The Effect of Attending Full-Day Kindergarten on English Learner Students

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Abstract

A significant and growing English learner (EL) population attends public schools in the United States. Evidence suggests they are at a disadvantage when entering school and their achievement lags behind non-EL students. Some educators have promoted full-day kindergarten programs as especially helpful for EL students. We take advantage of the large EL population and variation in full-day kindergarten implementation in the Los Angeles Unified School District to examine the impact of full-day kindergarten on academic achievement, retention, and English language fluency using difference-in-differences models. We do not find signficant effects of full-day kindergarten on most academic outcomes and English fluency through second grade. However, we find that EL students attending full-day kindergarten were 5 percentage points less likely to be retained before second grade and there are differential effects for several outcomes by student and school characteristics. © *2011 by the Association for Public Policy Analysis and Management.*

INTRODUCTION

The focus on education accountability, notably with the No Child Left Behind (NCLB) Act of 2001, has led to increased interest in improving student performance as early as possible. Policy efforts to enhance educational experiences for young children are based on the belief that student achievement is cumulative (Pianta, Cox, & Snow, 2007); therefore, early school success can lead to an increased likelihood of staying in school through high school graduation. Many state and local school district decision makers are interested in policies that expand kindergarten from half day to full day because of perceived benefits for learning (Clark & Kirk, 2000; Kauerz, 2005; Walston & West, 2004).[1] However, evidence to date on the actual benefits is limited to short-term gains and does not address how English learner (EL) students fare, which is the focus of this study (Cannon, Jacknowitz, & Painter, 2006; DeCicca, 2007; Le et al., 2006; Lee et al., 2006; Rathbun & West, 2004; Walston & West, 2004).

The perceived benefits have led to dramatic growth in the number of students attending full-day kindergarten programs across the country over the past few decades. In 1970, only about 13 percent of children were in full-day kindergarten classes (Elicker & Mathur, 1997), but that number has increased significantly to

[1] See Cannon, Jacknowitz, and Painter (2006) for more detail on the theory and background of full-day kindergarten.

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approximately 65 percent of children nationally in full-day classes in 2003 (Child Trends Data Bank, 2008). One reason often cited for changing to full-day classes is that they will provide extra academic instruction for economically disadvantaged students who start school with lower academic skills. Yet studies find that attending a full-day kindergarten program does not yield long-term benefits for either low-income students or their higher-income peers (Cannon, Jacknowitz, & Painter, 2006; DeCicca, 2007). Notable disadvantages for districts offering full-day kindergarten include the costs of extra personnel, facilities, and materials; depending on the objective, these additional resources may be better allocated to other early childhood programs.

Absent from past research on the effectiveness of full-day versus half-day kindergarten has been a focus on how full-day classes affect one specific disadvantaged group that may especially benefit from the extra time: EL students. Thus, the findings that full-day programs do not appear to produce better longer-term results than half-day programs are not necessarily applicable to the EL student population. Limited research suggests that EL students benefit from additional time spent hearing and speaking English (Genesee et al., 2005), and therefore moving students from a half-day to a full-day setting may be advantageous to them.[2]

Educators and policymakers are especially concerned about EL students, a growing portion of the U.S. student population, because they are at greater risk of failing to meet state education standards (Espinosa, 2007). A significant number of EL students attend public schools around the nation. In the 1999–2000 school year, approximately 3 million (7 percent) public school students were English learners, up from 2.1 million (5 percent) students in the 1993–1994 school year (Meyer, Madden, & McGrath, 2004). Census data from 2008 show that 6.9 percent of children ages 5 through 9 spoke a language other than English at home and spoke English with difficulty (Aud et al., 2010). A concern about EL students is that they are at a disadvantage when entering school, and their achievement lags behind non-EL students (Espinosa, 2007; Governor's Committee on Education Excellence, 2007; Reardon & Galindo, 2009). Increased English language proficiency is also one of the NCLB accountability goals for states. As a result, educators focus much attention on how to foster English language acquisition while educating students in traditional subjects. Policymakers are interested in intervention options to improve performance among these at-risk students, including considering extra student funding (e.g., Governor's Committee on Education Excellence, 2007).

Using student-level data available from the Los Angeles Unified School District (LAUSD), we address two primary research questions related to the early educational achievement of English learners. First, what is the effect of full-day versus half-day kindergarten on academic achievement, retention, and English proficiency among English learners? Second, does this effect of full-day kindergarten vary by student- and school-level characteristics? We address these questions using a difference-in-differences research design. This was possible due to the fact that, in addition to having a large EL population in the district, there was significant variation in timing of full-day kindergarten implementation within and across schools in LAUSD during the sample period. In addition, past full-day kindergarten research did not test for differences across the distribution of either student-level characteristics or indicators of school quality. 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 better positioned to take the most advantage of additional classroom time by building on existing skills.

[2] One potential advantage of full-day kindergarten is that teachers have more time to focus on individual student needs, which may be especially important for EL students. In a recent survey of California teachers of EL students, Gándara, Maxwell-Jolly, and Driscoll (2005) find that the second greatest teaching challenge for elementary teachers is lack of time.

Similar to previous research on full-day kindergarten, we do not find that EL full-day students perform any better than their half-day counterparts on first- or second-grade academic measures. In contrast to the results on academic skills, we find that full-day students are 5.2 percentage points less likely to be retained in kindergarten or first grade than their half-day peers. This suggests that the extra time in kindergarten may be helping kids at certain margins of risk. Furthermore, we find that students with higher levels of English fluency at kindergarten entry benefit from full-day kindergarten more than their low–English fluency peers in several ways: They are more likely to be reclassified fluent-English proficient by the end of second grade, have higher first- and second-grade reading skills, and have slightly higher first-grade English fluency.

DATA

The majority of data used in the analysis is from administrative data provided by LAUSD, with the remaining variables from the California Department of Education.

LAUSD Data

We examine our research questions using student-level data available from LAUSD. These data are unique in that the district decided to implement full-day kindergarten district-wide in all non-charter schools over a four-year period beginning in fall 2004. Because full-day kindergarten (FDK) was phased in over four consecutive years, there was significant variation in schools with and without FDK over several years, which is critical for analytical power. 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. We have data for seven cohorts of students entering kindergarten from fall 2001 through fall 2007; thus we have information capturing the period before and after full-day kindergarten was implemented. This represents 159,566 English learner students in 493 schools. Further, the data are provided at the student level, which allows for more sophisticated analytical techniques. Also, the panel nature of the data allows us to track kindergartners through third grade or spring of 2008 if they remain in the district. Finally, the district's student population is large and diverse, including many English learners, so results are meaningful beyond the district level.

California Department of Education Data

The LAUSD data are complemented with school-level data from the California Department of Education for the 2001–2002 through 2007–2008 school years. Specifically, we use the Academic Performance Index (API) data file, the California Basic Educational Data System School Information Form data file, and the California Basic Educational Data System Professional Assignment Information Form data file to construct the school-level measures used in the study. The California Department of Education data and more information on data availability and data collection procedures are available at http://www.cde.ca.gov/ds/.[3]

Analysis Sample

The final analytic sample contains information for 159,566 EL students and 503,542 EL observations. ELs represent over half of all LAUSD entering kindergartners in our time period.[4] From the full sample of children, we construct an analysis

[3] Data for this study were downloaded in October 2008.
[4] The number of all entering kindergartners meeting the same criteria as our analytic sample is 296,584.

sample of 159,566 EL students who enter kindergarten in one of the seven cohorts and have at least one outcome measure available for the main analysis or robustness checks. The criteria we employ for inclusion in the final analysis sample are described as follows, with the number of students and observations excluded in parentheses. We start with all students who began kindergarten in LAUSD. We limit the sample to students who are identified as English learners (181,883 students, 484,931 observations excluded). Students must have remained in the district through third grade or the 2007–2008 school year, whichever occurs first (20,582 students, 50,595 observations excluded). Students in third grade are included in the final analytic sample to test the robustness of our results to specifications using selected third-grade outcomes as dependent variables. Students must have a kindergarten school identification code (3,709 students, 10,210 observations excluded). A student's full-day kindergarten status must be known (1,718 students, 5,972 observations excluded).[5] 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 (339 students, 1,656 observations). Finally, an additional 20,039 students (65,891 observations) are excluded due to missing values for other control variables including student age, home language, country of birth, race/ethnicity, valid California English Language Development Test (CELDT) scores, and English language development level codes in kindergarten, as well as school-level indicators of percent of students who are English learners, percent of students in the meal program, and percent of students whose parents have less than a high school education.[6] Note that student-level parental education included a large number of missing values (approximately 30 percent), and we included a categorical variable in our regression models to capture them.

We have tested whether those EL students who were excluded from the analysis differ from those who were included using two-sided hypothesis tests, and we find that the two groups are very similar across socioeconomic student- and school-level characteristics, with a couple of exceptions, which are noted as follows (results available from authors). The excluded students are less likely to speak Spanish at home (92 percent excluded vs. 94 percent included) and to be born in the U.S. (84 percent vs. 89 percent). Excluded students are also more likely to be in a school with fewer instructors authorized to teach ELs (70 percent vs. 75 percent), less likely to be in a school with a Reading First program (23 percent vs. 35 percent), and more likely to be in a charter school (6 percent vs. 2 percent).[7]

Table 1 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 EL students. Statistics are reported for each kindergarten cohort and for full-day and half-day kindergarten students in years 2004–2005 through 2007–2008, when full-day kindergarten began being implemented district-wide (all students in our sample are in full-day classes in 2007–2008). The majority of EL students are Hispanic, low income, and enrolled in low API ranked schools. We find that in the first year of full-day kindergarten being phased in across the district (2004–2005), the students in full-day classes are somewhat different: They are less

[5] Included in the administrative data are several independent charter schools that are not directly affiliated with LAUSD and for which a school ID or full-day kindergarten status are not provided. We include all charter schools for which we are able to determine full-day kindergarten status and those for which we have outcome data.

[6] Results are substantively similar when indicators for missing binary variables and assigned means and corresponding missing indicators for continuous variables are used, and these additional observations are included in regressions.

[7] The Reading First program is a national program with the objective of ensuring that all children read by the end of third grade.

Table 1. Description of analysis sample of English learners.

	Cohort Mean Descriptive Statistics by School Year									
				2004–2005		2005–2006		2006–2007		2007–2008
Variable	2001–2002	2002–2003	2003–2004	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 second grade (%)	0.04	0.05	0.08	0.12*	0.10	0.12*	0.09	N/A	N/A	N/A
Student-level covariates										
Hispanic/Latino race/ethnicity	0.94	0.94	0.95	0.92*	0.94	0.94*	0.93	0.94	0.92	0.93
Parent highest 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 diploma	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 in months as of Sept. 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

(*Continued*)

Table 1. (*Continued*)

	Cohort Mean Descriptive Statistics by School Year									
				2004–2005		2005–2006		2006–2007		2007–2008
Variable	2001–2002	2002–2003	2003–2004	FDK	HDK	FDK	HDK	FDK	HDK	FDK
Student-level covariates (continued)										
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	1,205	1,197	1,185	872*	1,138	880*	1,053	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 ed.	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. 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; RFEP = Reclassified fluent-English proficient.

* indicates FDK mean is significantly different than HDK mean at 5 percent level.

likely to be Hispanic, 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 (2005–2006), and by the third year (2006–2007), when most students are in full-day classes, the small percentage who are enrolled in half-day programs appear to be more advantaged.

EMPIRICAL STRATEGY

To answer our first research question of estimating 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. We estimate ordinary least squares models as shown in Equation (1).

$$Y_{ist} = \alpha + \beta \mathrm{FD}_{st} + \gamma \mathrm{ST}_i + \delta \mathrm{SC}_{st} + \mu_s + \zeta_t + \varepsilon_{ist} \quad (1)$$

In Equation (1), Y_{ist} represents the dependent variable for student i in school s at time t;[8] FD_{st} is a dichotomous variable indicating whether the child attended full-day kindergarten; ST_i is a vector of student characteristics measured in the kindergarten year; and SC_{st} is a vector of school and teacher characteristics for the school the student attended as a first-time kindergartner. In addition, the model includes a school fixed effect (μ_s), a time fixed effect (ζ_t), and an error term (ε_{ist}).

There are two main potential problems with how students are assigned to full-day kindergarten classes that are of concern in this study. The first is on the part of the student (or parent) in selecting a school; the second is on the part of the school (or district) in deciding whether or not a school offers full-day kindergarten. For example, parents with greater resources or involvement may choose full-day classes if these are perceived as being desirable for learning. Students of these higher-resource parents may also be likely to have greater academic performance regardless of their kindergarten program. If better-performing students are disproportionately represented in full-day kindergarten classes, a comparison of outcomes between full-day and half-day classes would favor full day, and perhaps exaggerate the true effect. Alternatively, schools with high proportions of lower-performing children may choose to offer full-day classes as an academic boost. If lower-performing students are disproportionately enrolled in full-day kindergarten, a negative relationship between full day and student performance may be found but would not necessarily represent a causal relationship. Another scenario is that schools with the ability to offer full-day classes due to space and teacher availability may adopt full-day kindergarten more often. This would lead to finding a positive relationship between full-day classes and student performance, yet it may simply capture the effect of other factors associated with the school and not directly related to a full-day kindergarten effect.

In order to address these concerns and isolate the true effect of full-day kindergarten participation, the difference-in-differences models our study uses account for the fact that students are not randomly assigned to full-day kindergarten classes. 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 the timing within the same school. That is, we observe the same school across years both before and after it implemented full-day kindergarten.

Although we do not have evidence of the first concern being a problem for our identification strategy, we do know that the district did not implement FDK at random.[9]

[8] The school is the one that a student attended as a first-time kindergartner and for which the full-day kindergarten status is attributed. Time is measured as the school year.

[9] We do not believe selection by parents to be a concern in this paper for two reasons. First, the fixed effects model will account for selection that is similar across the schools. Second, Cannon, Jacknowitz, and Painter (2006) constructed instrumental variable models to account for this possible selection, and the results did not differ substantively.

The district allowed all schools with space to implement FDK in the first school year, 2004–2005. For schools with limited facilities, the district received funds through a bond to provide additional facilities such as portable classrooms. The district gave first priority for bond funds to schools with the lowest performance levels. In our sample, 25 percent of students were in full-day classes in 2004–2005, 75 percent in 2005–2006, 95 percent in 2006–2007, and all students in 2007–2008. To determine if this issue might be a problem, we compared the trends in kindergarten reading scores before full-day kindergarten implementation for each cohort of schools based on implementation year (results available on request). Even though the schools started at different base test scores, the trends are strikingly similar. From 2002–2003 to 2003–2004, test score growth was flat or positive, and after 2003–2004, test scores decline across all schools. We further found that it was not simply the lowest-performing schools that implemented FDK first.

Our identification strategy also relies on the assumption that there are 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 and that no other time-varying factors influence our results. In LAUSD, no additional teachers were hired in order to convert half-day classes into full-day classes because kindergarten teachers were already employed full time, so we do not believe 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 purposefully changed schools in order to teach or to avoid a full-day kindergarten class, which would bias our estimates. Likewise, if changes 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 think these are factors that are likely to occur at high rates in our sample. All teachers will end up with full-day classes within a few years and are unlikely to change schools solely for that purpose; principal changes are also not likely to occur nonrandomly 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. Thus, we believe that the nonrandom assignment of FDK will not bias our results.

Full-Day Kindergarten

The primary independent variable in the analysis is whether the child is attending a full-day kindergarten program versus a half-day program. In LAUSD, full-day classes are 320 instructional minutes for a school with 180 annual school days.[10]

Dependent Variables

This study estimates the effect of attending a full-day kindergarten program on academic outcomes, grade retention, and English proficiency for the analysis sample of English learners. The following variables capture academic achievement: reading skills composite score, California Standards Test (CST) math score, CST math proficiency level, CST English Language Arts (ELA) score, and CST ELA proficiency level. The reading skills composite score is based on the Open Court Reading curriculum, and the teacher assessments we use are administered in spring of kindergarten and first grade.[11] To create the composite scores, we included assessments

[10] 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).
[11] Open Court is a reading program for grades K through 6 published by SRA. LAUSD teachers administer skills assessments every 6 to 8 weeks to monitor student progress. We use the end-of-year assessments.

that required the least subjectivity of the teacher, were assessed at the end of the year, and were measured across all seven cohorts. Reading composite scores for kindergarten include summed scores for assessments of uppercase letters, lowercase letters, matched vowels, and matched consonants. The first-grade composite scores include reading fluency, reading comprehension, spelling, and word reading. Note that we are only using scores from students who were assessed in the English language and in sheltered English immersion classrooms, which is the vast majority of students. Both of these scores are standardized with a mean of zero and standard deviation of 1 within grade, year, and version of Open Court assessment.[12] Variables are standardized across all students before any observations are excluded from the data (see preceding description of analysis sample).

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.[13] We standardize the scale scores using a mean of zero and standard deviation of one. Scores are standardized within subject, grade, and year for all LAUSD students 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 across 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 any time before second grade. 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 be more likely to be retained the following year when it is clear they need more help.

To capture English proficiency we utilize the following variables: California English Language Development Test (CELDT) scores and an indicator for whether a student has been redesignated fluent-English proficient (RFEP). The CELDT is administered to EL students in the fall annually.[14] 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 1 within grade and school year for all LAUSD students before any observations are excluded (see description of analysis sample).[15]

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

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

[13] For more information on the CST scores, see http://www.cde.ca.gov/ta/tg/sr/resources.asp.

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

[15] The CELDT scale score cut points were updated in the 2006–2007 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.

reclassified and zero if not. The four criteria that California districts may use in their decision to reclassify students are: CELDT scores, CST ELA scores, teacher evaluation, and parent opinion and consultation.[16]

Control Variables

We include several student-level socioeconomic control variables in our models that are available in the LAUSD administrative data. These student characteristics, such as a student's race/ethnicity and the highest educational attainment of the mother and father, are expected to significantly relate to student outcomes based on prior research. We also include several school-level characteristics from the California Department of Education data that are theorized to play a role in student outcomes, such as a school performance measure and the percentage of disadvantaged students at the school. The exact specification of control variables can be found in Appendix Table 1.[17] 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 student repeated a grade prior to a measured first- or second-grade academic or English fluency outcome. Both of these variables are created using information from grades other than kindergarten.

Several of these control variables warrant further explanation. Meal program participation indicates whether the child resided in a household with an income at or below 185 percent of the poverty line and participated in the National School Lunch Program. 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 5 years old on or before December second of the kindergarten year. The English language development level is based on a student's performance when they enter kindergarten, categorized with a code of 1 to 5 (1 is lowest and a score of 1 or 2 is generally the case for kindergartners).

The school-level characteristic that is included with the LAUSD administrative data is participation in the Reading First program. LAUSD schools began implementing Reading First around the time full-day kindergarten began, so we control for this concurrent intervention. Additional school-level characteristics are from the California Department of Education. The Academic Performance Index represents a school's performance level and growth on statewide testing. The API ranges from 200 to 1,000 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 being the highest. In terms of the percent of teachers authorized to teach EL students, three different authorizations exist; 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 influence on learning.

The effect of attending a full-day kindergarten on academic scores is evaluated at three points in time (kindergarten, first grade, and second grade), the effect on grade retention and reclassification of English learners is evaluated at the end of second grade, and the effect on CELDT scores is evaluated in first and second

[16] For a discussion of reclassification practices in general, see Linquanti (2001).
[17] All appendices are available at the end of this article as it appears in JPAM online. See the complete article at wileyonlinelibrary.com.

grades.[18] All models adjust standard errors by clustering students at the school level.

Interactions

To address our second research question, we test for differential effects of attending full-day kindergarten across the distribution of selected student and school characteristics by estimating Equation (2) below:

$$Y_{ist} = \alpha + \beta \mathrm{FD}_{st} + \gamma \mathrm{ST}_i + \delta \mathrm{SC}_{st} + \zeta \mathrm{FD}_{st} * \mathrm{ST}_i + \lambda \mathrm{FD}_{st} * \mathrm{SC}_{st} + \mu_s + \zeta_t + \varepsilon_{ist} \quad (2)$$

For this analysis, we interact the following school-level variables, contained in SC_{st}, with full-day kindergarten: percent of students in a school in the meal program, the API state rank of the school, and the percent of students in a school who are English learners. Each of these measures captures the relative disadvantage of the students in the school or the previous performance of the school

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_i to capture a proxy of home environment. Students with more educated parents generally start school with more skills (Cannon & Karoly, 2007). Additionally, there are two measures of initial aptitude contained in ST_i that allow us to test for both 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 & 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 a recent survey of California public schools with kindergarten enrollment, some schools with full-day kindergarten programs phase in a full-length day over the first few months of the academic year because of this concern (Cannon et al., 2009). 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 the kindergarten CELDT score to be positive, as 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.

RESULTS

Our analysis of student academic scores reveals a short-term benefit of attending full-day kindergarten in terms of reading skills (see Table 2). For full-day students,

[18] We also look at the outcomes evaluated in third grade with a smaller number of students who stayed in our sample through third grade and find similar results (results available from authors). This smaller sample only includes one cohort of kindergartners who received full-day kindergarten during the first year of the full-day kindergarten district-wide implementation. They entered kindergarten in the 2004–2005 year, so we have 3rd-grade information on non-repeaters; however, only about 25 percent of this year's cohort was in full-day classes. Thus, we report on second-grade outcomes in our study because we are able to include two cohorts that received full-day kindergarten, which substantially increases the variation in full-day kindergarten attendance.

Table 2. Effect of full-day kindergarten: Main estimation results for LAUSD matched district individual samples.

Outcome	Coefficient	Standard Error	Sample Size
Kindergarten reading score (standardized)	0.125***	(0.021)	112,419
1st-grade reading score (standardized)	0.001	(0.020)	98,596
2nd-grade CST score—ELA (standardized)	−0.011	(0.020)	107,567
2nd-grade CST score—math (standardized)	−0.008	(0.022)	107,565
2nd-grade CST proficiency—ELA (%)	0.000	(0.009)	107,567
2nd-grade CST proficiency—math (%)	0.000	(0.010)	107,565
Retained by second grade (%)	−0.052***	(0.007)	110,952
1st-grade CELDT score (standardized)	0.029	(0.024)	102,602
2nd-grade CELDT score (standardized)	0.019	(0.023)	102,591
RFEP by end of second grade (%)	0.012	(0.008)	109,586

Notes: Standard errors are in parentheses and all models adjust standard errors by clustering at the school level. All models include year and school fixed effects as well as student- and school-level controls. CELDT = California English Language Development Test; CST = California Standards Test; ELA = English-language arts; RFEP = Reclassified fluent-English proficient.

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

we find a 0.125 standard deviation increase in kindergarten reading skills assessments compared to their half-day peers. This effect size is small relative to a number of other elementary education interventions, which range from 0.23 to 0.33, as cited in Hill et al. (2008). In the education context, where a host of factors affects student outcomes and many interventions do not significantly affect outcomes, smaller effects can be considered meaningful if they include a large number of children. This is a subjective determination. Looking separately at first-grade reading skills assessments, which are not directly comparable to kindergarten outcomes, we find no significant benefit of full-day classes for EL students on average.

We find no benefits of full-day kindergarten for either ELA or math second-grade CST scores or the probability of being considered proficient or higher on these assessments. We note again that the kindergarten and first-grade reading skills assessments are not intended for comparison with performance on the CST ELA test, so our results cannot be interpreted as a fading of effects over time. Each grade's assessment measures something different and can only be used to determine if there is a difference within that grade between full-day and half-day students. That said, this pattern of results is consistent with the aforementioned studies examining national kindergarten data, which find a benefit in the kindergarten year but no longer-term academic benefit.

Contrary to a previous study with national data (Cannon, Jacknowitz, & Painter, 2006), we find that attending full-day kindergarten for EL students in LAUSD reduces the likelihood of being retained in either kindergarten or first grade by 5.2 percentage points compared to half-day students (see Appendix Table 1 for full regression results).[19] We recognize that the magnitude of this finding is very large compared to the average retention rate of 5.1 percent over the 2001–2002 through 2003–2004 school years, when students were in half-day classes (1.4 percent in kindergarten and

[19] We did not examine the effects of full-day kindergarten on retention at the end of kindergarten or first grade separately because a small percentage of students are retained in each grade. Using a smaller sample of LAUSD students, we also examined the probability of being retained by third grade and find similar and larger benefits of full-day kindergarten (results available from authors). All appendices are available at the end of this article as it appears in JPAM online. See the complete article at wileyonlinelibrary.com.

3.7 percent in first grade).[20] EL students in half-day classes in the 2004–2005 and 2005–2006 school years had retention rates close to 7 percent, although this is a selected sample of students in schools that did not implement full-day classes in the first two years. Our findings equate to an approximately 75 percent reduction in retention rates as students transition to full-day kindergarten. Part of the explanation may be due to the fact that the data indicate there was a slight upward trend in retention before second grade in the early years of our sample before full-day classes were fully implemented, and this upward trend might have continued had full-day kindergarten not been implemented. We also find evidence that after full-day kindergarten was implemented for most students, there is a notable downward trend in retention before second grade, which supports our finding of a reduced likelihood of retention in full-day classes.

However, in California, retention policy is made at the district level, and it is unclear if similar retention results would be found in other districts with different retention policies. In LAUSD, retention decisions at the kindergarten and first-grade level are made by agreement of the teacher, school staff, and parents based on what is in the student's best interest. Decisions at grade two and three are based on adequate progress toward ELA standards and can be made without parental agreement. Given the strength and magnitude of our retention findings and that retention policy varies by district, similar analysis for other districts is worthwhile.

As discussed earlier, ELs benefit from full-day kindergarten for kindergarten reading and retention outcomes. Additionally, we originally conjectured that extra time in a kindergarten classroom speaking and hearing English would help ELs gain English fluency faster than students in shorter classes. We examined this in two ways in our study. The first is to examine whether full-day ELs have an increased likelihood of being reclassified as fluent-English proficient by the end of second grade. The second test is to determine if among ELs who are not reclassified by the end of first grade, ELs in full-day classes have higher CELDT scores in the fall of first or second grade compared to ELs in half-day classes. Contrary to expectations, our results indicate that ELs do not experience benefits in their first- or second-grade CELDT scores after having been in full-day kindergarten, nor do they appear to become reclassified at greater rates than half-day students on average.[21]

It is interesting that we find a significant reduction in early grade retention but no improvement in CST scores. It would seem that one major reason a student would be retained is due to failure to meet academic standards, even limited ones we examine in the earliest grades. If full-day kindergarten is helping kids who are closest to the threshold for being retained, it might be that the initial kindergarten boost we observe is enough to affect retention decisions on average, but it still will not be enough to greatly affect the average ability on skills assessed in the CST tests. Further, it is possible that, because more half-day children are retained and have an extra year of schooling before taking the CST, our estimates of the effects of full-day kindergarten on second-grade academic achievement are lower than they truly should be. However, recent literature on early grade retention suggests that being retained in kindergarten or first grade is associated with negative or neutral academic outcomes (Burkam et al., 2007; Hong & Raudenbush, 2005; Wu, West, & Hughes, 2008). We also tested the effect of full-day kindergarten on CST scores for only students who were not retained, and the results are quite similar to the results including retained students (results available from authors). Therefore, this scenario of benefits from an extra year of schooling is unlikely to affect our CST results.

[20] Among ELs in our sample, there was a consistent increasing trend in kindergarten retention for students in half-day kindergarten from 2001–2002 through 2005–2006. In 2004–2005 and 2005–2006, when full-day kindergarten began to be implemented, ELs in full-day classes were less likely to be retained in kindergarten than students in half-day classes.

[21] We also examined 3rd-grade CELDT scores and reclassification by end of third grade with a smaller sample of students, and the results were also nonsignificant (results available from authors).

An alternative consideration is that some factors associated with full-day kindergarten do not relate to academic performance, affecting classroom performance instead, such as maturity or behavior. This, in turn, could have an impact on retention decisions. Even if this classroom performance effect is the case, it does not seem to negatively affect CST scores later, as we do not find any negative differences.

Interactions

As discussed previously, even if many of the results were insignificant, it may be the case that certain segments of the EL population may benefit from attending full-day kindergarten. Table 3 presents interacted model results for academic and retention outcomes, and Table 4 presents interacted model results for English fluency outcomes. As shown, ELs with parents who have less than a high school education benefit more from full-day kindergarten than those whose parents have a college education in terms of kindergarten and first-grade reading skills (Table 3) and first-grade CELDT scores (Table 4). ELs in low-ranked schools appear to benefit more than ELs in higher API ranked schools for first- and second-grade reading (Table 3) and first-grade CELDT scores (Table 4). In addition, we find differences in the effect of full-day kindergarten for students of different kindergarten English fluency levels as measured by the CELDT score in kindergarten. The evidence is mixed, however. For kindergarten reading scores and retention, students with lower initial fluency take better advantage of the extra time (Table 3). On the contrary, students with the highest kindergarten CELDT scores in full-day programs compared to half-day programs are more likely to be reclassified fluent-English proficient by the end of second grade, more likely to be proficient on the second-grade CST ELA, and have slightly higher first-grade reading and CELDT scores than those with low kindergarten CELDT scores (Tables 3 and 4).[22] We interpret these findings to suggest that there are benefits throughout the population of ELs, but those closest to being fluent-English proficient are able to move across this proficiency threshold by receiving more attention in a full-day classroom.

Sensitivity Analysis

The richness of the LAUSD data enables us to test a variety of specifications and samples in order to determine if the estimates from our main results in Table 2 are robust. Results from these tests are shown in Table 5, with our main regression results shown in column 1.[23] First, we restricted our analysis sample to those students that remained in the same school during the sample period instead of remaining in the district (column 2). Second, we restricted the analysis sample used in our main model to students whose teachers did not change schools during the sample period (column 3). 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 in our sample of students and teachers who change schools 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 estimates similar to school fixed effects (column 4). It is possible that there are some fixed unobservable characteristics about teachers that are related to

[22] Analysis indicates that the gap between full-day and half-day outcomes occurs at the high end of the kindergarten CELDT score distribution, not the low end (results available from authors).
[23] Appendix Table 2 provides samples sizes for all regressions reported in Table 5. All appendices are available at the end of this article as it appears in JPAM online. See the complete article at wiley onlinelibrary.com.

Table 3. Interaction model results for academic achievement and retention outcomes.

Variable	K Reading Coef. (Std. Er.) [1]	1st-Grade Reading Coef. (Std. Er.) [2]	2nd-Grade CST ELA Scores Coef. (Std. Er.) [3]	2nd-Grade CST Math Scores Coef. (Std. Er.) [4]	2nd-Grade CST ELA Prof. Coef. (Std. Er.) [5]	2nd-Grade CST Math Prof. Coef. (Std. Er.) [6]	Retained by 2nd Grade Coef. (Std. Er.) [7]
Full-day kindergarten (FD)	0.375**	0.489***	0.223	0.111	−0.004	0.061	−0.097*
	(0.167)	(0.161)	(0.164)	(0.173)	(0.084)	(0.091)	(0.054)
FD × kindergarten entry age	−0.004**	−0.001	0.000	0.000	0.002*	0.000	0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
FD × parent HS diploma (omitted less than HS)	−0.013	0.005	0.015	−0.005	0.005	−0.011	−0.005
	(0.016)	(0.015)	(0.018)	(0.021)	(0.010)	(0.011)	(0.005)
FD × parent some college educ.	−0.015	−0.063***	−0.039	0.002	−0.017	−0.006	0.007
	(0.021)	(0.024)	(0.029)	(0.028)	(0.015)	(0.015)	(0.007)
FD × parent college education	−0.052**	−0.074**	−0.018	0.028	−0.018	0.009	0.004
	(0.024)	(0.033)	(0.039)	(0.038)	(0.022)	(0.020)	(0.008)
FD × parent graduate education	−0.055	0.034	0.046	−0.03	0.003	0.005	0.008
	(0.037)	(0.044)	(0.053)	(0.057)	(0.029)	(0.032)	(0.013)
FD × parent education missing	0.004	0.009	0.012	0.02	0.003	0.009	0.003
	(0.020)	(0.018)	(0.021)	(0.023)	(0.011)	(0.012)	(0.006)
FD × % EL students (school)	−0.078	−0.068	0.111	0.015	0.045	0.013	0.046
	(0.113)	(0.108)	(0.118)	(0.120)	(0.057)	(0.059)	(0.031)
FD × % students in meal program (school)	0.089	−0.304**	−0.284**	−0.122	−0.119*	−0.082	0.036
	(0.124)	(0.129)	(0.140)	(0.137)	(0.069)	(0.069)	(0.044)
FD × API rank	−0.014	−0.030***	−0.022**	−0.002	−0.005	−0.002	−0.010***
	(0.009)	(0.009)	(0.010)	(0.010)	(0.005)	(0.005)	(0.003)
FD × kindergarten CELDT score	−0.043***	0.019**	−0.015*	−0.006	0.010**	0.003	0.006**
	(0.012)	(0.008)	(0.009)	(0.009)	(0.004)	(0.005)	(0.003)
Kindergarten entry age as of September 1 (months)	0.011***	0.009***	0.014***	0.025***	0.006***	0.011***	−0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)

(*Continued*)

Table 3. (*Continued*)

Variable	K Reading Coef. (Std. Er.) [1]	1st-Grade Reading Coef. (Std. Er.) [2]	2nd-Grade CST ELA Scores Coef. (Std. Er.) [3]	2nd-Grade CST Math Scores Coef. (Std. Er.) [4]	2nd-Grade CST ELA Prof. Coef. (Std. Er.) [5]	2nd-Grade CST Math Prof. Coef. (Std. Er.) [6]	Retained by 2nd Grade Coef. (Std. Er.) [7]
Parent education level	0.063***	0.078***	0.064***	0.049***	0.025***	0.019***	−0.007***
High school diploma (omitted less than HS)	(0.012)	(0.010)	(0.008)	(0.009)	(0.004)	(0.005)	(0.002)
Some college	0.066***	0.120***	0.104***	0.053***	0.042***	0.025***	−0.015***
	(0.016)	(0.016)	(0.013)	(0.013)	(0.007)	(0.008)	(0.003)
College degree	0.106***	0.208***	0.175***	0.096***	0.077***	0.036***	−0.015***
	(0.019)	(0.020)	(0.020)	(0.018)	(0.010)	(0.009)	(0.004)
Graduate education	0.109***	0.178***	0.165***	0.149***	0.079***	0.061***	−0.014**
	(0.029)	(0.029)	(0.026)	(0.027)	(0.013)	(0.014)	(0.006)
Education missing	0.009	0.01	−0.007	−0.018*	−0.002	−0.009	−0.002
	(0.016)	(0.012)	(0.010)	(0.010)	(0.004)	(0.006)	(0.003)
% EL students (school)	0.154	−0.003	−0.079	0.047	−0.048	0.031	0.104**
	(0.156)	(0.163)	(0.145)	(0.159)	(0.064)	(0.072)	(0.043)
% students in meal program (school)	−0.205	−0.092	−0.097	−0.155	−0.072	−0.050	0.217***
	(0.172)	(0.176)	(0.163)	(0.159)	(0.075)	(0.084)	(0.052)
API rank	0.024**	0.010	−0.001	−0.004	0.000	−0.002	0.010***
	(0.009)	(0.009)	(0.009)	(0.010)	(0.004)	(0.005)	(0.003)
Kindergarten CELDT score	0.234***	0.159***	0.174***	0.162***	0.066***	0.069***	−0.026***
	(0.009)	(0.006)	(0.005)	(0.005)	(0.002)	(0.003)	(0.002)
Constant	−0.950***	−0.296	−0.35	−0.751***	0.220**	0.072	0.280***
	(0.242)	(0.239)	(0.240)	(0.259)	(0.110)	(0.128)	(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

Notes: All models adjust standard errors by clustering at the school level and include year and school fixed effects as well as additional student- and school-level controls. API = Academic Performance Index (1 = lowest to 10 = highest); CELDT = California English Language Development Test; Coef. = Coefficient; CST = California Standards Test; EL = English learner; ELA = English-language arts; HS = high school; Std. Er. = Standard error; Prof = proficiency.

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

Table 4. Interaction model results for English proficiency outcomes.

Variable	1st-Grade CELDT Score Coef. (Std. Er.) [1]	2nd-Grade CELDT Score Coef. (Std. Er.) [2]	RFEP by End of Second Grade Coef. (Std. Er.) [3]
Full-day kindergarten (FD)	0.537***	0.364**	−0.041
	(0.186)	(0.184)	(0.070)
FD × kindergarten entry age	−0.001	−0.001	0.001*
	(0.001)	(0.002)	(0.001)
FD × parent HS diploma (omitted less than HS)	0.02	−0.006	0.007
	(0.017)	(0.018)	(0.008)
FD × parent some college educ.	−0.023	−0.044*	0.009
	(0.023)	(0.025)	(0.010)
FD × parent college education	−0.057**	0.013	0.017
	(0.029)	(0.033)	(0.016)
FD × parent graduate education	−0.04	0.080*	0.036
	(0.047)	(0.046)	(0.026)
FD × parent education missing	0.015	0.009	0.001
	(0.021)	(0.022)	(0.010)
FD × % EL students (school)	−0.087	0.054	0.06
	(0.145)	(0.144)	(0.049)
FD × % students in meal program (school)	−0.336**	−0.277*	−0.044
	(0.165)	(0.159)	(0.068)
FD × API rank	−0.022**	−0.016	−0.002
	(0.010)	(0.010)	(0.004)
FD × kindergarten CELDT score	0.029**	0.008	0.023***
	(0.014)	(0.012)	(0.004)
Kindergarten entry age as of September 1 (months)	0.010***	0.011***	0.002***
	(0.001)	(0.001)	(0.000)
Parent education level	0.038***	0.065***	0.009***
High school diploma (omitted less than HS)	(0.007)	(0.007)	(0.002)
Some college	0.071***	0.105***	0.017***
	(0.010)	(0.011)	(0.004)
College degree	0.098***	0.151***	0.041***
	(0.015)	(0.016)	(0.007)
Graduate education	0.090***	0.121***	0.044***
	(0.021)	(0.023)	(0.009)
Education missing	0.019**	0.002	0.005*
	(0.009)	(0.009)	(0.003)
% EL students (school)	−0.014	0.095	0.023
	(0.159)	(0.169)	(0.071)
% students in meal program (school)	−0.205	−0.091	−0.041
	(0.201)	(0.173)	(0.062)
API rank	0.017*	0.019*	0.000
	(0.009)	(0.010)	(0.003)
Kindergarten initial CELDT score	0.349***	0.262***	0.023***
	(0.008)	(0.007)	(0.002)
Constant	−0.532*	−0.487	0.097
	(0.274)	(0.298)	(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 and include year and school fixed effects as well as additional student- and school-level controls. 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.

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

Table 5. Sensitivity tests of main estimation results.

Outcome	LAUSD Matched District Individual-Level 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]
Kindergarten reading	0.125***	0.106***	0.126***	0.117***	0.125***	0.127***
	(0.021)	(0.021)	(0.022)	(0.022)	(0.021)	(0.021)
1st-grade reading	0.001	−0.000	0.001	−0.001	0.001	−0.040*
	(0.02)	(0.022)	(0.022)	(0.024)	(0.02)	(0.023)
2nd CST score—ELA	−0.011	−0.012	−0.008	−0.03	−0.01	−0.035
	(0.02)	(0.023)	(0.022)	(0.024)	(0.02)	(0.022)
2nd CST score—math	−0.008	0.002	−0.013	−0.029	−0.008	−0.022
	(0.022)	(0.026)	(0.024)	(0.026)	(0.022)	(0.023)
2nd CST prof.—ELA	0.000	0.003	−0.001	−0.014	−0.001	−0.008
	(0.009)	(0.011)	(0.01)	(0.011)	(0.009)	(0.010)
2nd CST prof.—math	0.000	0.005	0.001	−0.006	0.001	−0.012
	(0.01)	(0.012)	(0.011)	(0.012)	(0.01)	(0.011)
Retained by second grade	−0.052***	−0.045***	−0.051***	−0.059***	−0.051***	−0.054***
	(0.007)	(0.006)	(0.007)	(0.009)	(0.007)	(0.007)
English proficiency						
1st-grade CELDT score	0.029	0.042	0.026	0.027	0.03	0.03
	(0.024)	(0.027)	(0.025)	(0.024)	(0.024)	(0.025)
2nd-grade CELDT score	0.019	0.013	0.018	0.009	0.018	−0.015
	(0.023)	(0.026)	(0.024)	(0.024)	(0.023)	(0.023)
RFEP by second grade	0.012	0.018*	0.013	0.011	0.013*	0.012
	(0.008)	(0.01)	(0.009)	(0.009)	(0.008)	(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. Model 1 is the main LAUSD specification as presented in Table 2. 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 that they stay through third grade. For example, for 2nd-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 controls 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). CELDT = California English Language Development Test; Coef. = coefficient; 2nd CST = Second-grade California Standards Test; ELA = English-language arts; prof. = Proficiency; FE = fixed effects; RFEP = Reclassified fluent-English proficient; Std. Er. = Standard error.

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

both our outcomes of interest and full-day kindergarten status, which 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 K through 3 (column 5). In contrast to 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 (2005–2006 through 2007–2008) 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 in column 6 adds contemporaneous control variables and three additional peer controls to our main specification, which allows us to control for time-varying within-school factors. We include these peer covariates as the student composition of the classroom in the current year could influence outcomes measured in that given 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[24] (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. Across the various specifications, all of the results were qualitatively similar to the results presented for Model 1 in column 1.

Finally, we also estimated our main models among all students and economically disadvantaged students in order to place our results in the context of previous studies. We find that the effects of full-day kindergarten on academic and retention outcomes among ELs are similar to those among all students and disadvantaged students (the full set of results is available in Cannon et al., 2009). Thus, it does not appear that ELs receive any additional benefit from full-day classes over other students that would lead us to believe that full-day classes would help narrow the achievement gap.

CONCLUSIONS AND DISCUSSION

The impetus for full-day kindergarten, among parents, educators, and policymakers, has in large part been driven by the idea that increased instructional time in the first year of public schooling can improve the performance of students, particularly at-risk students, as well as eliminate the need to find and finance child care. Yet implementation of full-day classes may be costly for some schools. Despite the support for full-day kindergarten, only limited research evidence supports the common claim that full-day kindergarten can improve student outcomes beyond kindergarten. Furthermore, no prior research has examined how full-day kindergarten affects English learners' academic progress, an important and logical target group for educators.

This study takes advantage of the recent increase in full-day kindergarten students in the Los Angeles Unified School District to examine if longer classes are

[24] We use the parent education and meal program variables to create the economically disadvantaged variable. We follow the same method as the California Department of Education to create a variable for whether a student is defined as economically disadvantaged—they are coded as 1 if they either participate in the meal program or have parents with less than a high school education. A small percentage of students are left with missing values for this variable because they do not participate in the meal program, but they have missing parent education information so we cannot accurately code them.

having a positive impact on English learner students. We find that full-day kindergarten students compared to half-day students have better performance on kindergarten reading skills assessments. We do not find that full-day students perform any better than half-day students on first-grade reading skills assessments or the CST ELA or math assessments in second or third grade, however. These patterns are consistent with previous national research on full-day kindergarten. In these analyses, we also find that full-day students are 5.2 percentage points less likely to be retained in kindergarten or first grade than their half-day peers. When examining English fluency outcomes, however, we do not find an extra benefit from full-day kindergarten attendance as we hypothesized. These results for all outcomes hold up under many different specifications.

In general, the reduced likelihood of retention in our study is a sizable effect compared to the relatively low overall rates of retention before second grade. The most comparable intervention in the literature to have a similar impact on early retention is Tennessee's Project STAR class size reduction (Folger & Breda, 1989), but Project STAR also had positive effects on academic achievement. Despite not finding effects outside of retention in our study, this reduced likelihood of retention can still affect a considerable number of students when multiplied across the student population. It has the potential to produce education cost savings if there are fewer funded educational years per student or if an extra year in early elementary school includes higher costs for remediation or extra support services (e.g., summer school, tutoring programs) that exceed the additional cost of offering full-day classes. In the longer term, several studies suggest reduced retention rates may help produce greater high school completion rates (Xia & Kirby, 2009), although a recent study finds mixed evidence of this for students retained in middle school (Jacob & Lefgren, 2009).

At the same time, we have limited research to date on how retention as early as kindergarten or first grade relates to high school completion rates (Alexander, Entwisle, & Dauber, 2003), so how a reduction in retention in the first two years of schooling translates to outcomes in high school and beyond is still uncertain. Moreover, we are unable to observe in this study whether or not the reduced retention rates we find are maintained through later grades. Because retention policy is determined at the district level, and in kindergarten and first grade at the school level, it is unclear whether the same magnitude of effects would be found in other districts. Given the focus on at-risk students nationwide and the large proportion of disadvantaged students in LAUSD, other districts with similar retention polices may be interested in these findings. It would be worthwhile to explore the effect of full-day kindergarten on retention rates in other districts to determine if similar effects are found in other areas.

Furthermore, several student and school characteristics may moderate the effectiveness of full-day kindergarten. The weight of the evidence indicates that students with higher levels of English fluency at kindergarten entry benefit from full-day kindergarten more than their low–English fluency peers in several ways: They are more likely to be reclassified fluent-English proficient by the end of second grade, more likely to be proficient on the second-grade CST ELA, and have slightly higher first-grade reading and CELDT scores. These differences by English fluency level may suggest the need for more programs to improve English fluency before kindergarten to benefit early reading performance and the transition to English proficiency. At the same time, the results suggest that policymakers should focus on low-performing schools first when considering a change from half-day kindergarten to full-day kindergarten. To a lesser extent, focusing on students whose parents have low education levels may also have merit.

We recognize that full-day programs may produce some benefits that are not well captured by the measures we have access to in our study and our methodology. For example, we do not test behavioral outcomes or approaches to learning (such as

task persistence) that might matter in the longer term. Also, we do not capture benefits related to maternal employment such as increased household income. More family resources may positively affect student outcomes in later years in ways we are unable to measure.

Because we find that there may be a benefit to full-day kindergarten and full-day classes are increasingly common, this presents an opportunity for educators to consider further ways that the additional class time may be used to improve student outcomes of interest. Some early childhood experts believe that how the time is spent may matter as much as or more than how much time is spent in the classroom (Gullo, 1990; Olsen & Zigler, 1989).[25] An exploration of specific class practices such as those used in LAUSD would prove beneficial to better understanding the mechanisms that are producing results on some margins and potential changes that may improve results overall.

The decision to offer full-day kindergarten should be guided by assessing its benefits in relation to the costs. These costs could include building or renovating space, personnel, teacher development, and equipment. Some of these costs such as building remodeling are start-up costs, and others such as personnel are ongoing expenses. In contrast, full-day kindergarten may generate savings through decreased transportation needs. To date, research on the costs of implementing full-day kindergarten or its cost-effectiveness is limited (Votruba-Drzal, Li-Grining, & Maldonado-Carreño, 2008). This is not surprising, as it is difficult to generate accurate and generalizable cost estimates because situations vary greatly between schools, even if they are in the same district or state. For example, full-day kindergarten will be more costly for a school that needs additional classroom space than one that does not, assuming all else is equal. Future research that systematically describes the costs of full-day kindergarten will greatly benefit the decision making of policymakers as they choose between implementing full-day kindergarten or alternative interventions.

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[25] We note again that LAUSD students receive 320 instructional minutes on average, which other state educators should put in the context of their own schools' kindergarten schedules to consider whether students would receive the same benefits we describe.

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APPENDIX

Table A1. Full model results for main estimation retention outcome.

Variable	Coefficient (Std. Er.)
Full-day kindergarten	−0.052***
	(0.007)
Hispanic/Latino race/ethnicity	0.013
	(0.008)
Parent highest education level (omitted less than high school)	
High school degree	−0.008***
	(0.002)
Some college	−0.013***
	(0.003)
College degree	−0.015***
	(0.004)
Graduate education	−0.011**
	(0.005)
Education missing	−0.002
	(0.002)
Kindergarten entry age as of September 1 (months)	−0.005***
	(0.000)
Redshirt	−0.007
	(0.005)
Primary home language is Spanish	0.014
	(0.009)
Birth country is U.S.	0.007***
	(0.002)
Meal program participation	0.006*
	(0.003)
Changed school between kindergarten and first grade	0.045***
	(0.003)
School size (in 100s)	−0.002
	(0.002)
API rank	0.005**
	(0.002)
% EL students (school)	0.112***
	(0.042)
% students in meal program (school)	0.203***
	(0.047)
% students with parent with less than high school education (school)	−0.012
	(0.029)
% teachers with EL authorization (school)	−0.006
	(0.032)
% teachers with full credential (school)	−0.254***
	(0.035)
% teachers with 5 or more years experience (school)	−0.108***
	(0.027)
Reading First program school	−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	0.306***
	(0.066)
R-squared	0.156
Sample size	110,952

Notes: Estimates from a linear probability model. Standard errors in parentheses and all models adjust standard errors by clustering at the school level. API = Academic Performance Index (1 = lowest to 10 = highest); CELDT = California English Language Development Test; EL = English learner; Std. Er. = Standard error.

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

Table A2. Sample sizes for regressions reported in Table 5.

Outcome	LAUSD Matched District Individual-Level [1]	Students Staying in Same School [2]	Teachers Staying in Same School [3]	Teachers Staying in Same School, Teacher FE [4]	Students with Varying Time in District [5]	Contemporaneous and Peer Covariates [6]
Kindergarten reading	112,419	85,963	91,467	91,467	123,902	108,626
1st-grade reading	98,596	72,392	80,535	80,535	105,797	94,911
2nd CST score—ELA	107,567	76,756	87,940	87,940	111,177	98,457
2nd CST score—math	107,565	76,734	87,949	87,949	111,152	98,408
2nd CST prof.—ELA	107,567	76,756	87,940	87,940	111,177	98,457
2nd CST prof.—math	107,565	76,734	87,949	87,949	111,152	98,408
Retained by second grade	110,952	78,291	90,664	90,664	117,513	107,256
English proficiency						
1st-grade CELDT score	102,602	73,941	83,945	83,945	108,671	96,895
2nd-grade CELDT score	102,591	73,942	83,940	83,940	108,663	98,811
RFEP by second grade	109,586	77,361	89,537	89,537	116,152	105,938

Notes: CELDT = California English Language Development Test; 2nd CST = second-grade California Standards Test; ELA = English-language arts; prof. = Proficiency; FE = fixed effects; RFEP = Reclassified fluent-English proficient.