)	0.127*** (0.021)
1st grade reading	0.001 (0.02)	-0.000 (0.022)	0.001 (0.022)	-0.001 (0.024)	0.001 (0.02)	-0.040* (0.023)

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Table D2. Sensitivity tests for main estimation model, *continued*

Outcome measure	LAUSD main estimation model Coef (Std er) [1]	Students staying in same school Coef (Std er) [2]	Teachers staying in same school Coef (Std er) [3]	Teachers staying in same school, teacher FE Coef (Std er) [4]	Students with varying time in district Coef (Std er) [5]	Contemporaneous and peer covariates Coef (Std er) [6]
English learners, <i>cont'd.</i>						
2nd CST score - ELA	-0.011 (0.02)	-0.012 (0.023)	-0.008 (0.022)	-0.03 (0.024)	-0.01 (0.02)	-0.035 (0.022)
2nd CST score - Math	-0.008 (0.022)	0.002 (0.026)	-0.013 (0.024)	-0.029 (0.026)	-0.008 (0.022)	-0.022 (0.023)
2nd CST prof - ELA	0.000 (0.009)	0.003 (0.011)	-0.001 (0.01)	-0.014 (0.011)	-0.001 (0.009)	-0.008 (0.010)
2nd CST prof - Math	0.000 (0.01)	0.005 (0.012)	0.001 (0.011)	-0.006 (0.012)	0.001 (0.01)	-0.012 (0.011)
Retained by 2nd grade	-0.052*** (0.007)	-0.045*** (0.006)	-0.051*** (0.007)	-0.059*** (0.009)	-0.051*** (0.007)	-0.054*** (0.007)
<u>English proficiency</u>						
1st grade CELDT score	0.029 (0.024)	0.042 (0.027)	0.026 (0.025)	0.027 (0.024)	0.03 (0.024)	0.03 (0.025)
2nd grade CELDT score	0.019 (0.023)	0.013 (0.026)	0.018 (0.024)	0.009 (0.024)	0.018 (0.023)	-0.015 (0.023)
RFEP by 2nd grade	0.012 (0.008)	0.018* (0.01)	0.013 (0.009)	0.011 (0.009)	0.013* (0.008)	0.012 (0.008)
Year fixed effects	Y	Y	Y	Y	Y	Y
School fixed effects	Y	Y	Y	N	Y	Y
Teacher fixed effects	N	N	N	Y	N	N
School-level controls	Y	Y	Y	Y	Y	Y
Student-level controls	Y	Y	Y	Y	Y	Y
Peer controls	N	N	N	N	N	Y
Contemporaneous controls	N	N	N	N	N	Y

NOTES: Standard errors in parentheses and all models adjust standard errors by clustering at the school level. ***p<0.01, **p<0.05, *p<0.10. Model 1 is the main LAUSD specification. Model 2 includes students who have stayed at the same school through third grade or spring 2008, whichever comes first. Model 3 includes students with kindergarten teachers who have stayed at the same school within the study period. Model 4 includes the same sample of students as Model 3 and uses teacher fixed effects rather than school fixed effects. Model 5 includes students who have stayed in the district through the time of the outcome measure rather than requiring they stay through third grade. For example, for second-grade results, a student who is in LAUSD from kindergarten through second grade but moves out of the district in third grade would be included in Model 5 but not in Model 1. Model 6 uses contemporaneous control variables and three additional peer controls in each model. The peer covariates are percentage of class that is Hispanic (not including the observed student); percentage of class that is English Learner (not including student); and percentage of class that is economically disadvantaged (not including student). Appendix B has further information on covariates used in each model. CELDT = California English Language Development Test; Coef = Coefficient; CST = California Standards Test; ELA = English-Language Arts; prof = proficiency; FE = fixed effects; RFEP = reclassified Fluent-English Proficient; Std er = Standard error.

Table D3. Sensitivity tests comparing LAUSD data against CDE data

Outcome measure	LAUSD main estimation model Coef (Std er) [1]	LAUSD school level with student and school controls Coef (Std er) [2]	LAUSD school level with school controls Coef (Std er) [3]	LAUSD subsample of CDE data with school controls Coef (Std er) [4]	State CDE data with school controls Coef (Std er) [5]
All students					
Kindergarten reading	0.109*** (0.013)	N/A	N/A	N/A	N/A
1st grade reading	0.043*** (0.015)	N/A	N/A	N/A	N/A
2nd CST score - ELA	0.021 (0.015)	0.029 (0.036)	0.054 (0.037)	0.046 (0.033)	0.042** (0.017)
2nd CST score - Math	0.026* (0.016)	0.043 (0.045)	0.067 (0.044)	0.063 (0.04)	0.047** (0.020)
2nd CST prof - ELA	0.015** (0.007)	0.009 (0.007)	0.013* (0.007)	0.013* (0.007)	0.016*** (0.004)
2nd CST prof - Math	0.012* (0.007)	0.010 (0.008)	0.014* (0.008)	0.014* (0.008)	0.011*** (0.004)
Retained by 2nd grade	-0.049*** (0.005)	N/A	N/A	N/A	N/A
Economically disadvantaged					
Kindergarten reading	0.118*** (0.015)	N/A	N/A	N/A	N/A
1st grade reading	0.034** (0.016)	N/A	N/A	N/A	N/A
2nd CST score - ELA	0.022 (0.016)	0.073 (0.047)	0.123*** (0.048)	0.116** (0.052)	0.104*** (0.028)
2nd CST score - Math	0.019 (0.017)	0.064 (0.055)	0.099* (0.054)	0.101* (0.059)	0.107*** (0.031)
2nd CST prof - ELA	0.014* (0.007)	0.011 (0.008)	0.020** (0.008)	0.017** (0.008)	0.018*** (0.004)
2nd CST prof - Math	0.010 (0.008)	0.016* (0.009)	0.022** (0.009)	0.017* (0.009)	0.016*** (0.005)
Retained by 2nd grade	-0.052*** (0.006)	N/A	N/A	N/A	N/A
English learners					
Kindergarten reading	0.125*** (0.021)	N/A	N/A	N/A	N/A
1st grade reading	0.001 (0.020)	N/A	N/A	N/A	N/A

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Table D3. Sensitivity tests comparing LAUSD data against CDE data, *continued*

Outcome measure	LAUSD main estimation model Coef (Std er) [1]	LAUSD school level with student and school controls Coef (Std er) [2]	LAUSD school level with school controls Coef (Std er) [3]	LAUSD subsample of CDE data with school controls Coef (Std er) [4]	State CDE data with school controls Coef (Std er) [5]
English learners, <i>cont'd.</i>					
2nd CST score - ELA	-0.011 (0.020)	0.004 (0.057)	0.07 (0.062)	0.09 (0.057)	0.021 (0.029)
2nd CST score - Math	-0.008 (0.022)	0.043 (0.064)	0.103 (0.066)	0.120* (0.062)	0.044 (0.032)
2nd CST prof - ELA	0.000 (0.009)	0.003 (0.011)	0.013 (0.012)	0.017 (0.011)	0.001 (0.006)
2nd CST prof - Math	0.000 (0.010)	0.003 (0.012)	0.016 (0.012)	0.025** (0.012)	0.007 (0.007)
Retained by 2nd grade	-0.052*** (0.007)	N/A	N/A	N/A	N/A
<u>English proficiency</u>					
1st grade CELDT score	0.029 (0.024)	-0.015 (0.067)	0.097 (0.065)	0.102* (0.055)	0.135*** (0.025)
2nd grade CELDT score	0.019 (0.023)	0.049 (0.062)	0.134** (0.065)	0.086 (0.058)	0.008 (0.031)
RFEP by 2nd grade	0.012 (0.008)	0.012 (0.010)	0.019* (0.011)	0.012 (0.009)	0.026*** (0.005)
Year fixed effects	Y	Y	Y	Y	Y
School fixed effects	Y	Y	Y	Y	Y
School-level controls	Y	Y	Y	Y	Y
Student-level controls	Y	Y	N	N	N
Data source	LAUSD	LAUSD	LAUSD	CDE	CDE

NOTES: Standard errors in parentheses and all models adjust standard errors by clustering at the school level. ***p<0.01, **p<0.05, *p<0.10. Model 1 is the main specification for analyses and includes student-level data for all LAUSD students who stay in the district K-3 or through the 2007-08 school year. Models 2-5 are sensitivity tests of the main data to check if the main results are comparable to the state-level data available from the California Department of Education (CDE). N/A indicates we are unable to examine these outcomes using data available from CDE so comparison tests are not performed. Models 2-5 use school means rather than individual data. They offer a mixture of school and individual-level covariates depending on the model. Model 5 is the statewide analysis conducted using school mean data and a limited set of school-level covariates from CDE for schools that responded to the PPIC Full-Day Kindergarten Survey. Model 4 is the subset of LAUSD schools from that CDE data. Model 3 is comparable to Model 4 but uses data from LAUSD rather than CDE. Model 2 is comparable to Model 3 but includes a set of individual-level controls that are not available in the CDE data. Appendix B has further information on covariates used in each model. CELDT = California English Language Development Test; Coef = coefficient; CST = California Standards Test; ELA = English-Language Arts; prof = proficiency; RFEP = Reclassified Fluent-English Proficient; Std er = Standard error.

Table D4. Full model results for main estimation retention outcome

Variables	All students	Economically disadvantaged	English learners
	Coef (Std er) [1]	Coef (Std er) [2]	Coef (Std er) [3]
Full-day kindergarten	-0.049*** (0.005)	-0.052*** (0.006)	-0.052*** (0.007)
Student race-ethnicity			
Hispanic/Latino			0.013 (0.008)
Asian	-0.033*** (0.003)	-0.028*** (0.005)	
African American/Black	-0.009*** (0.002)	-0.009*** (0.003)	
Filipino	-0.037*** (0.003)	-0.036*** (0.005)	
White	-0.017*** (0.003)	-0.008 (0.005)	
Other	-0.007 (0.007)	0.001 (0.009)	
Parent education level (omitted less than high school)			
High school degree	-0.014*** (0.002)	-0.014*** (0.002)	-0.008*** (0.002)
Some college	-0.026*** (0.002)	-0.026*** (0.002)	-0.013*** (0.003)
College degree	-0.029*** (0.002)	-0.029*** (0.003)	-0.015*** (0.004)
Graduate education	-0.031*** (0.003)	-0.021*** (0.004)	-0.011** (0.005)
Education missing	-0.008*** (0.002)	-0.006*** (0.002)	-0.002 (0.002)
Kindergarten entry age as of September 1 (months)	-0.006*** (0.000)	-0.007*** (0.000)	-0.005*** (0.000)
Redshirt	0.022*** (0.004)	0.022*** (0.005)	-0.007 (0.005)
English learner	0.032*** (0.002)	0.034*** (0.002)	
Primary home language (omitted English)			
Spanish	-0.028*** (0.002)	-0.031*** (0.002)	0.014 (0.009)
Other	-0.023*** (0.003)	-0.035*** (0.004)	
Birth country is U.S.	-0.015*** (0.002)	-0.015*** (0.002)	0.007*** (0.002)

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Table D4. Full model results for main estimation retention outcome, *continued*

Variables	All students	Economically disadvantaged	English learners
	Coef (Std er) [1]	Coef (Std er) [2]	Coef (Std er) [3]
Meal program participation	0.008*** (0.002)	-0.006 (0.006)	0.006* (0.003)
Changed school between kindergarten and first grade	0.043*** (0.002)	0.045*** (0.002)	0.045*** (0.003)
School size (in 100s)	-0.002 (0.001)	-0.002 (0.002)	-0.002 (0.002)
API rank	0.004** (0.002)	0.004** (0.002)	0.005** (0.002)
% EL students (school)	0.085** (0.033)	0.083** (0.039)	0.112*** (0.042)
% students in meal program (school)	0.131*** (0.028)	0.151*** (0.035)	0.203*** (0.047)
% students with parent with less than high school education (school)	-0.018 (0.025)	-0.012 (0.025)	-0.012 (0.029)
% teachers with EL authorization (school)	-0.037 (0.023)	-0.045* (0.027)	-0.006 (0.032)
% teachers with full credential (school)	-0.216*** (0.027)	-0.250*** (0.032)	-0.254*** (0.035)
% teachers with 5 or more years experience (school)	-0.125*** (0.022)	-0.141*** (0.025)	-0.108*** (0.027)
Reading First program school	-0.010** (0.005)	-0.016*** (0.006)	-0.016** (0.007)
English Language Development level in kindergarten (omitted Level 1)			
Level 2			-0.043*** (0.003)
Level 3, 4, or 5			-0.047*** (0.005)
Kindergarten initial CELDT score			-0.025*** (0.001)
Constant	0.579*** (0.054)	0.588*** (0.067)	0.306*** (0.066)
R-squared	0.139	0.137	0.156
Sample size	208,061	174,043	110,952

NOTES: Linear probability model. Standard errors in parentheses and all models adjust standard errors by clustering at the school level. ***p<0.01, **p<0.05, *p<0.10 Appendix B has further information on covariates used in each model. API = Academic Performance Index (1 = lowest to 10 = highest); CELDT = California English Language Development Test; Coef = Coefficient; EL = English learner; Std er = Standard error.

Table D5. Interaction model results, all students

Variables	Kindergarten reading Coef (Std er) [1]	1st grade reading Coef (Std er) [2]	2nd grade CST ELA score Coef (Std er) [3]	2nd grade CST math score Coef (Std er) [4]	2nd grade CST ELA proficiency Coef (Std er) [5]	2nd grade CST math proficiency Coef (Std er) [6]	Retained by 2nd grade Coef (Std er) [7]
Full-day kindergarten (FD)	0.466*** (0.107)	0.207* (0.113)	0.168 (0.119)	0.024 (0.122)	-0.030 (0.059)	0.060 (0.058)	-0.186*** (0.040)
FD x kindergarten entry age	-0.004*** (0.001)	0.002 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001* (0.001)	0.000 (0.001)	0.002*** (0.000)
FD X parent HS degree (omitted less than HS)	-0.028** (0.014)	-0.004 (0.014)	0.005 (0.016)	0.017 (0.017)	0.004 (0.008)	0.000 (0.008)	0.001 (0.004)
FD X parent some college educ.	-0.059*** (0.015)	-0.028* (0.016)	-0.007 (0.018)	0.018 (0.018)	0.000 (0.010)	0.010 (0.009)	0.009* (0.004)
FD X parent college education	-0.060*** (0.016)	-0.011 (0.020)	0.004 (0.023)	0.054** (0.022)	-0.003 (0.011)	0.015 (0.011)	0.007 (0.004)
FD X parent graduate education	-0.056*** (0.018)	0.033 (0.029)	0.02 (0.032)	0.043 (0.033)	0.000 (0.015)	0.014 (0.015)	0.012** (0.005)
FD X parent education missing	-0.023 (0.016)	-0.011 (0.016)	0.000 (0.018)	0.008 (0.019)	0.001 (0.010)	0.005 (0.010)	0.005 (0.004)
FD X % EL students (school)	0.033 (0.065)	-0.026 (0.073)	0.158** (0.075)	0.106 (0.077)	0.045 (0.036)	0.046 (0.034)	0.034** (0.017)
FD X % students in meal program (school)	-0.029 (0.066)	-0.203*** (0.071)	-0.240*** (0.077)	-0.099 (0.076)	-0.044 (0.039)	-0.041 (0.033)	0.000 (0.020)
FD X API rank	-0.013** (0.006)	-0.024*** (0.007)	-0.024*** (0.007)	-0.009 (0.007)	-0.005 (0.003)	-0.004 (0.003)	-0.007*** (0.002)
Kindergarten entry age as of September 1 (months)	0.020*** (0.001)	0.019*** (0.001)	0.023*** (0.001)	0.031*** (0.001)	0.010*** (0.000)	0.014*** (0.000)	-0.007*** (0.000)

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Table D5. Interaction model results, all students, *continued*

Variables	Kindergarten reading Coef (Std er) [1]	1st grade reading Coef (Std er) [2]	2nd grade CST ELA score Coef (Std er) [3]	2nd grade CST math score Coef (Std er) [4]	2nd grade CST ELA proficiency Coef (Std er) [5]	2nd grade CST math proficiency Coef (Std er) [6]	Retained by 2nd grade Coef (Std er) [7]
Parent education level							
High school degree (omitted less than high school)	0.106*** (0.010)	0.097*** (0.008)	0.071*** (0.007)	0.050*** (0.007)	0.028*** (0.003)	0.021*** (0.004)	-0.014*** (0.002)
Some college	0.159*** (0.011)	0.170*** (0.011)	0.154*** (0.010)	0.113*** (0.009)	0.065*** (0.005)	0.051*** (0.005)	-0.028*** (0.002)
College degree	0.197*** (0.013)	0.293*** (0.014)	0.281*** (0.013)	0.224*** (0.012)	0.117*** (0.006)	0.088*** (0.006)	-0.030*** (0.003)
Graduate education	0.198*** (0.014)	0.358*** (0.021)	0.369*** (0.020)	0.314*** (0.018)	0.135*** (0.008)	0.100*** (0.007)	-0.034*** (0.003)
Education missing	0.060*** (0.012)	0.060*** (0.011)	0.030*** (0.008)	0.014* (0.009)	0.013*** (0.004)	0.006 (0.005)	-0.009*** (0.002)
% EL students (school)	-0.059 (0.104)	-0.223* (0.127)	-0.157 (0.103)	-0.042 (0.113)	-0.057 (0.047)	-0.004 (0.052)	0.082** (0.034)
% students in meal program (school)	-0.055 (0.104)	0.014 (0.112)	0.005 (0.103)	-0.064 (0.099)	-0.032 (0.057)	-0.032 (0.049)	0.150*** (0.033)
API rank	0.013** (0.006)	0.004 (0.007)	-0.004 (0.007)	-0.006 (0.007)	-0.003 (0.003)	-0.003 (0.003)	0.007*** (0.002)
Constant	-1.492*** (0.146)	-1.006*** (0.180)	-1.156*** (0.161)	-1.644*** (0.175)	-0.117 (0.081)	-0.203** (0.084)	0.576*** (0.060)
R-squared	0.045	0.16	0.25	0.199	0.187	0.127	0.14
Sample size	217,842	188,741	201,832	201,832	201,832	201,832	208,061

NOTES: Standard errors in parentheses and all models adjust standard errors by clustering at the school level. ***p<0.01, **p<0.05, *p<0.10 Appendix B has further information on covariates used in each model. API = Academic Performance Index (1=lowest to 10=highest); Coef = Coefficient; EL = English learner; HS = high school; Std er = Standard error.

Table D6. Interaction model results, economically disadvantaged students

Variables	Kindergarten reading Coef (Std er) [1]	1st grade reading Coef (Std er) [2]	2nd grade CST ELA score Coef (Std er) [3]	2nd grade CST math score Coef (Std er) [4]	2nd grade CST ELA proficiency Coef (Std er) [5]	2nd grade CST math proficiency Coef (Std er) [6]	Retained by 2nd grade Coef (Std er) [7]
Full-day kindergarten (FD)	0.381*** (0.134)	0.173 (0.131)	0.166 (0.134)	0.031 (0.136)	-0.028 (0.070)	0.059 (0.069)	-0.205*** (0.049)
FD x kindergarten entry age	-0.004*** (0.001)	0.002 (0.001)	0.001 (0.001)	0.001 (0.002)	0.002*** (0.001)	0.000 (0.001)	0.002*** (0.001)
FD X parent HS degree (omitted less than HS)	-0.024* (0.014)	-0.002 (0.014)	0.006 (0.017)	0.009 (0.017)	0.004 (0.009)	0.000 (0.008)	0.002 (0.004)
FD X parent some college educ.	-0.062*** (0.016)	-0.029* (0.018)	-0.019 (0.020)	0.003 (0.020)	-0.012 (0.011)	0.002 (0.010)	0.010** (0.005)
FD X parent college education	-0.067*** (0.019)	-0.028 (0.024)	0.016 (0.026)	0.057** (0.026)	-0.005 (0.014)	0.024* (0.013)	0.011** (0.005)
FD X parent graduate education	-0.054* (0.029)	0.016 (0.034)	0.023 (0.041)	0.028 (0.044)	0.008 (0.021)	0.004 (0.021)	0.009 (0.008)
FD X parent education missing	-0.018 (0.017)	-0.021 (0.016)	-0.009 (0.018)	0.000 (0.019)	-0.003 (0.010)	0.002 (0.010)	0.006 (0.005)
FD X % EL students (school)	0.049 (0.074)	-0.033 (0.079)	0.164** (0.079)	0.105 (0.078)	0.050 (0.037)	0.046 (0.037)	0.03 (0.020)
FD X % students in meal program (school)	0.042 (0.101)	-0.170* (0.098)	-0.265*** (0.097)	-0.103 (0.094)	-0.099* (0.050)	-0.061 (0.045)	0.029 (0.032)
FD X API rank	-0.013** (0.006)	-0.027*** (0.007)	-0.027*** (0.007)	-0.012* (0.007)	-0.007** (0.003)	-0.004 (0.003)	-0.008*** (0.002)
Kindergarten entry age as of September 1 (months)	0.022*** (0.001)	0.020*** (0.001)	0.024*** (0.001)	0.032*** (0.001)	0.010*** (0.000)	0.014*** (0.000)	-0.007*** (0.000)

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Table D6. Interaction model results, economically disadvantaged students, *continued*

Variables	Kindergarten reading Coef (Std er) [1]	1st grade reading Coef (Std er) [2]	2nd grade CST ELA score Coef (Std er) [3]	2nd grade CST math score Coef (Std er) [4]	2nd grade CST ELA proficiency Coef (Std er) [5]	2nd grade CST math proficiency Coef (Std er) [6]	Retained by 2nd grade Coef (Std er) [7]
Parent education level							
High school degree (omitted less than high school)	0.101*** (0.010)	0.106*** (0.008)	0.081*** (0.007)	0.059*** (0.008)	0.031*** (0.004)	0.024*** (0.004)	-0.015*** (0.002)
Some college	0.162*** (0.012)	0.185*** (0.012)	0.170*** (0.010)	0.129*** (0.010)	0.070*** (0.005)	0.055*** (0.005)	-0.028*** (0.002)
College degree	0.198*** (0.015)	0.284*** (0.016)	0.253*** (0.014)	0.202*** (0.014)	0.112*** (0.007)	0.079*** (0.007)	-0.031*** (0.003)
Graduate education	0.171*** (0.022)	0.235*** (0.023)	0.209*** (0.019)	0.179*** (0.020)	0.088*** (0.010)	0.070*** (0.010)	-0.023*** (0.004)
Education missing	0.053*** (0.013)	0.052*** (0.011)	0.022*** (0.009)	0.007 (0.009)	0.009** (0.004)	0.003 (0.005)	-0.008*** (0.002)
% EL students (school)	-0.046 (0.115)	-0.214 (0.131)	-0.182 (0.113)	-0.074 (0.122)	-0.08 (0.051)	-0.02 (0.056)	0.076* (0.041)
% students in meal program (school)	-0.092 (0.130)	0.041 (0.122)	0.018 (0.113)	-0.084 (0.107)	-0.019 (0.056)	-0.039 (0.052)	0.154*** (0.044)
API rank	0.015** (0.006)	0.007 (0.007)	-0.003 (0.007)	-0.003 (0.008)	-0.002 (0.003)	-0.003 (0.004)	0.008*** (0.002)
Constant	-1.636*** (0.175)	-1.147*** (0.198)	-1.257*** (0.185)	-1.711*** (0.192)	-0.192** (0.089)	-0.269*** (0.092)	0.596*** (0.074)
R-squared	0.042	0.106	0.158	0.13	0.125	0.09	0.138
Sample size	176,715	156,524	168,635	168,639	168,635	168,639	174,043

NOTES: Standard errors in parentheses and all models adjust standard errors by clustering at the school level. ***p<0.01, **p<0.05, *p<0.10 Appendix B has further information on covariates used in each model. API = Academic Performance Index (1 = lowest to 10 = highest); Coef = Coefficient; EL = English learner; HS = high school; Std er = Standard error.

Table D7. Interaction model results, English learner students

Variables	Kindergarten reading Coef (Std er) [1]	1st grade reading Coef (Std er) [2]	2nd grade CST ELA score Coef (Std er) [3]	2nd grade CST Math score Coef (Std er) [4]	2nd grade CST ELA proficiency Coef (Std er) [5]	2nd grade CST math proficiency Coef (Std er) [6]	Retained by 2nd grade Coef (Std er) [7]
Full-day kindergarten (FD)	0.375** (0.167)	0.489*** (0.161)	0.223 (0.164)	0.111 (0.173)	-0.004 (0.084)	0.061 (0.091)	-0.097* (0.054)
FD x kindergarten entry age	-0.004** (0.002)	-0.001 (0.002)	0.000 (0.002)	0.000 (0.002)	0.002* (0.001)	0.000 (0.001)	0.000 (0.001)
FD X parent HS degree (omitted less than HS)	-0.013 (0.016)	0.005 (0.015)	0.015 (0.018)	-0.005 (0.021)	0.005 (0.010)	-0.011 (0.011)	-0.005 (0.005)
FD X parent some college educ.	-0.015 (0.021)	-0.063*** (0.024)	-0.039 (0.029)	0.002 (0.028)	-0.017 (0.015)	-0.006 (0.015)	0.007 (0.007)
FD X parent college education	-0.052** (0.024)	-0.074** (0.033)	-0.018 (0.039)	0.028 (0.038)	-0.018 (0.022)	0.009 (0.020)	0.004 (0.008)
FD X parent graduate education	-0.055 (0.037)	0.034 (0.044)	0.046 (0.053)	-0.03 (0.057)	0.003 (0.029)	0.005 (0.032)	0.008 (0.013)
FD X parent education missing	0.004 (0.020)	0.009 (0.018)	0.012 (0.021)	0.02 (0.023)	0.003 (0.011)	0.009 (0.012)	0.003 (0.006)
FD X % EL students (school)	-0.078 (0.113)	-0.068 (0.108)	0.111 (0.118)	0.015 (0.120)	0.045 (0.057)	0.013 (0.059)	0.046 (0.031)
FD X % students in meal program (school)	0.089 (0.124)	-0.304** (0.129)	-0.284** (0.140)	-0.122 (0.137)	-0.119* (0.069)	-0.082 (0.069)	0.036 (0.044)
FD X API rank	-0.014 (0.009)	-0.030*** (0.009)	-0.022** (0.010)	-0.002 (0.010)	-0.005 (0.005)	-0.002 (0.005)	-0.010*** (0.003)
FD X kindergarten CELDT score	-0.043*** (0.012)	0.019** (0.008)	-0.015* (0.009)	-0.006 (0.009)	0.010** (0.004)	0.003 (0.005)	0.006** (0.003)

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Table D7. Interaction model results, English learner students, *continued*

Variables	Kindergarten reading Coef (Std er) [1]	1st grade reading Coef (Std er) [2]	2nd grade CST ELA score Coef (Std er) [3]	2nd grade CST math score Coef (Std er) [4]	2nd grade CST ELA proficiency Coef (Std er) [5]	2nd grade CST math proficiency Coef (Std er) [6]	Retained by 2nd grade Coef (Std er) [7]
Kindergarten entry age as of September 1 (months)	0.011*** (0.001)	0.009*** (0.001)	0.014*** (0.001)	0.025*** (0.001)	0.006*** (0.000)	0.011*** (0.000)	-0.005*** (0.000)
Parent education level							
High school degree (omitted less than HS)	0.063*** (0.012)	0.078*** (0.010)	0.064*** (0.008)	0.049*** (0.009)	0.025*** (0.004)	0.019*** (0.005)	-0.007*** (0.002)
Some college	0.066*** (0.016)	0.120*** (0.016)	0.104*** (0.013)	0.053*** (0.013)	0.042*** (0.007)	0.025*** (0.008)	-0.015*** (0.003)
College degree	0.106*** (0.019)	0.208*** (0.020)	0.175*** (0.020)	0.096*** (0.018)	0.077*** (0.010)	0.036*** (0.009)	-0.015*** (0.004)
Graduate education	0.109*** (0.029)	0.178*** (0.029)	0.165*** (0.026)	0.149*** (0.027)	0.079*** (0.013)	0.061*** (0.014)	-0.014** (0.006)
Education missing	0.009 (0.016)	0.01 (0.012)	-0.007 (0.010)	-0.018* (0.010)	-0.002 (0.004)	-0.009 (0.006)	-0.002 (0.003)
% EL students (school)	0.154 (0.156)	-0.003 (0.163)	-0.079 (0.145)	0.047 (0.159)	-0.048 (0.064)	0.031 (0.072)	0.104** (0.043)
% students in meal program (school)	-0.205 (0.172)	-0.092 (0.176)	-0.097 (0.163)	-0.155 (0.159)	-0.072 (0.075)	-0.050 (0.084)	0.217*** (0.052)
API rank	0.024** (0.009)	0.010 (0.009)	-0.001 (0.009)	-0.004 (0.010)	0.000 (0.004)	-0.002 (0.005)	0.010*** (0.003)
Kindergarten initial CELDT score	0.234*** (0.009)	0.159*** (0.006)	0.174*** (0.005)	0.162*** (0.005)	0.066*** (0.002)	0.069*** (0.003)	-0.026*** (0.002)
Constant	-0.950*** (0.242)	-0.296 (0.239)	-0.35 (0.240)	-0.751*** (0.259)	0.220** (0.110)	0.072 (0.128)	0.280*** (0.069)
R-squared	0.099	0.168	0.194	0.159	0.131	0.105	0.157
Sample size	112,419	98,596	107,567	107,565	107,567	107,565	110,952

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Table D7. Interaction model results, English learner students, *continued*

Variables	1st grade CELDT score Coef (Std er) [8]	2nd grade CELDT score Coef (Std er) [9]	RFEP by end of 2nd grade Coef (Std er) [10]
Full-day kindergarten (FD)	0.537*** (0.186)	0.364** (0.184)	-0.041 (0.070)
FD x kindergarten entry age	-0.001 (0.001)	-0.001 (0.002)	0.001* (0.001)
FD X parent HS degree (omitted less than HS)	0.02 (0.017)	-0.006 (0.018)	0.007 (0.008)
FD X parent some college educ.	-0.023 (0.023)	-0.044* (0.025)	0.009 (0.010)
FD X parent college education	-0.057** (0.029)	0.013 (0.033)	0.017 (0.016)
FD X parent graduate education	-0.04 (0.047)	0.080* (0.046)	0.036 (0.026)
FD X parent education missing	0.015 (0.021)	0.009 (0.022)	0.001 (0.010)
FD X % EL students (school)	-0.087 (0.145)	0.054 (0.144)	0.06 (0.049)
FD X % students in meal program (school)	-0.336** (0.165)	-0.277* (0.159)	-0.044 (0.068)
FD X API rank	-0.022** (0.010)	-0.016 (0.010)	-0.002 (0.004)
FD X kindergarten CELDT score	0.029** (0.014)	0.008 (0.012)	0.023*** (0.004)

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Table D7. Interaction model results, English learner students, *continued*

Variables	1st grade CELDT score Coef (Std er) [8]	2nd grade CELDT score Coef (Std er) [9]	RFEP by end of 2nd grade Coef (Std er) [10]
Kindergarten entry age as of September 1 (months)	0.010*** (0.001)	0.011*** (0.001)	0.002*** (0.000)
Parent education level			
High school degree (omitted less than HS)	0.038*** (0.007)	0.065*** (0.007)	0.009*** (0.002)
Some college	0.071*** (0.010)	0.105*** (0.011)	0.017*** (0.004)
College degree	0.098*** (0.015)	0.151*** (0.016)	0.041*** (0.007)
Graduate education	0.090*** (0.021)	0.121*** (0.023)	0.044*** (0.009)
Education missing	0.019** (0.009)	0.002 (0.009)	0.005* (0.003)
% EL students (school)	-0.014 (0.159)	0.095 (0.169)	0.023 (0.071)
% students in meal program (school)	-0.205 (0.201)	-0.091 (0.173)	-0.041 (0.062)
API rank	0.017* (0.009)	0.019* (0.010)	0.000 (0.003)
Kindergarten initial CELDT score	0.349*** (0.008)	0.262*** (0.007)	0.023*** (0.002)
Constant	-0.532* (0.274)	-0.487 (0.298)	0.097 (0.092)
R-squared	0.288	0.231	0.122
Sample size	102,602	102,591	109,586

NOTES: Standard errors in parentheses and all models adjust standard errors by clustering at the school level. ***p<0.01, **p<0.05, *p<0.10 Appendix B has further information on covariates used in each model. API = Academic Performance Index (1 = lowest to 10 = highest); CELDT = California English Language Development Test; Coef = Coefficient; EL = English learner; HS = high school; RFEP = Reclassified Fluent-English Proficient; Std er = Standard error.

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