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Dual Identification? The Effects of EL Status on SPED Placement in an Equity-Focused District

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ABSTRACT

This study examines the effects of English Learner (EL) status on subsequent Special Education (SPED) placement. Through a research-practice partnership, we link student demographic data and initial English proficiency assessment data across seven cohorts of test takers and observe EL and SPED programmatic participation for these students over seven years. Our regression discontinuity (RD) estimates at the English proficiency margin consistently differ substantively from positive associations generated through regression analyses. RD evidence indicates that EL status had no effect on SPED placement at the English proficiency threshold. Grade-by-grade and subgroup RD analyses at this margin suggest that ELs were modestly under-identified for SPED during grade 5 and that ELs whose primary language was Spanish were under-identified for SPED.

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Introduction

The effectiveness of educational support services holds tremendous influence on the academic success of millions of public school students in the U.S. (Thurlow et al., 2006). When such services meet students' needs for linguistic or disability support, indicators of student success can improve (Berkeley et al., 2010; Morgan et al., 2010; Schwartz et al., 2021; Wang & Lam, 2017). Conversely, when needs are unmet, student success can falter (Morgan et al., 2010). Persistent achievement gaps between student populations who are eligible for services and those who are not suggest that there is substantial room for improvement nationwide (Albus & Thurlow, 2013; Pasternack, 2014; Schwartz et al., 2021). Furthermore, some students rely not solely on English Learner (EL) services or Special Education (SPED) services, but rather on supports for *both* a disability and developing English proficiency. We refer to these students as *dually-identified* students (i.e., identified for both EL and SPED) and they are a central focus of this study (Carnock & Silva, 2019; Umansky et al., 2017).

Despite a substantial body of descriptive and qualitative research on the relation between EL and SPED placement, little is known about the causal link between the two. Prior work has highlighted disproportionate representation of EL students in SPED using descriptive regression and hazard analyses (Morgan et al., 2015, 2017, 2018; Umansky et al., 2017). This work has found grade-level heterogeneity with EL students' being under-identified for SPED in elementary grades, but over-identified for SPED in secondary grades (Umansky et al., 2017). However, a clear evaluation of how EL status *affects* subsequent SPED placement has not yet been conducted. Previous studies on this topic note that to most thoroughly examine disproportionate representation, student-level data are necessary (Morgan et al., 2017).

Through a research partnership with a large, urban school district in California, we employ student-level data across seven cohorts of kindergarten students to examine the relation between EL status and SPED placement. We principally leverage a regression discontinuity (RD) design to generate credibly-causal estimates of the effects of EL status on subsequent SPED placement for students near the English proficiency margin. However, we also examine descriptive results using raw placement rates and regression analysis that allow us to understand the relation between EL status and SPED placement across the broader English language proficiency continuum. Results obtained through these different empirical approaches strengthen our understanding of how SPED placement is related to the range of possible levels of English language proficiency. For example, the probability of being in SPED is higher for students with lower levels of English proficiency. This paper makes at least two critical contributions.

First, our application of the RD research design to detailed, student-level data adds new evidence based on a rigorous quasi-experimental approach about the placement of EL students in SPED services. The RD design allows for the unbiased estimation of the Local Average Treatment Effect (LATE) by comparing individuals just above and below an arbitrary cut point or threshold that determines assignment to a particular intervention (Angrist & Pischke, 2009; Thistlewaite & Campbell, 1960). A core strength of this empirical approach is the modest number of assumptions that must hold in order for inferences to be considered valid (Angrist & Pischke, 2009). Furthermore, compared with other quasi-experimental research designs (e.g., propensity score matching; interrupted time series designs, etc.), the RD approach stands out because the identifying assumptions can be empirically tested (Calonico et al., 2014; McCrary, 2008).

Our main RD findings indicate that EL status largely led to proportionate representation of EL students in SPED at the English proficiency margin. These results, based on the pooled sample, suggest that the district identified a close-to-proportionate number of EL students for SPED placement at the English proficiency threshold during the years of our study.

However, a limitation of the RD approach is that our estimand (i.e., the LATE) is local and may not speak to patterns occurring across the full continuum of English language proficiency. Given this, we also explore descriptive results in order to provide a more complete picture of the complex relation between EL status and SPED placement. Our unconditional placement rate comparisons and Ordinary Least Squares (OLS) regression analyses indicate that for the full analytical sample, EL students in this district are overrepresented in SPED by at least 2.3 percentage points; it is possible that the effect of EL status on SPED placement is heterogeneous at varying levels of English proficiency. Furthermore, across a wide range of bandwidths, we reject the null hypothesis that our RD estimate is statistically the same as OLS estimates. This highlights the novel information generated by the RD approach.

Second, we generate highly policy-relevant evidence for practitioners that can facilitate the continuous improvement of SPED identification procedures for ELs. Initially, we explore how the *timing* of SPED placement may reflect disproportionate representation. Prior literature has found that disproportionate identification of students who entered kindergarten as ELs for SPED identification can vary by grade level (e.g., Umansky et al., 2017). We look specifically at RD results for SPED placement in each year following initial EL classification in kindergarten, from grade 1 to grade 6, and find evidence that slight under-identification of EL students for SPED placement occurred during grade 5. These findings provide insight to district staff on the implementation of SPED placement procedures that may differ by grade or student age and the implications of these practices. Additionally, we explore effect heterogeneity by students' primary language to shed light on possible differences that occurred across language groups. To do this, we split our sample into three subgroups (students speaking Spanish as the primary language; students speaking Mandarin/Cantonese; and students speaking any other non-English language) and apply our RD approach to each subgroup separately. After doing this, we observe suggestive evidence of heterogeneity by primary language group. Spanish-speaking ELs were under-identified for SPED while Mandarin- or Cantonese-speaking ELs and ELs speaking other non-English languages were proportionately identified for SPED. Our findings help to illuminate potential differences in the way EL students were placed into SPED based on the primary language spoken. Such distilled information can aid district leaders to develop more targeted approaches for students in each of the three distinct subgroups.

In combination, these contributions build on previous literature and strengthen the available evidence pertaining to the intersection of EL status and SPED placement. While our main results do not raise clear concerns for inequitable SPED placement practices overall based on EL status in this district, subgroup analyses suggest areas for adjusting the SPED identification process for ELs.

Students in EL and SPED Services

English Learners

ELs are students between the ages of 3 and 21 who need additional support to improve their English language listening, speaking, reading, and/or writing abilities to be able to succeed in academic courses where English is the language of instruction (U.S. Department of Education (DOE), 2016). Also referred to as students with limited English proficiency or as emergent bilingual/multilingual students, EL students have been a protected class of students since the

1974 Supreme Court decision in *Lau v. Nichols*. Title III of the *Every Student Succeeds Act* (2015) provides state educational agencies with substantial latitude in how EL students are to be identified, but most commonly (including in our partner district) the process involves a home language survey being sent to newly-enrolled students. Students whose families indicate that a language other than English is spoken at home are then given a formal assessment to determine if the student qualifies for EL classification. In California districts, including our partner district, the California English Language Development Test (CELDT) was the formal assessment used to evaluate a student's English language skills from 2001 to 2017. Approximately 10 percent of the total U.S. student population was classified as EL in 2015 (U.S. DOE, 2017). At the time, more than three quarters of the "current EL" population, or students with active EL classification, identified as Latino/a, yet the current EL population overall was extremely diverse with regard to race, ethnicity, nationality, and languages spoken (U.S. DOE, 2014). The ten districts enrolling the highest proportions of current ELs were located in California, Alaska, New Jersey, Arizona, and Washington (U.S. DOE, 2014).[3] Of the current EL population, approximately 14 percent qualified for SPED (U.S. Department of Education, 2017).

Students who classify as EL (i.e., not English-proficient) are entitled to educational services for English language development (ELD) (U.S. DOE, 2016). Services for EL students vary across schools, districts, and states. Some ELs are enrolled in bilingual or dual language programs, in which their primary language is used in addition to English for content instruction; others are enrolled in courses taught only in English but have designated ELD time in their weekly schedules. In our partner district, dual language programs that provide home language instruction from kindergarten to grade 8 are offered in Spanish, Cantonese, Mandarin, and Korean. Additional shorter-term bilingual and biliteracy programs in these and other languages are also available in select schools. Students who are unable to or choose not to attend a dual language program receive designated and integrated ELD, which aims to support linguistic progress as well as academic core content skills. Designated and integrated ELD take the form of courses focused on developing communicative and academic English proficiency or content-based courses with language development embedded.

Students in Special Education

Students in SPED receive services to enable them to access a free and appropriate public education (FAPE). Since 1975, federal law and related judicial rulings have required that all children aged 3-21 nationwide have access to FAPE. This means that any student with needs due to a disability are to receive individually-tailored supports and accommodations. The *Individuals with Disabilities in Education Act* (2004) part B covers students aged 3-21 and requires schools to provide services in the least restrictive environment (Carnock & Silva, 2019). As a result, schools must provide necessary supports while also ensuring the students are not unnecessarily diverted from typical educational settings. IDEA defines 13 distinct disability categories.[4] When a child aged 3-21 is identified as having a disability in any of these 13 categories, the student is entitled to SPED services and an Individualized Education Program (IEP) is established.

In compliance with federal and state policies, our partner district follows a multistep process to identify student eligibility for SPED services. For students who are identified as having difficulty with academics, health, behavior, or attendance, schools may first suggest a variety of interventions such as a Student Success Team. If evidence suggests the interventions are insufficient for addressing a student's needs, family, school staff, and other adults in the community can initiate a referral for an evaluation to find out if the student has a disability. The district guards against inappropriate basis for referral by requiring data-based documentation that the challenges in the student's educational progress are not primarily due to lack of appropriate instruction in reading or math, English language acquisition, cultural, environmental, economic, or socio-linguistic factors.

During an evaluation, existing information is reviewed and new assessments can be conducted to identify all of the student's needs for SPED and other services. IDEA specifies that tests and interviews given in the evaluation must be in the student's primary language and must not be conducted in a way that discriminates against any student based on a disability or on their cultural or racial background. In this district, assessments are available in English, Spanish, Mandarin, and Cantonese. Informed by the evaluation results, decisions regarding the student's eligibility for SPED services are made by a team that includes the students' family, school staff in general education and SPED, and sometimes other educators and/or caregivers. For eligible students, a meeting is held to develop an IEP, which states the services the district will provide.

Additionally, the district conducts a meeting at least once a year with the student's family to review the student's progress toward goals in the current IEP and make appropriate changes. Under IDEA, students must be reevaluated at least every three years to see if they continue to be "with a disability" as defined by law and to update their educational needs and services.

Nationwide, since 2007-08, between 13-14 percent of all students have been placed in SPED after being identified as having a disability within one of the 13 categories specified in IDEA. This translates to more than six million students annually receiving SPED services under IDEA (U.S. DOE, 2013, Table 204.30). Students identified with either a "specific learning disability" or "speech or language impairment" made up more than half of all disability classifications.[5]

Dually-Identified Students

Around 700,000 students nationwide in 2014-15 were dually identified, or eligible for both EL and SPED services, when counted using a current-EL framework, which considers only ELs who have not yet attained fluent English proficiency or exited EL services. Further, current-EL students were more likely to be identified for either the "specific learning disability" or "speech or language impairment" disability categories than non-EL students (U.S. DOE, 2014). However, these statistics mask substantial complexity in defining the presence of EL and dually-identified students nationwide by failing to account for students who were ELs at one time but have since reclassified to English-proficient. In contrast, an "ever-EL" framework encompasses a broader set of students who are either current ELs or students who have exited EL services. A major strength of using the ever-EL framework is that the underlying sample remains consistent over time, retaining all students who ever are identified for EL status regardless of reclassification status (Umansky, 2016b). Using the ever-EL framework is especially important for studying dually-identified students because it helps to compare SPED placement rates for students who were similar at baseline, or prior to any EL intervention (Umansky et al., 2017).

Dually-identified students are an important student population, and their unique intersection of needs for educational services calls for greater study and evaluation (Carnock & Silva, 2019; Fagan & Pentón Herrera, 2022; Park et al., 2016). The provision of both EL and SPED services is required by federal law but implemented at the local level. Federal appropriations for SPED have historically only covered a limited portion of the actual costs to provide such services to districts (National Council on Disability, 2018). In recent years, federal appropriations for SPED have provided just over 15 percent of the actual cost districts experience when implementing these services. For EL services, real funding levels (i.e., adjusted for inflation) have recently dropped below the per pupil amount appropriated in 2002 (Carnock

& Silva, 2019). The lack of sufficient funding for both EL and SPED programs makes concerns regarding the provision of services for dually-identified students who rely on both programs even more stark.

Furthermore, extant qualitative research on bilingual students with needs for SPED services (also referred to as ELs with disabilities, emergent bilinguals with disabilities, or emergent bilinguals labeled as disabled (EBLAD)) highlights considerable limitations in their access to learning opportunities. In a review of the literature on normalcy, disability, and race, Cioè-Peña (2017a) pointed out that in relation to an ideology of normalcy, for which a command of the English language is a prerequisite, EBLAD students are perceived as doubly disabled. These inaccurate perceptions can have a major impact on the inclusion of EBLADs, often resulting in segregation and ostracization of students from their peers and/or limited access to multilingual learning environments (Cioè-Peña, 2017a, 2017b). Cioè-Peña (2020a) found that even in schools that offer bilingual or dual language education, EBLAD children tended to be placed in English-only programs because they are viewed as less likely to be able to attain, sustain, and benefit from a multilingual identity. A related study focusing on EBLAD teachers and school staff found that these program placement decisions are often made solely by the school without input from students and their families, and the disconnect between school and home leads to the families' having limited capacity to support their children's learning (Cioè-Peña, 2020b). In a review of literature focused on bilingual children with autism spectrum disorders, Park (2014) also highlighted empirical findings that challenged the notion that bilingual education is too difficult for autistic children. Park (2014) showed that developing dual-language abilities is essential for facilitating communication with parents, increasing social interactions, and identity formation.

In our partner district, IEPs for EL students must (a) state that the student is to be assessed annually using the English language proficiency assessment in California or an alternate (with modification and/or accommodation if appropriate) and the results considered; (b) include the student's current level of academic achievement and functional performance; (c) indicate whether general education, SPED, or both will provide ELD services and ensure teachers have appropriate primary language support, ELD, and SPED credentials; (d) create ELD goals and ensure all students receive at least 30 minutes of daily ELD appropriate for their proficiency level; (e) state the language of instruction for other goals; and (f) offer the family translated documents.

Associations Between EL Classification and SPED Placement

Existing research suggests that EL classification can affect later student placement in SPED (Burr, 2019; Burr et al., 2015; Hibel & Jasper, 2012; Umansky et al., 2017). To the extent disproportionate placement occurs, SPED placement may be a key moderator of the effect of EL classification on students' short- and long-term outcomes. Evidence on this topic is mostly associative in nature and documented using regression or hazard analyses. In this section, we discuss extant literature describing the challenging work of disentangling disabilities from developing language proficiency, the prior focus on disproportionate representation, how both under-identification and over-identification of EL students for SPED can be harmful, and recent methodological advances in the work exploring the effects of EL classification and reclassification.

Disentangling Disabilities from Developing Language Proficiency

Prior studies highlight the challenge of differentiating disabilities from needs for ELD. Poorly-designed language assessments with weak psychometric properties, for example, can create problems for discerning between language needs and disability needs (Macswan & Rolstad, 2006). Additionally, an early study noted that a disproportionate number of Latino/a students were labeled as having a learning disability solely due to limited English proficiency (Ortiz & Polyzoi, 1986). More recent literature suggests that difficulty differentiating between a disability and language proficiency continues to challenge educational institutions and staff (Carnock & Silva, 2019; Park, 2019b). This can be especially true for students in the early grades and frequently results in diagnoses for a language need earlier than a disability (Burr, 2019; Carnock & Silva, 2019). Qualitative research found educators beliefs about whether and when to identify EL students for SPED evaluation to cluster around two themes: "wait to be sure" and "the sooner the better" (Park, 2020). Policies pertaining to district SPED identification processes may be particularly relevant and important to consider relative to this phenomenon (Burr, 2019).

Disproportionate Identification

Multiple studies highlight the issue of a potential disproportionality (i.e., either underrepresentation or overrepresentation) of EL student participation in SPED. Crucially, under-identification of EL students for SPED can be harmful for students academically if EL students with disabilities are not receiving necessary services (Greenberg Motamedi et al., 2016). Such a phenomenon could be occurring as a result of delayed testing for EL students (Samson & Lesaux, 2009). A delay may be stimulated by some form of explicit or implicit bias against EL students (Figueroa & Newsome, 2006). For example, the model-minority stereotype has been found to create biases that affect SPED identification for Asian-American students in different ways (Park, 2019a). One assumption identified by that study was that Asian-American students were obedient and achieved academic success without need for support, so those who showed deviant behavior or struggled academically must have had a disability. An alternative explanation is that EL students may be more difficult to identify for SPED due to difficulty differentiating between language proficiency and a disability (Burr, 2019; Carnock & Silva, 2019). Regardless, under-identification merits concern because some students with needs for SPED lack access to essential support services.

On the other hand, over-identification of EL students for SPED can also be harmful to students (Burr, 2019; Burr et al., 2015) if inappropriate placement in SPED limits EL students' inclusion in general education classrooms (Samson & Lesaux, 2009). A key component of federal law establishing protections for both EL and SPED students dictates that students must be placed in the *least* restrictive educational environment (Carnock & Silva, 2019). Accordingly, placement in SPED without a need for the service can stymie a student's ability to participate in general education class settings, which may be essential for the student's growth and development. Furthermore, prior work has highlighted that SPED participation can lead to harmful stigmatization (Shifrer, 2013).

Proportionate representation at the margin, therefore, would suggest that services are being adequately provided with students still having access to less restrictive classroom settings. This represents the appropriate middle ground that districts are seeking to reach (Burr et al., 2015).

Umansky and colleagues (2017) used discrete-time hazard analyses and an ever-EL framework to examine the likelihood that a student subsequently participates in SPED (i.e., becomes dually identified). They found that ever-EL students were less present in SPED overall and within most disability categories (Umansky et al., 2017). However, an important limitation of this study was that a causal link was not identified. In other words, it is unclear whether participation in EL services *led* students to be under-classified in SPED. As such, outstanding questions about whether EL status *causes* disproportionate classification for SPED remain.

Other existing work on the intersection of EL classification and SPED classification also suggests that ELs tend to be both disproportionately identified for most disability categories and identified later than non-ELs for SPED services (Hibel & Jasper, 2012; Morgan et al., 2015; Samson & Lesaux, 2009). Notably, however, these three studies did not report findings for the subgroup of students that were initially classified for EL, but rather examined samples of students who either spoke another language at home or were identified as children of immigrants (i.e., students who *may or may not* have been eligible for EL services). Still other work has looked exclusively at subgroups of *current-EL* students to analyze disproportionality (e.g., Artiles et al., 2005; Sullivan, 2011; Sullivan & Bal, 2013; Wagner et al., 2005). However, as has been previously noted in the literature, a key consideration when reviewing these analyses is that they did not consider reclassification. In other words, the results reported in these articles did not account for that the sample of EL students changing as students reclassify as English-proficient and exit EL status. Retaining reclassified students in the sample is appropriate as it enables a full and consistent comparison of students over time. Not accounting for these students may lead to inaccurate evaluations of SPED placement rates. A further limitation to some extant literature is the reliance on repeated cross-sectional data instead of panel data (e.g., Klingner et al., 2005; Morgan et al., 2015; Samson & Lesaux, 2009). Using only cross-sectional data inhibits the ability to precisely identify if observed relationships were due to policy interventions or changes in the underlying sample. In sum, a substantial amount of prior research has emphasized the importance of understanding the disproportionality of EL students in SPED. However, to date, the empirical methods applied to this topic, while consistently becoming more advanced, have remained unable to explore a causal link.

Our study, combining panel-based research designs, the ever-EL approach (which compares ever-ELs to never-ELs, both of whom entered kindergarten at the cusp of fluent English proficiency) and fine-grain student-level EL and SPED participation data, allows for a rigorous quantitative analysis of the causal relations between EL status and SPED placement near the English proficiency margin. In particular, using an RD design, we examine the probability of SPED participation between one and six years after being designated for EL status for students who scored similarly on the CELDT initial assessment during kindergarten.[6]

Regression Discontinuity Evidence on EL Classification and Reclassification

Up to this point, the RD design has not been applied to study how EL status affects SPED placement. However, recent research on how EL status affects other educational outcomes illustrates the value of this approach. Several studies have leveraged student scores from the CELDT or other English proficiency assessments to employ RD designs that estimate the effect of EL status on academic achievement and attainment (Johnson, 2019; Shin, 2018; Umansky, 2016a, 2016b; Umansky et al., 2021). More specifically, Umansky et al. (2021) explored the effect of initial EL classification on Alaska Native student outcomes using an RD with a standardized screener assessment score as the forcing variable. They found negative impacts on academic outcomes for Alaska Native students in grades 3 and 4. Johnson (2019) used a binding-score RD framework and found the effects of initial EL classification on outcomes such as high school graduation and college attendance to be limited. Shin (2018) found weak positive effects of initial EL classification on standardized test scores. Two other RD studies that used initial student CELDT scores as the forcing variable found that EL classification was in fact harmful to the likelihood of taking rigorous academic coursework and student achievement on standardized tests (Umansky, 2016a, 2016b).

In addition to these RD studies that examined the effects of *initial* EL classification, this research builds on an important body of work on EL reclassification. Robinson (2011) highlighted that assessment-based criteria are powerful levers for guiding reclassification decisions and demonstrated approaches to evaluating assessment score thresholds. This paper showed that when it comes to determining an appropriate threshold for transitioning ELs out of language services, rather than a positive effect, a null effect (which signals a smooth transition with no improvement or detriment to subsequent academic outcomes) is the desirable result. Following this work, several studies estimated the effects of shifting reclassification criteria and of reclassification decisions on students' downstream outcomes. For example, Robinson-Cimpian and Thompson (2016) found that using more stringent assessment-based criteria (thus making reclassification more difficult to attain) eliminated negative effects that reclassification had previously had on students' English language arts test scores and high school graduation rates. Carlson and Knowles (2016) estimated the effects of reclassifying at the end of 10th grade and found positive effects on students' ACT scores and some evidence for positive effects on high school graduation and postsecondary enrollment. These studies suggested that school districts (a) monitor student outcomes following the reclassification decision and make changes to the threshold if necessary and (b) examine their provision of academic opportunities and ensure that resources are available to all students regardless of their reclassification decision.

Our study advances the literature examining disproportionate representation of EL students in SPED by applying three key components shared by these studies on EL initial classification and reclassification: an RD design, student-level data, and a known cut score to determine EL eligibility.

Data

We partner with a large urban school district with a long history of serving a diverse EL population through an exceptionally rich variety of EL services. We leverage the district's longitudinal data from the California Longitudinal Pupil Achievement Data System (CALPADS). The data include four essential sets of information: (a) SPED placement, (b) EL classification; (c) the results (overall and by domain) that students obtained during their *initial* CELDT; and (d) students' demographic characteristics. Our study is based on panel data for SPED placement, EL classification, and demographic characteristics from School Year (SY) 2006-07 through SY 2018-19. Results from the initial CELDT are available from SY 2006-07 through 2016-17.[7]

To understand the effect of EL status on a consistent set of SPED outcomes, our sample focuses exclusively on students who took the initial CELDT during their kindergarten year.[8] The students in our sample, therefore, were those whose families reported speaking a language other than English at home and entered the district during their kindergarten year.[9] Critically, our analytical sample includes all students who took the CELDT, whether they were classified as EL or English-proficient.[10]

In order to gain clear insight into the SPED placement outcomes across the elementary school timespan, we follow seven cohorts of initial CELDT takers for seven years (i.e., during the initial CELDT year and in the six subsequent years). Figure 1 provides an illustration of the cohorts included in our sample. For the main analyses, we keep cohorts of initial CELDT takers from SY 2006-07 through SY 2012-13 (N=12,607).[11] For each of these cohorts, we observe SPED placement for students in each subsequent year.[12] Table 1 provides summary statistics.

Our principal outcome variable is an indicator that the student was first placed in SPED between grades 1 and 6 after the initial CELDT in kindergarten. Students that were identified for SPED in the *same* year (kindergarten) as the initial CELDT are not flagged by this outcome. This is because we do not observe the precise start date (day and month) of SPED placement during kindergarten and cannot identify whether SPED placement occurred before or after the CELDT. Also, many students enter kindergarten having been flagged as needing SPED services through an early childhood education program (e.g., Head Start; Pre-kindergarten).[13] Therefore, our analysis focuses on those students identified for SPED *following* the initial CELDT so that we can directly understand the influence of EL status.

In addition, our data include baseline demographic characteristics that make up our student-level controls. We include a flag for whether the student identifies as female. Further, we have race/ethnicity-based flags for individuals that identify as (a) Hispanic, (b) Chinese, or (c) Decline to State Race/Ethnicity. Our data also include measures of the highest level of education received by the students' mother or father. We synthesize this information into a flag for whether the highest-educated parent had at least a high school diploma.[15] Our final baseline student characteristic approximates the student's age at the time of the initial assessment.[16]

Our data from the initial CELDT also include information about the primary language spoken by the student. More than 40 different languages were represented in the sample, with large groups of students speaking Spanish, Mandarin, or Cantonese. As shown in Table 1, approximately 32 percent of students taking the initial CELDT assessment indicated speaking Spanish. Another 36 percent of students spoke Mandarin or Cantonese, and about 33 percent of students indicated speaking another non-English language. Using this information, we explore effect heterogeneity by language group. This analysis was of interest because the district has SPED assessments available in English, Spanish, Mandarin, and Cantonese, but not in other languages. Students for whom home language assessment was not available were assessed in English. As a result, we consider the possibility of differential experiences and outcomes across languages.[17]

Methods

One approach to understanding the relation between EL status and SPED placement is to observe raw participation rates and differences between ELs and non-ELs. Another is to simply regress EL status and other covariates on our SPED outcome variables of interest to estimate an association between the two. Prior work on this topic largely relied on these types of descriptive approaches. Following this line of research, we report raw SPED placement rates and OLS regression results for our data.

A key limitation of such results, however, is the inability to determine how EL status *affects* SPED placement without making strong and likely invalid assumptions (e.g., selection on observables) about the relation. The central contribution of our study is the application of a more advanced quasi-experimental research design that can rigorously estimate a causal impact of EL status on SPED placement for students at the English proficiency margin. Leveraging CELDT scale score data, we differentiate between treatment and control groups by first determining whether the student was eligible for EL status based on their CELDT score. Then, we account for the imperfect take-up of treatment assignment by relying on an instrumental variables (IV) approach that uses the level of compliance with EL assignment based on CELDT scores as the instrument. This type of fuzzy RD or RD-IV approach has been previously applied to EL research in California (e.g., Robinson-Cimpian & Thompson, 2016; Robinson, 2011).

Using this approach, we leverage a core underpinning concept from the RD literature—the idea that students near the EL threshold were similar to one another in expectation and provide a strong counterfactual group (Thistlewaite & Campbell, 1960). Based on the assumption that students were unable to precisely manipulate their score (which appears to hold according to numerous empirical tests presented in Appendix Tables A1, A2, and A3 and Appendix Figures A1, A2 and A3), EL status can be considered as good as randomly assigned for ranges of the sample near the threshold. Leveraging this natural experiment that occurs near the arbitrary EL threshold enables the use of a stronger counterfactual comparison group than other quasi-experimental research designs, such as propensity score matching (Angrist & Pischke, 2009; Thistlewaite & Campbell, 1960). Updating our results to account for noncompliance of EL assignment through the RD-IV approach allows us to sharpen our examination and narrowly consider the effects of EL status on SPED placement.

Kindergarten students needed to meet a predetermined cut score across multiple language domains in order to be classified as English-proficient. Students with an overall scale score below the “Beginning Advanced” level, a listening scale score below the “Intermediate” level, or a speaking scale score below the “Intermediate” level were classified as ELs. The initial step to implement the RD approach in this context is to construct a “binding score” forcing variable that accounts for these three ways in which a kindergarten student could have been classified as an EL (Papay et al., 2011; Porter et al., 2017; Reardon & Robinson, 2012). To do this, we create variables for the overall scale score and the listening and speaking scale scores that are centered around the cut scores for each domain and based on *initial* CELDT assessment results in each particular year. This allows us to put scores from each kindergarten cohort on the same scale despite minor adjustments to the CELDT assessment year to year. For each student, we then take the minimum value of these three variables to create the binding score for student *i* in school *s* and cohort *c*:

$$BindingScore_{isc} = MIN\{CenteredOverall_{isc}; CenteredListening_{isc}; CenteredSpeaking_{isc}\}$$

As reported in Table 1, for 92 percent of students, the binding section was the overall score. For 6 percent of students, the binding section was listening. For the remaining students, speaking was the binding section.

First, we define the point at which we expect there to be a discontinuous jump in the probability of treatment:

$$EL\ Eligible_{isc} = \mathbf{1}(BindingScore_{isc} < 0)$$

We then apply the first stage equation of our RD design to understand how well the $EL\ Eligible_{isc}$ indicator predicts actual EL status:

$$EL\ Status_{isc} = \alpha(EL\ Eligible_{isc}) + f(BindingScore_{isc}) + \lambda_{sc} + \boldsymbol{\beta X_{isc}} + \epsilon_{isc}$$

In this specification, α signifies the discrete jump at the cutoff for EL assignment and is our coefficient of interest. The indicator $EL\ Eligible_{isc}$, flags observations that were below the cutoff based on the binding score. The $f(BindingScore_{isc})$ term represents a flexible function of the binding score.[18] We implement this as specifications that include linear splines of the forcing variable.[19] λ_{sc} represents school-cohort fixed effects, which allow us to remove variation that is consistent across groups of students testing from the same school-cohort combination. $\boldsymbol{X}_{isc}$ is a vector of student-level covariates, including an approximation of the student's age at initial assessment and indicators for being female, Hispanic, Chinese, having declined to state race/ethnicity, and having the most educated parent being at least a high school graduate. ϵ_{isc} is the mean-zero error term.

Through this specification, we test how our binding score forcing variable influenced the probability of actual EL assignment. We also probe for manipulation of the forcing variable around the cutoff through a variety of different diagnostic tests.[20]

Appendix Table A1 provides point estimates of the first-stage relationships across a variety of specifications at the CCT optimal bandwidth. We observe large and statistically significant relationships between our discontinuity parameter, α, and EL assignment. In all cases, we estimate the jump in probability of being assigned EL status to be more than 75 percentage points. Importantly, this indicates that in most instances our binding score forcing variable is effectively flagging students that ultimately entered EL status (i.e., were "compliers" with treatment assignment). Further, the F-statistic for our main instrument, $EL\ Eligible_{isc}$, is over 1000 for each reported specification.[21] Still, these results highlight that our binding score forcing variable does not perfectly identify treatment. In some cases, a student may have scored below the threshold but was classified as English-proficient (i.e., was a "never-taker" of treatment assignment) or scored above the threshold but was still classified as EL (i.e., was an "always-taker" of treatment assignment). Figure 2 illustrates the high probability of EL classification based on the CELDT binding score. The visual provides binned averages for the CCT bandwidth.

However, we are most prominently interested how EL status impacted SPED placement rates. Therefore, the specification of primary interest for our key outcomes relies on the following second-stage equation:

$$Y_{isc} = \gamma EL\ \widehat{Eligible}_{isc} + f(BindingScore_{isc}) + \ +\lambda_{sc} + \boldsymbol{\beta X_{isc}} + \epsilon_{isc}$$

In this fuzzy RD specification, γ is our coefficient of interest on the predicted values from our first stage equation, $EL\ \widehat{Eligible}_{isc}$. In contrast to the first-stage equation, rather than using actual EL status as the outcome measure, we use Y_{isc} to look at our key SPED placement outcomes overall and by grade-level. The remaining terms of this second-stage equation are consistent with the terms from the first-stage equation. The key differences in this specification, therefore, are that: (1) by using the $EL\ \widehat{Eligible}_{isc}$ indicator, we are focusing on how EL assignment affected SPED placement for the subset of "complying" students; and (2) by replacing EL assignment with Y_{isc}, we examine SPED placement, our key outcomes of interest.

Given that our primary interest is in how EL status affected SPED placement (i.e., the effect for "compliers"), the fuzzy RD or RD-IV design, in which the $EL\ \widehat{Eligible}_{isc}$ indicator serves as an instrument for the students' actual assignment to EL status, is most appropriate. Importantly, in order to implement the fuzzy RD design, we estimate two-stage-least-squares (2SLS) models. Results from those models are reported in Tables 3, 4, and 5. The reported results, focused exclusively on those individuals who complied with treatment, represent the Treatment on the Treated (TOT) estimand.

Additionally, in Table 3 and in Appendix Tables C1 and C2, we also report results from the following "reduced-form" specification for reference:

$$Y_{isc} = \omega(EL\ Eligible_{isc}) + f(BindingScore_{isc}) + \lambda_{sc} + \boldsymbol{\beta X_{isc}} + \epsilon_{isc}$$

Here, our primary interest is on ω, the coefficient on the $EL\ Eligible_{isc}$ indicator. The key distinction with this model is that we do not rely on the predicted indicator (i.e., $EL\ \widehat{Eligible}_{isc}$), but rather solely examine results for our SPED outcomes of interest based on whether the CELDT binding score was below the specified cutoff. These results are inclusive of compliers, always takers and never takers and provide evidence for the effects on SPED placement in contexts where the compliance rate for EL assignment is similar to our district.

Results

Descriptive Evidence

Raw SPED placement rates for the main sample are presented in Table 1. Appendix Tables B1-B4 provide extended descriptive statistics, including the raw placement patterns for EL students and English-proficient students for the overall sample and for primary language subsamples. In our main sample, 7.4 percent of EL students were placed in SPED between grades 1 and 6 while 4.8 percent of English-proficient students were placed in SPED. These raw placement rates suggest over-identification of EL students in SPED by 2.6 percentage points. However, this relationship does not account for any observable or unobservable characteristics.

Table 2 presents OLS regression results for the relation between EL status and SPED placement. The bivariate regression results with no controls presented in Column (1) align with the raw difference in rates described above. In Columns (2) and (3), we add relevant student-level controls and school-cohort fixed effects. Across specifications, the relationship in our context is significant and positive. The model with all controls and fixed effects suggests that being assigned EL in kindergarten is associated with a 3.4 percentage point increase in the probability of SPED placement between grades 1 and 6. Thus both the unconditional and conditional (i.e., on observable student-level controls and school-cohort fixed effects) differences indicate that EL students were *over*-represented in SPED in this district overall.

RD Evidence

Table 3 presents our main RD results examining the effect of EL eligibility and EL status on subsequent SPED placement between grades 1 and 6. In Columns (1) – (3), we report reduced-form RD results, which estimate the intent-to-treat (ITT) estimand. In Columns (4) – (6), we report two-stage-least-squares (2SLS) RD results, which estimate the TOT estimand. In all models we account for heteroskedasticity of the error term by implementing Eicker-Huber-White robust standard errors. We present three versions of our main specification. Columns (1) and (4) provide results from RD specifications that includes a linear spline of the forcing variable, but no other controls. Columns (2) and (5) report results from RD specifications that retain the linear spline of the forcing variable and include a set of baseline student-level demographic controls. Columns (3) and (6) present results from RD specifications that retain the linear spline of the forcing variable and the student-level controls and add school-cohort fixed effects.

While we report reduced-form estimates (columns 1-3) of EL eligibility on SPED placement, our preferred specification is the 2SLS estimate of EL status on SPED placement reported in column (6). We prefer the 2SLS estimate over the reduced-form estimate because it considers how EL status rather than EL eligibility impacted SPED placement. Additionally, we prefer the specification in column (6) over the specifications reported in columns (4) and (5) due to the inclusion of both student-level covariates and school-cohort fixed effects, which modestly aids precision and controls for other relevant factors.[22]

A crucial consideration for the RD design is the choice of bandwidth. Rows in Table 3 report estimates of the discontinuous jump at the threshold for different bandwidth samples for each of our RD specifications. Row (2) reports results for +/- 32 points, which is the optimal RD bandwidth suggested by the Calonico et al. (2014), or CCT, approach. Row (1) reports results for twice the CCT optimal bandwidth, or +/- 64 points from the cut score. Row (3) reports results using half of the CCT optimal bandwidth, or +/- 16 points.

For the CCT optimal bandwidth, +/- 32, we observe small and non-significant estimates of between -0.006 and -0.013 across specifications for ITT and TOT effects. This suggests that students eligible for or classified as ELs were similarly likely to be placed in SPED between grades 1 and 6 than those eligible for or classified as English-proficient. Results for all models at the other two bandwidths similarly indicate that EL eligibility or classification had no effect on SPED placement between grades 1 and 6 after initial EL classification in kindergarten, with non-significant estimates between -0.002 and -0.019. Figure 3 presents a graphical illustration for the CCT optimal bandwidth of +/- 32 from the cutoff. Examination of both the visual relationships and the regression results indicates that students scoring below the English proficiency threshold were about as likely as their English-proficient peers to be identified for SPED between grades 1 and 6. These RD results stand in stark contrast to the positive association from the OLS regression analysis.

We further probe the robustness of our main results across a larger number of bandwidth samples using our preferred specification (i.e., the RD-IV specification with a linear spline, student-level controls, and school-cohort fixed effects). Figure 4 presents the 2SLS point estimates and their corresponding 95% confidence intervals. For relatively small bandwidth samples, the point estimates are somewhat volatile and the confidence intervals are wider. This is what we would expect given the smaller sample sizes. As bandwidths increase, confidence intervals narrow and point estimates stabilize around -0.019, or 1.9 percentage points below English-proficient students. Importantly, our point estimates are largely indistinguishable from zero (the blue dotted line), indicating that we have a precisely-estimated null result. However, these estimates are statistically different from the regression analysis estimates (the red dotted line). For all bandwidth samples presented, we reject the null hypothesis (when α=0.05) that the RD coefficient of interest is equal to our OLS regression coefficient.

Table 4 reports 2SLS results for our preferred specification for first being placed in SPED during each grade separately. Column (1) replicates the RD result for our main outcome, first SPED placement between grade 1 and 6. Column (2) reports the RD estimate for first placed in SPED in grade 1; column (3) for first placed in SPED in grade 2; and columns (4)-(7) follow in cognate form. In identical form to Table 3, the rows of this table correspond to different bandwidth samples (i.e., the full sample, +/- 64, +/- 32, and +/- 16).

Results from columns (2-5) and (7) indicate no major difference in SPED placement probability in grade 1 to 4 or grade 6 for students classified as EL and English-proficient. Results from column (6), however, show marginally-significant (p<0.1) point estimates of about -0.01 in bandwidth samples +/- 64 and +/- 32. This provides suggestive evidence that EL status was leading to modest under-identification for SPED in grade 5.

In Table 5, we examine heterogeneous effects by students' primary language for our main outcome of interest.[23] Column (1) presents results for students whose primary language was Spanish. Here, we observe negative point estimates across bandwidths, and a statistically-significant -0.090 for the CCT optimal bandwidth. These results suggest that Spanish-speaking students classified as ELs were less likely to be placed in SPED between grades 1 and 6 than Spanish-speaking students classified as English-proficient. To contextualize these results, about 10.5 percent of Spanish-speaking students in the sample were placed in SPED between grades 1 and 6. Relative to this rate, the magnitude of our RD estimate is substantial. Column (2) of Table 5 presents RD results for the subsample of students who primarily spoke Mandarin or Cantonese. Point estimates are close to zero and not statistically significant across all reported bandwidths. This suggests proportionate representation of these EL students placed in SPED between grades 1 and 6. Column (3) of Table 5 shows estimates for students who primarily spoke languages other than English, Spanish, Mandarin, or Cantonese. Here, too, none of the point estimates are statistically significant.[24]

Figure 5 provides graphical illustrations of these heterogeneous results: Panel A for ELs whose primary language was Spanish; Panel B for ELs whose primary language was Mandarin or Cantonese; and Panel C for ELs whose primary language was a language other than English, Spanish, Mandarin, or Cantonese. Based on the point estimates and graphical results, we find suggestive evidence of under-identification for students whose primary language was Spanish and no evidence of disproportionate representation for the other two subgroups.

Discussion

Prior research has documented concerns specifically about EL students' being misidentified for SPED services and focused the analyses on disproportionate representation of EL students in SPED (Morgan et al., 2015, 2018; Umansky et al., 2017). However, largely due to data restrictions, these efforts have mainly resulted in descriptive findings. In this study, we present descriptive as well as causal evidence pertaining to the interaction of EL status and SPED placement in our partner district.

Descriptive and Causal Evidence

First, we report unconditional SPED placement rates for all students in our analytical sample, by EL eligibility, and by assigned EL status (see Table 1 and Appendix Tables B1-B4). These are raw SPED placement rates for all students in the English proficiency score distribution without any statistical controls, separated by the cut score (or EL status). If we subtract the rate for EL students from the rate for English-proficient students, we get a raw difference in means between these groups without any controls. By and large, EL students had higher SPED placement rates.

Then, we present OLS estimates (Table 2), which enable the assessment of the difference in probability of SPED placement when classification changes from English-proficient to EL. Importantly, in computing our OLS estimates, we are able to control for a variety of student characteristics (i.e., race/ethnicity; parental education level; and age) and school-cohort fixed effects (i.e., common changes for students attending the same school in the same cohort). The contrast between our raw difference reported in Table 2, Column 1 and OLS estimates with controls (Table 2, Columns (2) and (3)) can be interpreted as the part of the relation that is explained away by the controls in the OLS models. Both OLS estimates and raw placement rates facilitate the estimation of average SPED participation rates for students who scored above and below the cut score. An advantage of the OLS estimates is that the estimation of the conditional mean difference in SPED classification rates between students who scored above and below the CELDT threshold is computed using data for all students in the score distribution. A downside to the OLS approach is that the results would be biased estimates of the causal effect if variables (observable or unobservable) that are correlated with both the treatment and the outcome are omitted. Since we only observe a few control variables, we treat our OLS estimates cautiously and interpret them as descriptive rather than causal evidence. In addition, the effect of EL status on SPED placement may be heterogeneous across the full range of English language proficiency, which our single OLS estimate is unable to capture.

Both the raw SPED placement rates and the OLS estimate indicate that in this district overall, EL students are overrepresented in SPED services. This has important implications for teacher education and professional development. SPED teachers need to be trained for supporting EL students; EL teachers also need to be prepared to support students with a disability. To ensure that both support services are aligned and integrated with core academic content, close collaboration is required for school and district staff who specialize in EL and SPED services and core subject instruction.

Finally, we report RD results (Tables 3-5), which allow us to estimate the probability of SPED placement in our partner district separately for observations just above the cut score and observations just below the cut score. Our coefficient of interest indicates the size of the gap between these estimated probabilities, or the jump in the probability of SPED placement at the cut score. Due to the predetermined nature of the CELDT cut scores and the inability for students to precisely manipulate their scores, these RD estimates can be interpreted as credibly-causal estimates of the effect of scoring below the cut score (a strong proxy for EL status) on SPED placement. However, this LATE is only valid if assumptions for the RD design are met (e.g., the continuity of the forcing variable through the threshold). We probe these assumptions in Appendix A and do not find clear evidence suggesting that they are invalid. By using the RD design, the estimation of the causal impact is not prone to omitted variable bias like in OLS, illustrating a substantial strength of this approach. Furthermore, it provides an important and highly rigorous snapshot of differentials in SPED placement rates at the English proficiency margin.

RD Findings at the English Proficiency Margin

Using this rigorous quasi-experimental research design and data from a large school district, we provide new evidence about the effect of EL status on SPED placement at the English proficiency threshold. In contrast to positive correlations suggested by regression analyses, our main RD results at the English proficiency margin indicate a null or slightly negative overall effect of EL status on SPED placement between grades 1 and 6 after initial EL classification in kindergarten. Our credibly-causal results indicate that differences are modest when comparing SPED placement rates for students who barely reach and students who barely miss the English proficiency threshold in kindergarten. EL status, therefore, led to proportionate identification of EL students for SPED in our partner district when compared with their English proficient peers. This finding suggests that qualitative analyses about the districts' identification protocols and practices would likely be informative and valuable.

Suggestive Evidence for Heterogeneity by Grade Level and Primary Language

Furthermore, we were able to consider disproportionate representation over time and by primary language subgroups. Our results indicate that under-representation by about 1 percentage point arose during grade 5. One potential explanation for under-identification of ELs in grades 5 is the preparation for elementary to middle school transition, which typically takes place after grade 5 in the district. It is possible that to prepare for this transition, school staff are paying extra attention to students' learning challenges and needs. Teachers may be more likely to refer students who are native English users or initially English-proficient to be assessed for disabilities. In contrast, EL students may be less likely to be referred for a disability assessment if the teacher believes the challenges EL students experience with learning are due to developing language proficiency and not due to a potential disability.

We were also able to examine effect heterogeneity by primary language category. Practices for identifying special needs used by the district factor prominently into understanding these results. In our partner district, many tools for assessing needs for disabilities are provided in English, Spanish, Cantonese, and Mandarin. In other words, when ELs who are Spanish and Mandarin/Cantonese speakers are assessed for special needs, the assessments can often be conducted in their primary language, while ELs who speak other languages are assessed in English. We would expect the availability of primary language assessment to lead to more accurate placement that matches students' needs. But this could also either increase or decrease the rate of SPED placement relative to using an English assessment. Although both Spanish-speaking and Mandarin/Cantonese-speaking ELs had access to primary-language SPED assessment, we find suggestive evidence that Spanish-speaking ELs were under-identified for SPED relative to Spanish-speaking English-proficient students while Mandarin/Cantonese-speaking ELs were proportionately identified. It is possible that Spanish-speaking and Mandarin/Cantonese-speaking ELs were given primary-language SPED assessments at different rates, or that SPED assessments performed differently with respect to primary language—either of which may have had an impact on referral outcomes. However, we do not observe the language of the assessment administered to each student and are unable to analyze the effect of primary-language assessments. The role of primary-language assessment in SPED placement is worth investigating by future research.

Limitations & Future Directions

An important limitation of the RD estimates described above is that they are most relevant and valid for the subset of students close to the English proficiency cut score. In other words, our RD results likely do not provide causal estimates for students who are far below or far above the cut score. Students with very low English proficiency may have SPED placement rates, as well as SPED service experiences and outcomes, that are different from students at the English proficiency margin. Unfortunately, the RD design does not allow us to interrogate the causal relations among English proficiency, EL classification, and SPED placement for this group. This is an important limitation to our RD approach and highlights the ongoing value of the descriptive results. In this case, raw placement rates and OLS estimates help us to contextualize the RD estimates, and vice versa. In presenting descriptive and causal findings, we aim to provide a more nuanced picture of the complex relations among English proficiency, EL status, and SPED placement.

Several other limitations to this study merit consideration. First, the data come from one district with a long history of serving a large, diverse EL student population and a mature research-practice partnership with a large research university, so the findings may be particularly influenced by this context. In other district settings, ELs may be overrepresented, proportionally represented, or underrepresented in SPED and variation by primary language may be different. This district's demographic composition and extensive experience in addressing the needs of immigrant and EL students are unique. For example, the district has a tradition of close collaboration between its large EL and SPED departments, and multiple staff members specialize in identifying, serving, and reclassifying students for *both* English language and SPED needs. As a result, the district's SPED identification process for emergent multilingual students is somewhat distinct from English-proficient students. Thus, our results may not be generalizable to other districts which serve smaller, less diverse EL populations or apply the same SPED identification procedures to all students. District leaders should consider the demographic composition of their own EL and general student population as well as their EL and SPED classification policies and services when evaluating the applicability of these findings to their context. Future work can consider exploring the placement of EL students in SPED across different districts contexts.

Second, the data did not support further disaggregation by disability type or a robust exploration of results for students taking the initial CELDT assessment after kindergarten. For example, the proportionality of SPED placement by EL status may have differed among the disability categories, but we did not have full access to student-level disability categories. Thus, our results may mask important heterogeneity along this line. Further analysis of this topic should be explored in future work. Also, the sample size did not allow a robust standalone analysis of ELs who entered the district between grade 1 and 5. Appendix Tables D1 and D2 provide an initial consideration of this sample, but future research should consider differential effects of later district entry on dual identification when more data become available.

Finally, this study was not able to identify the precise mechanisms driving the observed effect of kindergarten EL classification or the source of heterogeneous treatment effect by students' primary language. Detailed mixed-methods inquiry into this topic could prove valuable for identifying such mechanisms in future research.

Conclusion

For students with special needs, timely and appropriate placement into educational support services is essential (Burr, 2019). Delayed identification or misidentification can be academically and psychologically harmful for students (Carnock & Silva, 2019). Our results offer a causal assessment of how EL status in kindergarten affected subsequent SPED placement in our partner district using an RD design. These findings advance our understanding of the representation of EL students in SPED around the English proficiency margin. They demonstrate the viability of the RD approach in this context and suggest that ongoing research can use RD in addition to descriptive analyses to better understand the interaction of these two major educational service programs. Our results also shed light on *when* and *for whom* disproportionate representation occurred. Such information is valuable to our partner district as they look to improve policy pertaining to the SPED placement process for EL students.

Additionally, this study directly informs education practice and policy. Having discussed the findings with the research team, the district has begun multiple initiatives. First, both SPED and EL departments have set out to analyze qualitative data on SPED identification, with a focus on ELs with Spanish as their primary language. Second, the partnership plans to examine additional data to analyze EL pathways through SPED identification and programs. This study has thus motivated a series of mixed-methods inquiries aimed at continuing to develop more equitable practices around SPED identification and services.

Scholarship that advances existing literature and that provides directly usable results for practitioners highlights the valuable contributions of research conducted through research-practice partnerships. Furthermore, the application of the RD design to explore this topic sets the stage for ongoing research studying the interaction of EL and SPED services in other contexts.

Endnotes

[1] **Blinded for Peer Review**
[2] **Blinded for Peer Review**
[3] Overall, during the 2014-15 school year, the western and southwestern regions had substantially larger current-EL populations than most other parts of the U.S. (U.S. DOE 2014).
[4] Specifically, the categories are: (1) autism; (2) deaf-blindness; (3) developmental delay; (4) emotional disturbance; (5) hearing impairment; (6) intellectual disability; (7) multiple disabilities; (8) orthopedic impairment; (9) other health impairment; (10) specific learning disability; (11) speech or language impairment; (12) traumatic brain injury; and (13) visual impairment (including blindness) (Carnock & Silva, 2019).
[5] The next most commonly experienced categories of disability were "other health impairment" and "autism", which together accounted for just under one quarter of all disability classifications. The next three most prominent categories are "developmental delay", "intellectual disability" and "emotional disturbance". Together, these three categories made up approximately 18 percent of all disabilities classified. Finally, hearing impairments, multiple disabilities, orthopedic impairments, traumatic brain injury and visual impairments consistently made up less than 5 percent of all disabilities classified (U.S. DOE, 2013). In addition, approximately 10 percent of SPED students also classified as being an EL (National Council on Disability, 2018).
[6] From this point forward, we refer to one year after being designated for EL status as grade 1, two years after as grade 2, and so on. However, it is possible that a student was retained in a particular grade for a second year. Due to missingness in the grade level variable in our dataset, we cannot exactly estimate the frequency of this occurrence. The district reports a low level of retention overall, however, suggesting that it was quite infrequent.
[7] After 2016-17, California began implementing the English Language Proficiency Assessments for California (ELPAC) and discontinued the use of the CELDT.
[8] In Appendix Tables D1 and D2, we report results for when we consider an additional sample of students who took the initial CELDT assessment between grades 1 and 5. We privilege the kindergarten sample in our main analysis because students who enter the district and are assessed at kindergarten entry are more comparable to one another than students who enter the district in later grades. Of the students taking the initial CELDT assessment between kindergarten and grade 5, more than 75 percent were assessed during the kindergarten year. The focus on kindergarten CELDT takers is also consistent with other recent RD studies relying on the CELDT forcing variable (e.g. see Johnson, 2019; Shin, 2018; Umansky, 2016b).
[9] We exclude students that scored the minimum score overall or in the speaking or listening domains because the CELDT assessment simply gives these students the lowest raw score and does not differentiate between abilities at these levels. We also exclude students with missing outcome or covariate data. More details about the analytical sample can be found in Appendix A.
[10] California refers to students scoring above the cut score as Initially Fluent English Proficient (IFEP); in other contexts, the term "English-proficient" is more commonly used.
[11] A critical tradeoff in our sample construction was between the number of cohorts to include and the length of time for which we would observe their outcome. We chose this analytical sample in an effort to study the most relevant time window with the greatest statistical power.
[12] In OLS and RD results reported in Appendix Tables C4 and C5, we examine more cohorts of students across shorter periods of time, as well as fewer cohorts of students across longer periods of time.

[13] Appendix Table C6 reports a robustness check where we calculate 2SLS RD estimates when using being placed in SPED between kindergarten and grade 6 as the outcome. We observe slightly larger negative effects, but a pattern that is quite similar to our main results.
[14] Appendix Table B1 provides extended descriptive results about the main analytical sample for (a) students above and below the CELDT threshold; and (b) students classified as EL and English-proficient by the district.
[15] Appendix A describes our process for constructing the parental education variable.
[16] Since our data only provide the birth month and birth year of each student, we necessarily approximate student age at the initial CELDT assessment.
[17] Appendix Tables B2, B3, and B4 provide extended descriptive statistics about the subsamples by primary language for (a) students above and below the CELDT threshold; and (b) students classified as EL and English-proficient by the district.
[18] In order to conform to the RD structure required by the -rdrobust- command in Stata (which we rely on for implementing our analyses), binding scores needed to be transformed linearly in the following way: [(-1*$BindingScore_{isc}$) – 1]. Positive values denote the treatment group (students who scored below the English proficiency threshold) and the difference when subtracting their score from the cut score. Negative values denote the control group (students who scored above the English proficiency threshold) and the difference when subtracting their score from the cut score. We rely on this transformed binding score forcing variable for all manipulation tests and RD analyses (i.e., including first stage, reduced-form, and 2SLS analyses).
[19] While we examined models that incorporated quadratic splines of the forcing variable, the Akaike Information Criteria (AIC) indicated that linear specifications should be privileged. As a result, we principally report specifications with linear splines of the transformed forcing variable. We also explored allowing various higher order polynomial specifications of the transformed forcing variable. Appendix Figure C1 provides the visuals from these examinations, which tend to show a similar relation to what we observe using the linear specification of the forcing variable.
[20] Appendix Figures A1, A2 and A3 and Appendix Tables A1 and A2 provide evidence pertaining to the continuity of the forcing variable. Figure A1 presents raw histogram of the transformed forcing variable (see endnote 18) for full and CCT samples. Figure A2 shows results from the McCrary (2008) density test. Figure A3 illustrates results from the Cattaneo et al. (2018) density test. Table A1 provides the first stage analysis and Table A2 reports covariate balance across the threshold. The combined evidence does not suggest a violation of the continuity assumption. In addition to these checks, Appendix Figures A4, A5 and A6 provide first stage analyses at the relevant CCT optimal bandwidth, McCrary (2008) density tests and raw histograms for the forcing variable for each primary language subsample: Spanish, Mandarin/Cantonese, and all other languages. For these subsamples, we similarly observe no evidence of a discontinuity at the threshold.
[21] We also test the first stage relationship for three primary language subsamples (i.e., Spanish, Mandarin/Cantonese, and all other languages) and find quite consistent results across language groups. As shown in Appendix Figures A4, A5 and A6, we observe large and statistically significant jumps at the threshold (all greater than 0.7) with the first bin to the left of the threshold exhibiting the largest rate of non-compliance: a likelihood of EL classification between 0.1 and 0.2. The observed fuzziness is quite similar across subsamples.

[22] However, we know that reduced-form estimates may be of interest. Appendix Tables C1 and C2 present reduced-form estimates that parallel Tables 4 and 5 from the main analysis.

[23] Each language subgroup is only about one-third of the main analytical sample, which reduces the precision of our estimates.

[24] Appendix Table C3 provides grade-by-grade 2SLS RD results for the CCT bandwidth across the three primary language subgroups.

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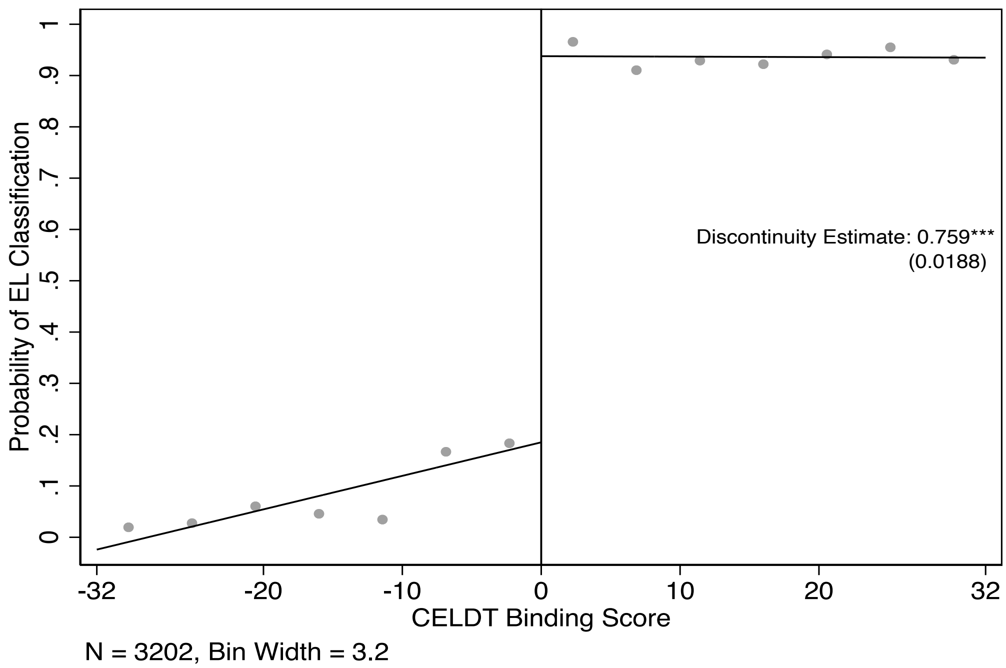
Figure 1. CELDT Cohort Data Visual

Kindergarten Cohort	*t=0*	*t=1*	*t=2*	*t=3*	*t=4*	*t=5*	*t=6*	*t=7*	*t=8*	*t=9*	*t=10*	*t=11*	*t=12*
2006-07	m	m	m	m	m	m	m	s	s	s	s	e	e
2007-08	m	m	m	m	m	m	m	s	s	s	s	e	
2008-09	m	m	m	m	m	m	m	s	s	s	s		
2009-10	m	m	m	m	m	m	m	s	s	s			
2010-11	m	m	m	m	m	m	m	s	s				
2011-12	m	m	m	m	m	m	m	s					
2012-13	m	m	m	m	m	m	m						
2013-14	s	s	s	s	s	s							
2014-15	s	s	s	s	s								
2015-16	s	s	s	s									
2016-17	e	e	e										
2017-18	e	e											
2018-19	e												

Notes: Student-level data for individuals who took their initial CELDT assessment in kindergarten are from CALPADS for SY 2006-07 through SY 2018-19. Our main analysis includes cohorts who took the initial assessment from SY 2006-07 through SY 2012-13, observed annually during the assessment year and the six subsequent years. Our supplemental analyses include cohorts who took the inital assessment from SY 2006-07 through SY 2015-16 observed in three to ten subsequent years. We exclude data from cohorts after SY 2015-16 cohorts and we exclude data after the 10th subsequent year for SY 2006-07 and SY 2007-08 cohorts. In the graphic above, "m" indicates that the data were used in the main analysis; "s" indicates that the data were used in supplemental analyses, and "e" indicates that the data were excluded.

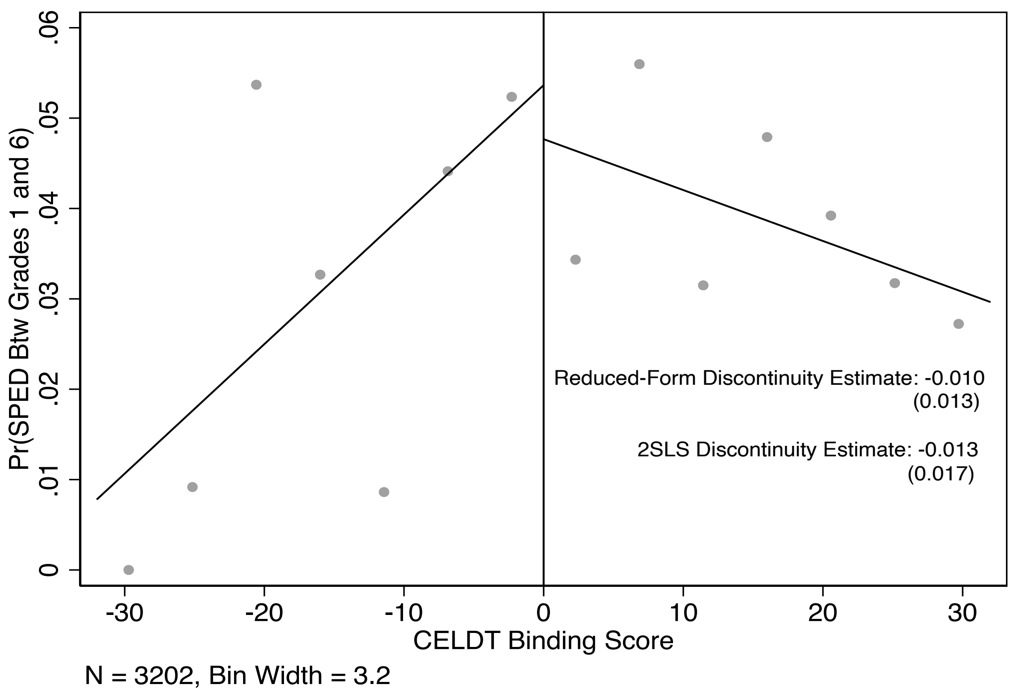
Figure 2. First-Stage: Probability of EL Classification by CELDT Binding Score, CCT Optimal Bandwidth



Notes: This figure depicts the probability of EL classification by the transformed CELDT Binding Score forcing variable for the CCT optimal bandwidth (+/- 32 points) analytical sample (N=3,202). Bin widths are 3.2 points. In order to conform to the RD structure required by -rdrobust-, binding scores were transformed linearly in the following way: [(-1*BindingScore_isc) – 1]. Positive values denote the treatment group (students who scored below the English proficiency threshold). Negative values denote the control group (students who scored above the English proficiency threshold). Each plotted point provides a binned average; a line of best fit is separately provided for data above and below the threshold. Discontinuity estimate is based on model that includes student covariates and cohort-school fixed effects.

*** p < 0.01 ** p < 0.05 * p < 0.1

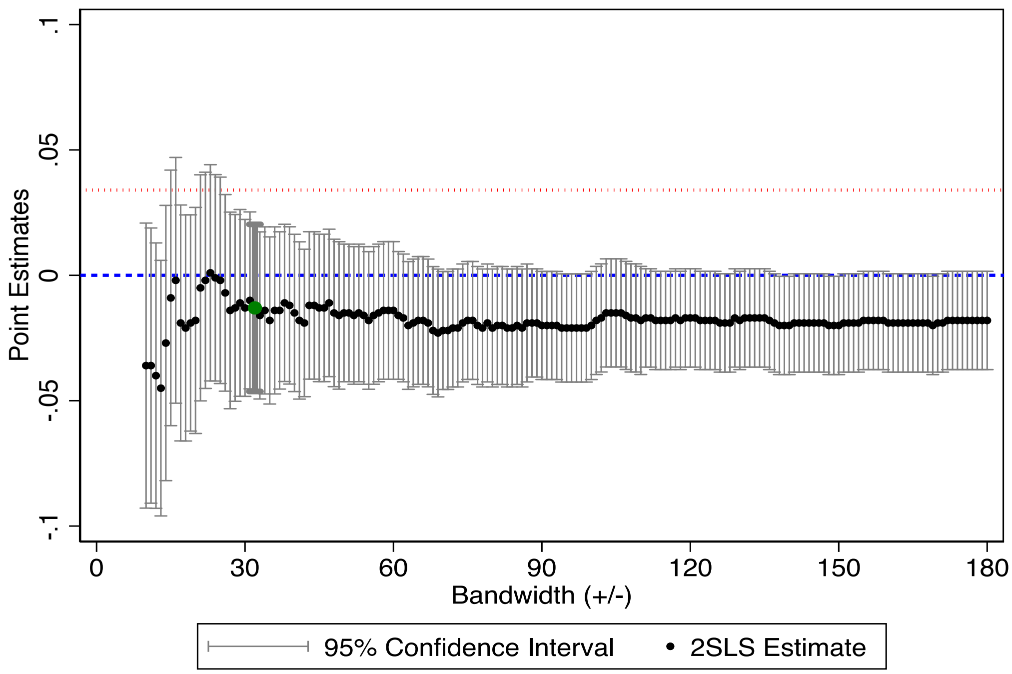
Figure 3. Probability of SPED Placement Between Grades 1 and 6 by Binding Score Forcing Variable, Reduced-Form and 2SLS Estimates.



Notes: This figure depicts the probability of being first placed in SPED between Grades 1 and 6 by the transformed CELDT Binding Score forcing variable for the CCT optimal bandwidth (+/- 32) analytical sample (N=3,202). Bin widths are 3.2 points. In order to conform to the RD structure required by -rdrobust-, binding scores were transformed linearly in the following way: [(-1*BindingScore_isc) – 1]. Positive values denote the treatment group (students who scored below the English proficiency threshold). Negative values denote the control group (students who scored above the English proficiency threshold). Each plotted point provides a binned average; a line of best fit is separately provided for data above and below the threshold. Discontinuity estimate is based on model that includes student covariates and cohort-school fixed effects.

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$

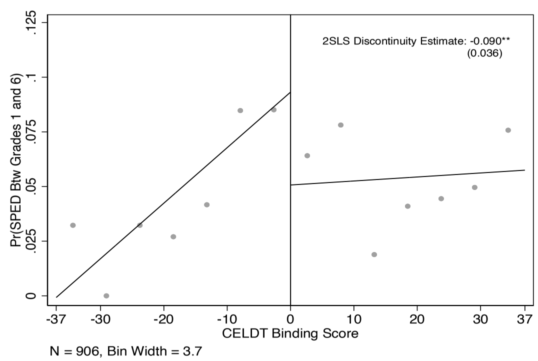
Figure 4. Sensitivity of Estimated 2SLS Estimates of EL Status on SPED Placement, Across Bandwidths.



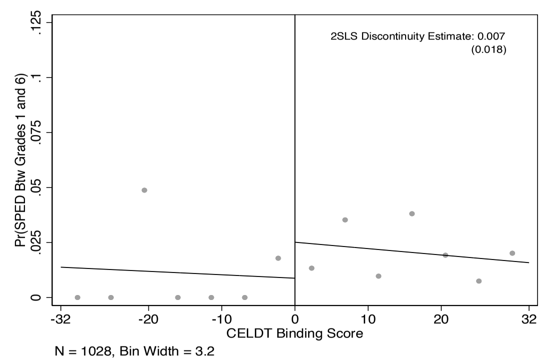
Notes: The dependent variable is a flag for being placed in SPED between Grades 1 and 6. All models are the 2SLS specification and include a linear spline of the transformed forcing variable (see endnote 18 for details), school-cohort fixed effects and the following student-level controls: an indicator for female; an indicator for the student's most educated parent being at least a HS graduate; an indicator for being Hispanic; an indicator for being Chinese; an indicator for declining to state race/ethnicity; and the student's age at initial assessment. We exclude point estimates for samples with bandwidths less than or equal to +/- 9. The 95 percent confidence interval around each estimate is also graphed. The blue line is 0 and the red dotted line is the full analytical sample OLS benchmark estimate of 0.034. The 2SLS estimate for the CCT optimal bandwidth (+/- 32) is shown in green. The confidence interval for the CCT optimal bandwidth is bolded.

Figure 5. Probability of SPED Placement Between Grades 1 and 6 by Binding Score Forcing Variable and Primary Language at the CCT Optimal Bandwidth, 2SLS Estimates.

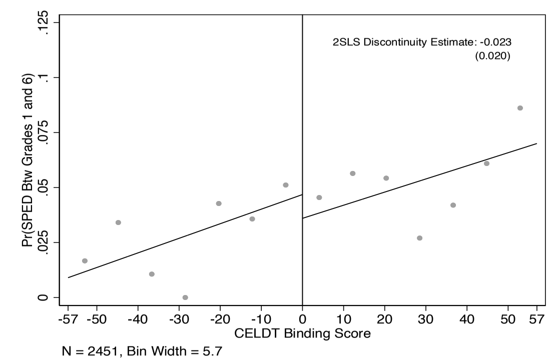
Primary Language: Spanish



Primary Language: Mandarin or Cantonese



Primary Language: Other



CCT Optimal Bandwidths

Notes: These figures illustrate the probability of first being placed in SPED between Grades 1 and 6 by the transformed CELDT Binding Score forcing variable. The CCT optimal bandwidths for analytical samples by primary language are used. The leftmost graph is for students with a primary language of Spanish (CCT optimal bandwidth: +/- 37; N=906; bin width: 3.7 points); the middle graph is for students with a primary language of Mandarin or Cantonese (CCT optimal bandwidth: +/- 32; N=1,028; bin width: 3.2 points); and the rightmost graph is for students with a different primary language (CCT optimal bandwidth: +/- 57; N=2,451; bin width: 5.7 points). In order to conform to the RD structure required by -rdrobust-, binding scores were transformed linearly in the following way: [(-1*BindingScore_isc) – 1]. Positive values denote the treatment group (students who scored below the English proficiency threshold). Negative values denote the control group (students who scored above the English proficiency threshold). Each plotted point provides a binned average; a line of best fit is separately provided for data above and below the threshold. Discontinuity estimate is based on model that includes student covariates and cohort-school fixed effects.

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$

Table 1. Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
Student Characteristics in Year of Initial Assessment				
Female	0.50	0.50	0	1
Hispanic	0.35	0.48	0	1
Chinese	0.38	0.48	0	1
Decline to State Race/Ethnicity	0.04	0.20	0	1
Parent's Highest Education Level ≥ High School Diploma	0.49	0.50	0	1
Age at Initial Assessment (approximation)	6.4	0.3	4.6	7.4
Primary Language: Spanish	0.32	0.47	0	1
Primary Language: Mandarin/Cantonese	0.36	0.48	0	1
Primary Language: Other	0.33	0.47	0	1
California English Language Development Test				
Binding Score	-56	52	-176	151
Centered Overall Scale Score	-55	52	-176	151
Centered Listening Scale Score	-18	56	-147	161
Centered Speaking Scale Score	3	60	-156	225
Binding Section: Overall	0.92	0.27	0	1
Binding Section: Listening	0.06	0.25	0	1
Binding Section: Listening	0.01	0.12	0	1
English Learner and Special Education				
Assigned EL by District	0.836	0.371	0	1
Eligible for EL (Binding Score < 0)	0.863	0.344	0	1
First Placed in SPED Between Grades 1 and 6	0.070	0.255	0	1
First Placed in SPED Between Grades 1 and 6 (if Binding Score < 0)	0.077	0.266	0	1
First Placed in SPED Between Grades 1 and 6 (if Binding Score ≥ 0)	0.028	0.166	0	1
First Placed in SPED in Grade 1	0.016	0.124	0	1
First Placed in SPED in Grade 2	0.012	0.111	0	1
First Placed in SPED in Grade 3	0.014	0.117	0	1
First Placed in SPED in Grade 4	0.012	0.109	0	1
First Placed in SPED in Grade 5	0.010	0.097	0	1
First Placed in SPED in Grade 6	0.006	0.079	0	1

Source: California Longitudinal Pupil Achievement Data System (CALPADS), SY 2006-07 through SY 2018-19.

Notes: The full sample includes students from this district who took the California English Language Development Test (CELDT) for the first time in Kindergarten between SY 2006-07 and SY 2012-13, had valid covariate and outcome data, and scored above the minimum score Overall and in Listening and Speaking domains (N=12,607). Excluded from the sample are students who took the initial CELDT assessment for the first time in 1st grade or later. The intent-to-treat group includes students who scored above the cutoff (N=10,880). The control group includes students who scored below the cutoff (N=1,727).

Table 2. OLS: Estimated Association Between EL Assignment and SPED Placement

	Dependent Variable: First Placed in SPED Between Grades 1 and 6		
Independent Variable:	(1)	(2)	(3)
Assigned EL by District	0.027***	0.023***	0.034***
	(0.0053)	(0.0055)	(0.0059)
Controls	no	yes	yes
School-Cohort FE	no	no	yes
R^2	0.002	0.026	0.077

Notes: Robust standard errors are in parentheses. Each model reports the OLS relationship between being Assigned EL by the District and placement in SPED between Grades 1 and 6. The analytical sample (N=12,607) includes students that took the CELDT initial assessment in kindergarten between SY 2006-07 and SY 2012-13, had covariate and outcome measures available, and scored above the minimum score Overall and in Listening and Speaking domains. The model in column (2) includes the following student-level controls: an indicator for female; an indicator for the student's most educated parent being at least a HS graduate; an indicator for being Hispanic; an indicator for being Chinese; an indicator for declining to state race/ethnicity; and the student's age at initial assessment (coefficients suppressed). The model in column (3) includes the same set of student-level controls and adds school-cohort fixed effects (coefficients suppressed). The OLS estimate in column (3) is used to compare to subsequent Regression Discontinuity estimates.

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$

Table 3. Reduced-Form and 2SLS Estimates of EL Eligibility and EL Status on SPED Placement, by Bandwidth

	Dependent Variable: First Placed in SPED Between Grades 1 and 6						
	Reduced-Form			2SLS			
Bandwidth Sample	(1)	(2)	(3)	(4)	(5)	(6)	N
2*CCT (+/- 64)	-0.012	-0.013	-0.015	-0.016	-0.017	-0.019	6,793
	(0.011)	(0.011)	(0.010)	(0.014)	(0.013)	(0.013)	
CCT (+/-32)	-0.006	-0.006	-0.01	-0.008	-0.008	-0.013	3,202
	(0.015)	(0.015)	(0.013)	(0.019)	(0.019)	(0.017)	
0.5*CCT (+/- 16)	-0.01	-0.01	-0.002	-0.015	-0.014	-0.002	1,534
	(0.022)	(0.022)	(0.017)	(0.031)	(0.031)	(0.025)	
Student-Level Controls	no	yes	yes	no	yes	yes	-
Cohort-School FE	no	no	yes	no	no	yes	-

Notes: Robust standard errors are in parentheses. All models include a linear spline of the transformed CELDT binding score forcing variable (see endnote 18 for details). Each cell represents a separate regression. The CCT optimal bandwidth is +/- 32. Columns (1) - (3) provide reduced-form estimates of the intent-to-treat (ITT) estimand. Columns (4) - (6) provide 2SLS estimates of the treatment on the treated (TOT) estimand. Models reported in columns (2), (3), (5), and (6) include the following student-level controls: an indicator for female; an indicator for the student's most educated parent being at least a HS graduate; an indicator for being Hispanic; an indicator for being Chinese; an indicator for declining to state race/ethnicity; and the student's age at initial assessment (coefficients suppressed). The models reported in columns (3) and (6) also include school-cohort fixed effects (coefficients suppressed). The point estimate for our preferred specification, model (6), is statisically different (p<0.01) from the OLS point estimate (i.e., from Table 2, column (3)) for all bandwidth samples.

*** p < 0.01 ** p < 0.05 * p < 0.1

Table 4. 2SLS Estimates of EL Status on Other SPED Placement Outcomes, by Bandwidth

	Dependent Variable: First Placed in SPED in							
	Grades 1 through 6	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	
Bandwidth Sample	(1)	(2)	(3)	(4)	(5)	(6)	(7)	N
2*CCT (+/- 64)	-0.019	-0.004	0.010	0.004	0.003	-0.009*	-0.002	6,793
	(0.013)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)	
CCT (+/-32)	-0.013	-0.000	-0.013	0.012	0.008	-0.012*	-0.008	3,202
	(0.017)	(0.006)	(0.008)	(0.008)	(0.006)	(0.007)	(0.007)	
0.5*CCT (+/- 16)	-0.002	-0.005	-0.004	0.001	0.007	-0.000	0.002	1,534
	(0.025)	(0.008)	(0.012)	(0.011)	(0.009)	(0.011)	(0.011)	

Notes: Robust standard errors are in parentheses. Each cell represents a separate regression. The +/- 32 bandwidth is the CCT optimal bandwidth. All models provide 2SLS estimates of the treatment on the treated (TOT) estimand and include a linear spline of the transformed forcing variable (see endnote 18 for details), student-level controls and school-cohort fixed effects (coefficients suppressed). The student-level controls include the following: an indicator for female; an indicator for the student's most educated parent being at least a HS graduate; an indicator for being Hispanic; an indicator for being Chinese; an indicator for declining to state race/ethnicity; and the student's age at initial assessment.

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$

Table 5. 2SLS Estimates of EL Status on SPED Placement, by Bandwidth and Primary Language

	Dependent Variable: First Placed in SPED Between Grades 1 and 6					
	Spanish		Mandarin or Cantonese		All Other Languages	
Bandwidth Sample	(1)	N	(2)	N	(3)	N
2*CCT	-0.045	2,185	0.008	2,296	-0.010	3,826
	(0.029)		(0.014)		(0.016)	
CCT	-0.090**	906	0.007	1,028	-0.023	2,451
	(0.036)		(0.018)		(0.020)	
0.5*CCT	-0.017	411	0.007	471	-0.010	1,239
	(0.043)		(0.028)		(0.029)	

Notes: Robust standard errors are in parentheses. Each cell represents a separate regression. The CCT optimal bandwidth for the Spanish-speaking sample is +/- 37; for the Mandarin- or Cantonese-speaking sample is +/- 32; and for the sample of all other languages is +/- 57. All models provide 2SLS estimates of the treatment on the treated (TOT) estimand and include a linear spline of the transformed forcing variable (see endnote 18 for details), student-level controls and school-cohort fixed effects (coefficients suppressed). The student-level controls include the following: an indicator for female; an indicator for the student's most educated parent being at least a HS graduate; an indicator for being Hispanic; an indicator for being Chinese; an indicator for declining to state race/ethnicity; and the student's age at initial assessment. The mean SPED placement rate between Grades 1 and 6 after the initial CELDT assessment for key subgroups are as follows: 0.108 for Spanish speakers overall; 0.114 for Spanish speakers scoring below the threshold; 0.048 for Spanish speakers score above the threshold; 0.037 for Cantonese or Mandarin speakers overall; 0.040 for Cantonese or Mandarin speakers below the threshold; 0.008 for Cantonese or Mandarin speakers above the threshld; 0.070 for speakers of all other languages overall; 0.082 for speakers of all other languages below the threshold; and 0.029 for speakers of all other langauges above the threshold.

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$

Appendix A. Regression Discontinuity Design Validity Checks

While the regression discontinuity (RD) design relies on fewer assumptions than most other quasi-experimental research designs, it is critical to thoroughly interrogate the validity of the assumptions that underpin this approach. We provide evidence for the validity of the RD design, which offers support for interpreting the estimates as credibly causal.

Figures A1-A3 all provide graphical evidence pertaining to assessing the continuity of our underlying binding score forcing variable for the full analytical sample. The RD design turns on the idea that students just to the right and the left side of the cut score are highly similar in expectation except for their position relative to the cut score. If students' scores were manipulated precisely (for example, if the students were rated by teachers who knew the cut score, and teachers were scoring some students higher or lower just to push them above/below the cut score), then students just to the right and left of the cut score may not be comparable. Such a finding would indicate that the RD design would likely not be an appropriate empirical approach for this context. We therefore check the density of the assessment scores for any evidence of score manipulation.

Figure A1 presents two histograms of the transformed binding score forcing variable (see endnote 18 for details). Using a bin width of 10 points, Panel A depicts the density of the forcing variable for the full sample. Panel B presents the density of the forcing variable using a bin width of 2 points for the CCT optimal bandwidth sample, +/- 32 points from the cutoff. Visual inspections of both histograms do not suggest manipulation (i.e., heaping) of the forcing variables at the cut score.

Figure A2 presents visual results from two iterations of the McCrary (2008) density test. These statistical tests look to identify evidence of discontinuities in the density of the forcing variable at the threshold. Panel A offers the results when using the full sample and a bin width of 10 points. For this test, the discontinuity estimate reported is -0.037 with a standard error of (0.071). This result is not statistically significant, and the corresponding visual suggests smoothness through the threshold. Panel B reports results when using the full sample and a bin width of 2 points. Again, our discontinuity estimate is not statistically significant. The point estimate is 0.006 and the standard error is (0.070). A visual inspection of the graph again shows no evidence of a jump at the threshold. These tests provide no evidence of a discontinuity in the forcing variable at the cut score.

Figure A3 presents graphical results for the Cattaneo et al. (2018) test for manipulation at the threshold. Here, we again don't see clear evidence of a discontinuity, though the robust p-value reported is closer to marginally significant (p=0.144). A key component of this density test is the use of the CCT optimal bandwidth, which may partially explain why the results appear somewhat different from the McCrary (2008) density test. Overall, based on the results from Figures A1-A3, we find no clear evidence that suggests our continuity assumption is invalid.

Having interrogated the density of the forcing variable, we proceed to several additional checks on the validity of our RD design and report the findings in Tables A1 and A2. First, we test that the forcing variable, the transformed CELDT binding score, was used to determine treatment status. Table A1 presents the estimates for the first stage, or the estimated effect of English Learner (EL) eligibility (i.e., scoring below the CELDT cut score) on being assigned EL status by the district. With statistically-significant point estimates of 0.75 across models, we conclude that the first stage is strong and that EL eligibility significantly induced EL assignment.

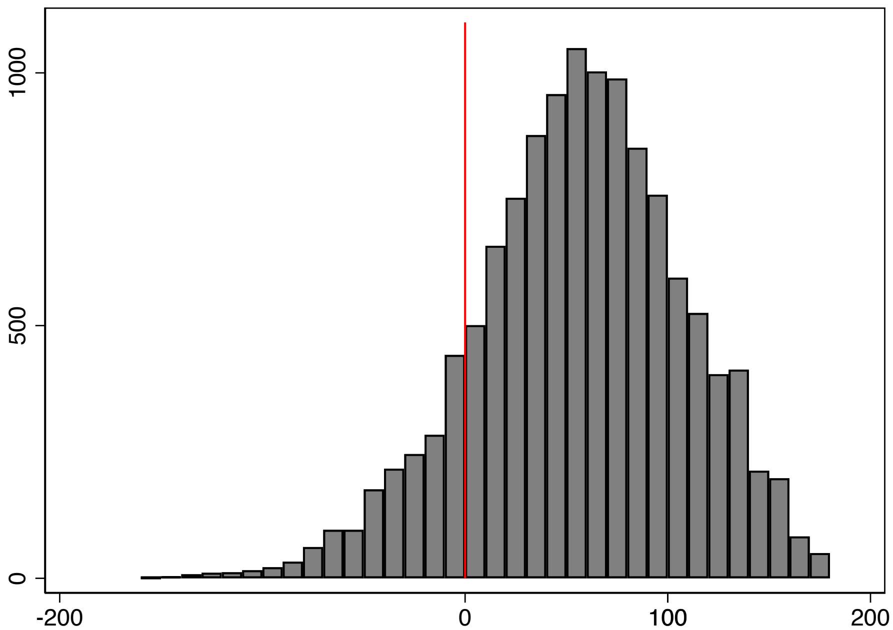
Table A2 provides an additional check on our continuity assumption by interrogating the pretreatment covariates in our sample. If the threshold cannot be precisely manipulated, we expect that the density of our covariates through the threshold would be smooth. In particular, we employ a two-step process for evaluating whether our covariates appear to be unbalanced across the threshold. First, we regress our "first placed in SPED between grades 1 and 6" outcome variable on our set of student-level controls. Then we obtain the predicted values, $\hat{Y}$, from this regression. In the second stage, we regress $\hat{Y}$ on the "first placed in SPED between grades 1 and 6" outcome variable and a linear spline of the forcing variable. We retain school-cohort fixed effects in each step. Table A2 presents the resulting evidence for the continuity of covariate balance across the cutoff. Findings are presented for the same set of selected bandwidth samples reported in Tables 3-5 of the main analysis. A statistically-significant result would indicate imbalance of our baseline covariates. However, across all bandwidths, we do not observe statistically significant results. Therefore, we do not find evidence of covariate imbalance at the threshold for any of the bandwidth samples reported.

Since the analytical sample is comprised of ELs who indicate Spanish, Mandarin, Cantonese, and other non-English languages as their primary language, we further interrogate the density of the forcing variable around the cut score for subsamples based on students' primary language. Figures A4-A6 each provides the histogram, McCrary density test, and first-stage estimates for one of the primary language groups (A4 for ELs with a primary language of Spanish; A5 for ELs with a primary language of Mandarin or Cantonese; and A6 for speakers of other languages). We find no evidence of density heaping around the cut sore for any of the primary language subsamples.

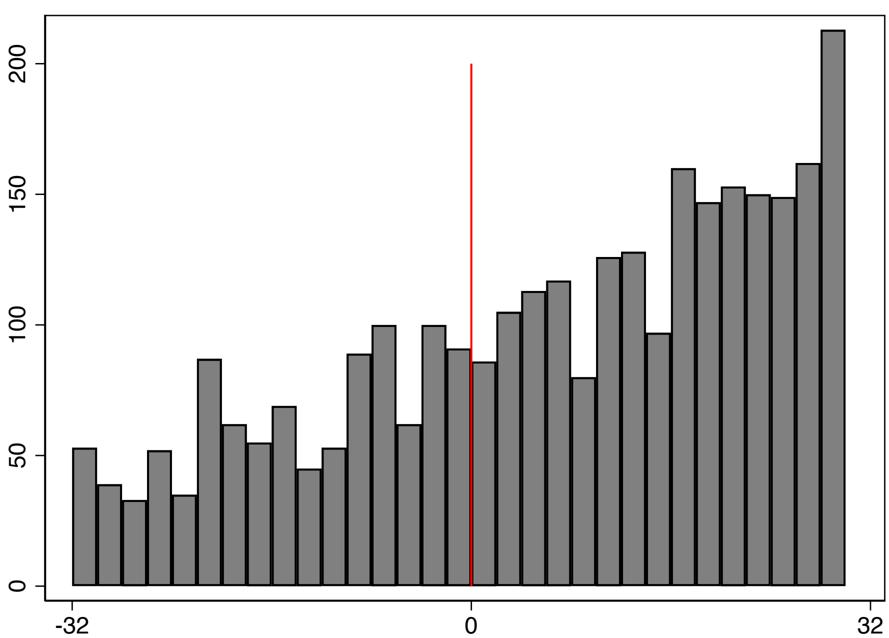
We conduct two more checks to interrogate if students around the English proficiency cut score are similar and comparable. Table A3 provides results from examining attrition at the margin of the English-proficient cut score. Attrition is defined as having left the district, or not being observed in the administrative data, in one or more grades between 1 and 6. For the timing of attrition, we flag the first time a student leaves the district after kindergarten, even if the student returns to the district in a later grade. For example, if a student is observed in grades kindergarten and 1, not observed in grade 2, and observed again in grades 3-6, we flag the student as having left the district between grades 1 and 6 and more specifically, left the district during grade 2. For columns (1) to (7), each column's header is the dependent variable for the analyses in that column. The bandwidth used for each row is provided on the left, and the sample size on the far right. Estimates are main effects from the RD model with linear splines of the forcing variable and should be interpreted as the difference in attrition rates between students below the English proficiency cut score and students above the cut score. The attrition rate for the control group (students above the cut score) is listed below the standard errors for the point estimates. Here, we observe some significant or marginally-significant evidence of differences across the cutoff, but nothing that stands out as consistently concerning.

Our CALPADS data include annual assessment and SPED placement data for 16,900 kindergarten students who took the initial CELDT between 2006-07 and 2012-13. We exclude 3,773 students (i.e., between 387 and 713 students each year) who received the lowest obtainable CELDT score on the overall scale, listening domain, or speaking domain. For students who reported a parent's education level for at least one year, we replace the missing values in any of the other years using the modal education level. Then, we generate a "parent high school graduate" indicator that equals 1 if either the father or the mother graduated from high school and 0 if neither parent graduated. Of our remaining sample of 13,126 students, a total of 520 students had missing values for this “parent high school graduate” variable because they did not report any parent’s education level in any year. We exclude these students from the analytical sample after two checks. First, we test the balance of this variable’s missingness across the threshold by applying our linear RD specification. The probability of missingness for the “parent high school graduate” variable was balanced at the CELDT threshold, represented by the small and statistically non-significant estimate. Then, we run our OLS and two-stage least squares (2SLS) RD models with and without these 520 students and compare the results. As reported in Table A4, our OLS estimates are similar with and without the inclusion of students with the missing parent education covariate. We also observe very similar 2SLS RD estimates with and without the missing students for the full sample and at the +/- 32 bandwidth. These findings provide some reassurance that the exclusion of these students from the sample does not alter our main findings.

Appendix Figure A1. Histograms of the Forcing Variable



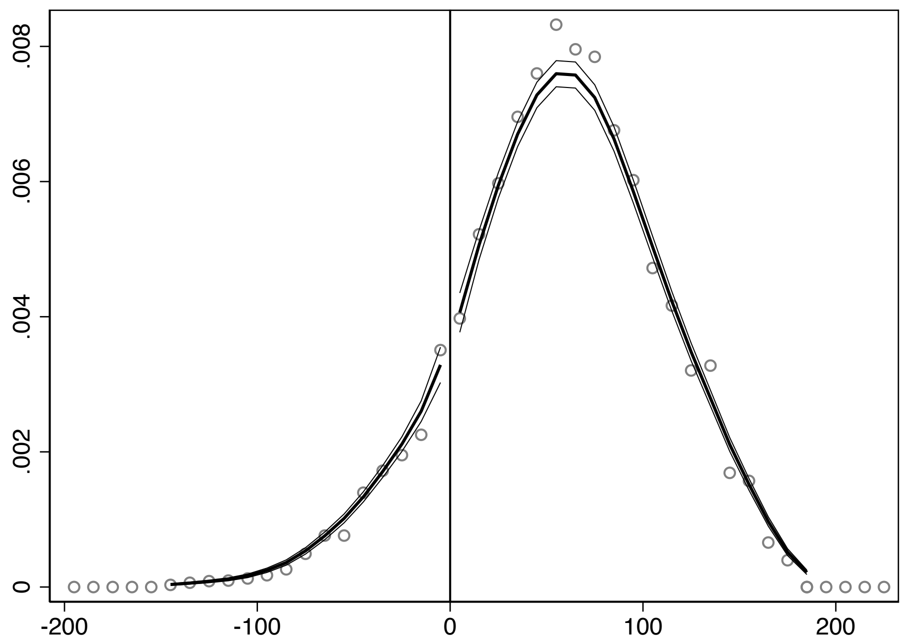
Panel A. Full Sample



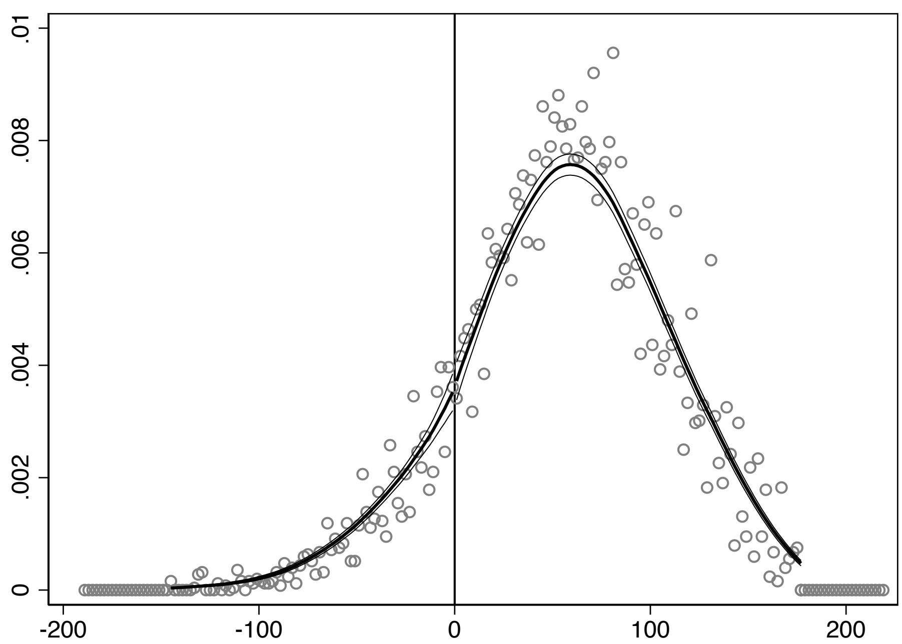
Panel B. CCT Optimal Bandwidth Sample

Notes: The full analytical sample presented in Panel A includes students who took the CELDT for the first time in kindergarten between SY 2006-07 and SY 2012-13, had valid covariate and outcome data, and scored above the minimum score Overall and in Listening and Speaking Domains (N=12,607). Panel A graphs frequencies using bin widths of 10 of the transformed CELDT binding score forcing variable (see endnote 18 for details). The CCT optimal bandwidth analytical sample presented in Panel B includes students who received a binding score between -32 and 32 (N=3,202). Panel B graphs frequencies using bin widths of 2.

Appendix Figure A2. McCrary (2008) Density Tests



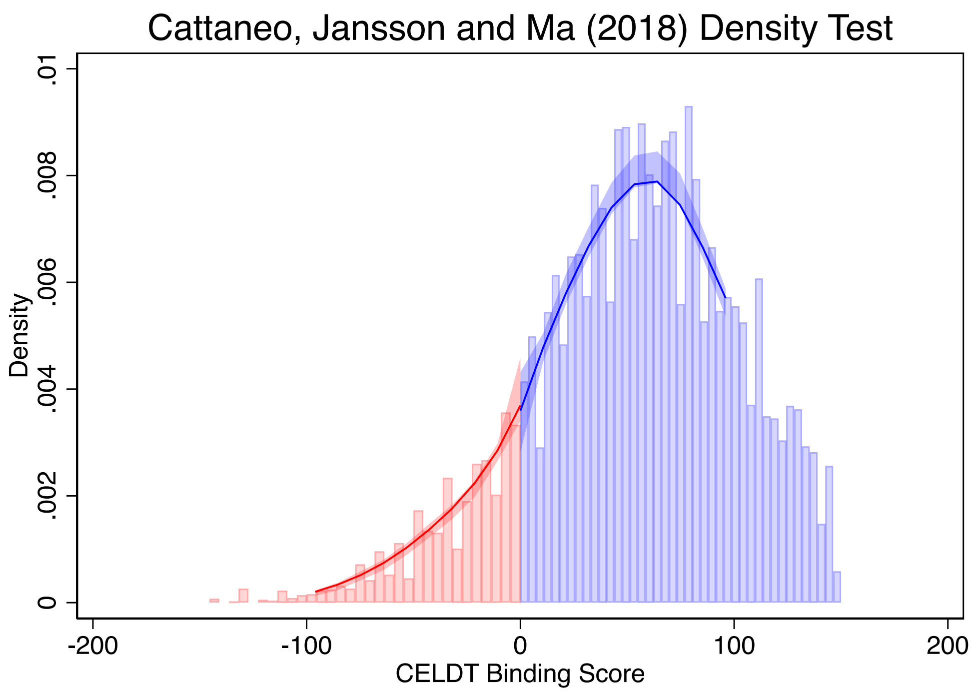
Panel A: Full Sample, Bin Width of 10



Panel B: Full Sample, Bin Width of 2

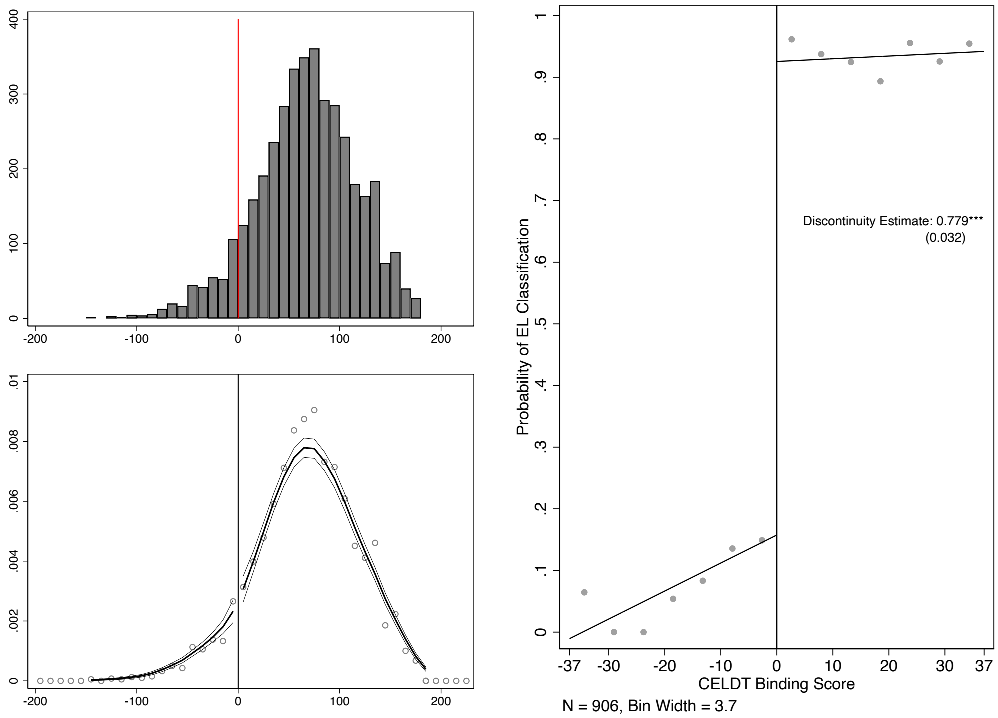
Notes: Panel A provides graphical results of the McCrary (2008) test for forcing variable manipulation using bin widths of 10 for the transformed CELDT binding score (see endnote 18 for details). For this panel, the discontinuity estimate is not statistically significant, with a point estimate of -0.037 with a standard error of 0.071. Panel B provides graphical results of the McCrary (2008) test for forcing variable manipulation using bin widths of 2. For this panel, the discontinuity estimate is not statistically significant, with a point estimate of 0.006 and a standard error of 0.070.

Appendix Figure A3. Cattaneo, Jansson and Ma (2018) Density Test



Notes: These graphical results are for the Cattaneo, Jansson and Ma (2018) manipulation test at the threshold for the transformed CELDT binding score (see endnote 18 for details). The p-value of the robust discontinuity estimate is 0.1441 for the +/- 32 bandwidth, indicating that we fail to reject the null hypothesis (α=0.05) that the forcing variable is continuous through the threshold.

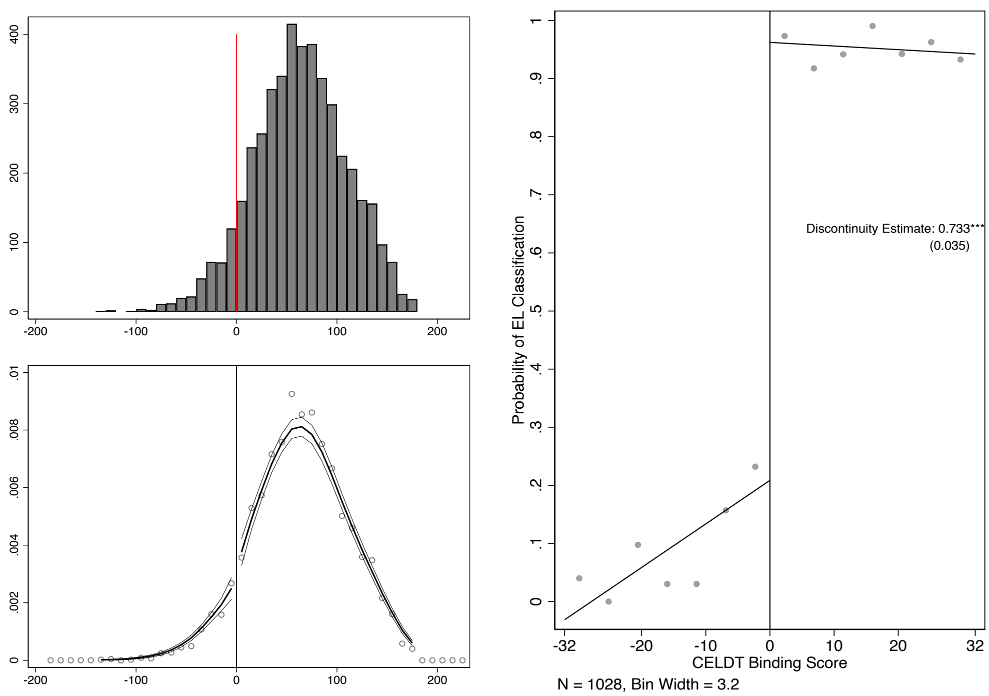
Appendix Figure A4. Histogram, McCrary Density Test, and First Stage for the Students Whose Primary Language was Spanish



Notes: The analytical sample includes students whose primary language was Spanish, who took the CELDT for the first time in kindergarten between SY 2006-07 and SY 2012-13, had valid covariate and outcome data and scored above the minimum score Overall and in Listening and Speaking Domains (N=3,990). The upper left panel shows the raw frequency of the transformed CELDT binding score (see endnote 18 for details) with bin widths of 10. The lower left panel provides the McCrary density test visual for this subsample also using bin widths of 10 of the transformed CELDT binding score. For this panel, the discontinuity estimate is not statistically significant, with a point estimate of 0.004 and a standard error of 0.138. The right hand panel shows the first stage for the CCT optimal bandwidth sample (+/- 37; N=906) using the tranformed CELDT binding score.

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$

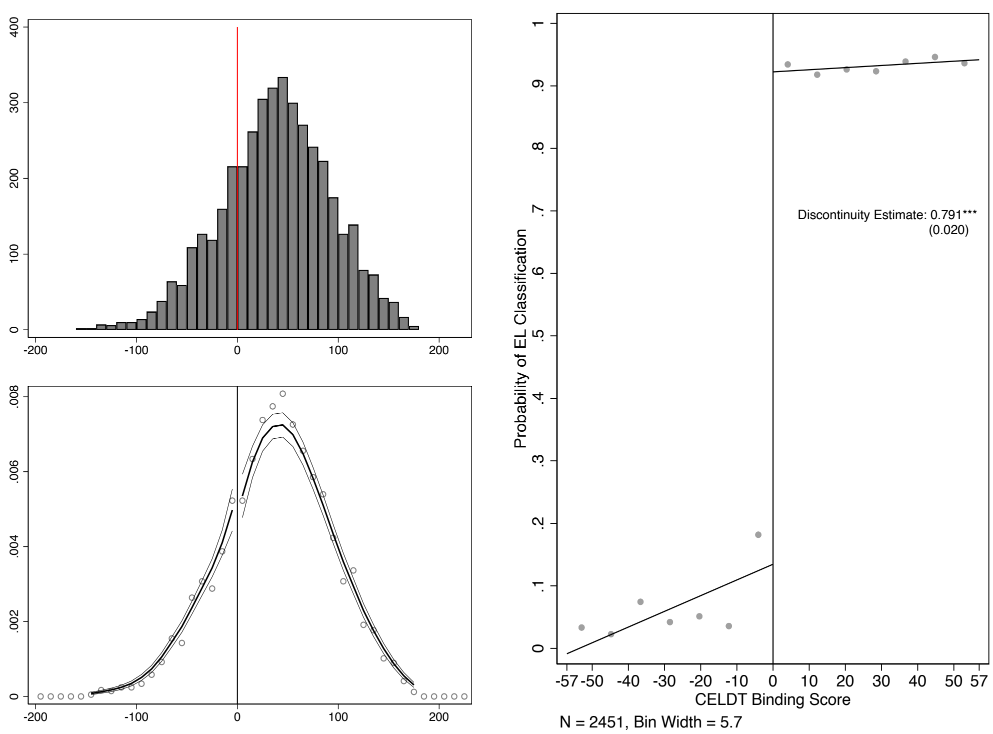
Appendix Figure A5. Histogram, McCrary Density Test, and First Stage for the Students Whose Primary Language was Cantonese or Mandarin



Notes: The analytical sample includes students whose primary language was Cantonese or Mandarin, who took the CELDT for the first time in kindergarten between SY 2006-07 and SY 2012-13, had valid covariate and outcome data and scored above the minimum score Overall and in Listening and Speaking Domains (N=4,483). The upper left panel shows the raw frequency of the transformed CELDT binding score (see endnote 18 for details) with bin widths of 10. The lower left panel provides the McCrary density test visual for this subsample also using bin widths of 10 of the transformed CELDT binding score. For this panel, the discontinuity estimate is not statistically significant, with a point estimate of 0.121 and a standard error of 0.130. The right hand panel shows the first stage for the CCT optimal bandwidth sample (+/- 32; N=1,028) using the tranformed CELDT binding score.

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$

Appendix Figure A6. Histogram, McCrary Density Test, and First Stage for the Students Whose Primary Language was a Different Language



Notes: The analytical sample includes students whose primary language was a different language (i.e., not English, Spanish, Cantonese or Mandarin), who took the CELDT for the first time in kindergarten between SY 2006-07 and SY 2012-13, had valid covariate and outcome data and scored above the minimum score Overall and in Listening and Speaking Domains (N=4,134). The upper left panel shows the raw frequency of the transformed CELDT binding score (see endnote 18 for details) with bin widths of 10. The lower left panel provides the McCrary density test visual for this subsample also using bin widths of 10 of the transformed CELDT binding score. For this panel, the discontinuity estimate is not statistically significant, with a point estimate of -0.133 and a standard error of 0.103. The right hand panel shows the first stage for the CCT optimal bandwidth sample (+/- 57; N=2,451) using the transformed CELDT binding score.

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$

Appendix Table A1. First-Stage Estimates of EL Eligibility on Being Assigned EL by District, CCT Bandwidth Sample

	Dependent Variable: Assigned EL by District		
Independent Variable:	(1)	(2)	(3)
I($BindingScore_i$ < 0)	0.753***	0.756***	0.759***
	(0.0223)	(0.0222)	(0.0188)
N	3,202	3,202	3,202
Controls	no	yes	yes
School-Cohort FE	no	no	yes

Notes: Robust standard errors are in parentheses. Each coefficient represents the results from a separate regression discontinuity model of the effect of the intent-to-treat on treatment status. Results are reported for the CCT optimal bandwidth (+/- 32 points). In order to conform to the RD structure required by the Stata command -rdrobust-, binding scores were transformed linearly in the following way: [(-1*BindingScore_isc) – 1]. Positive values denote the treatment group (students who scored below the English proficiency threshold). Negative values denote the control group (students who scored above the English proficiency threshold).

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$

Appendix Table A2. Auxiliary RD Estimates of Baseline Covariate Balance, by Bandwidth

	Dependent Variable: $\hat{Y}$ (First Placed in SPED Between Grades 1 and 6)	
Bandwidth Sample	(1)	N
2*CCT (+/- 64)	0.0019	6,793
	(0.0014)	
CCT (+/- 32)	-0.0003	3,202
	(0.0014)	
0.5*CCT (+/- 16)	-0.0030	1,534
	(0.0022)	

Notes : Robust standard errors are in parentheses. Each cell shows the estimate from a two-stage regression. In the first stage, the "First Placed in SPED Between Grades 1 and 6" indicator is regressed on all baseline covariates and a predicted index is generated. In the second stage, the predicted index is regressed on the "First Placed in SPED Between Grades 1 and 6" indicator and a linear spline of the transformed CELDT binding score forcing variable (see endnote 18 for details). The +/- 32 bandwidth is the CCT optimal bandwidth. School-cohort fixed effects are included in each step of each model.

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$

Appendix Table A3. 2SLS Estimates of EL Status on Leaving the District for First Time, by Bandwidth

	Dependent Variable: Leaving the District for First Time							
	Between Grades 1 and 6	During Grade 1	During Grade 2	During Grade 3	During Grade 4	During Grade 5	During Grade 6	
Overall Mean (full sample):	0.198	0.003	0.011	0.021	0.040	0.044	0.079	
Bandwidth Sample	(1)	(2)	(3)	(4)	(5)	(6)	(7)	N
2*CCT (+/- 64)	0.021	0.004*	0.008	-0.002	-0.018	-0.02	0.048***	6,793
	(0.027)	(0.002)	(0.007)	(0.010)	(0.015)	(0.015)	(0.018)	
Control Group Mean	0.268	0.001	0.010	0.031	0.064	0.067	0.095	
CCT (+/- 32)	0.027	0.007**	0.01	0.007	0.001	-0.018	0.02	3,202
	(0.036)	(0.003)	(0.009)	(0.014)	(0.020)	(0.021)	(0.025)	
Control Group Mean	0.261	0.000	0.011	0.031	0.063	0.068	0.088	
0.5*CCT (+/- 16)	0.078	0.006*	0.049***	-0.007	0.017	-0.037	0.05	1,534
	(0.052)	(0.003)	(0.013)	(0.020)	(0.029)	(0.030)	(0.036)	
Control Group Mean	0.255	0.000	0.013	0.028	0.066	0.064	0.084	

Notes: Robust standard errors are in parentheses. Each cell represents a separate regression. The +/- 32 bandwidth is the CCT optimal bandwidth. All models are the 2SLS specification and include a linear spline of the transformed forcing variable (see endnote 18 for details), student-level controls and school-cohort fixed effects (coefficients suppressed). The student-level controls include the following: an indicator for female; an indicator for the student's most educated parent being at least a HS graduate; an indicator for being Hispanic; an indicator for being Chinese; an indicator for declining to state race/ethnicity; and the student's age at initial assessment. The "control group mean" is the rate of leaving the district among students who were classified as English Proficient.

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$

Appendix Table A4. Comparing Results Across Specifications to Assess Impact of Missingness

	Dependent Variable: First Placed in SPED Between Grade 1 and Grade 6					
	OLS Full Sample		2SLS Full Sample		2SLS CCT (+/- 32)	
Sample	(1)	(2)	(3)	(4)	(5)	(6)
OLS Estimate	0.027***	0.027***	-	-	-	-
	(0.005)	(0.005)				
RD Estimate	-	-	-0.024**	-0.024**	-0.005	-0.008
			(0.010)	(0.010)	(0.019)	(0.019)
Includes Students with Missing Covariate Data?	yes	no	yes	no	yes	no
N	13,127	12,607	13,127	12,607	3,346	3,202

Notes: Robust standard errors are in parentheses. Each coefficient represents the results from a separate model. Column (1) reports OLS results for the full analytical sample plus the 520 students with missing covariate data. Column (2) reports OLS results for the full sample. Column (3) reports 2SLS RD results without controls for the full sample plus the 520 students with missing covariate data. Column (4) reports 2SLS RD estimates without controls for the full sample. Column (5) reports 2SLS RD results without controls for the CCT optimal bandwidth sample (+/- 32) plus 144 students with missing covariate data who fall in that range. Column (6) reports 2SLS RD results without controls for the CCT optimal bandwidth sample. All RD specifications include a linear spline of the transformed forcing variable (see endnote 18 for details).

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$

Appendix B: Raw Special Education Placement Rates by CELDT and EL Status

Although the RD design supports estimation of the causal effects around the cut score with high internal validity, the findings may not generalize well to other parts of the forcing variable distribution (in this study, along the CELDT binding score continuum). To address this limitation, we provide descriptive findings using data for students in our sample across the CELDT score distribution. In each analysis, we calculate the unconditional special education placement rates for four groups of students: (a) students scoring below the CELDT cutoff; (b) students scoring above the CELDT cutoff; (c) students classified as ELs by the district; and (d) students classified as English-proficient by the district. The results are reported in Tables B1-B4. Table B1 presents unconditional special education placement rates for the full analytical sample. Tables B2-B4 presents analogous results for subsamples by primary language.

Appendix Table B1. SPED Placement Rates by CELDT Cutoff and EL Status

Variable	Mean	Std. Dev.	Min	Max
Special Education Placement Rates for Students Scoring Below Cutoff (N=10,880)				
First Placed in SPED Between Grades 1 and 6	0.077	0.266	0	1
First Placed in SPED in Grade 1	0.017	0.131	0	1
First Placed in SPED in Grade 2	0.013	0.115	0	1
First Placed in SPED in Grade 3	0.015	0.122	0	1
First Placed in SPED in Grade 4	0.014	0.116	0	1
First Placed in SPED in Grade 5	0.010	0.101	0	1
First Placed in SPED in Grade 6	0.007	0.083	0	1
Special Education Placement Rates for Students Score Above Cutoff (N=1727)				
First Placed in SPED Between Grades 1 and 6	0.028	0.166	0	1
First Placed in SPED in Grade 1	0.004	0.064	0	1
First Placed in SPED in Grade 2	0.007	0.083	0	1
First Placed in SPED in Grade 3	0.007	0.083	0	1
First Placed in SPED in Grade 4	0.003	0.054	0	1
First Placed in SPED in Grade 5	0.005	0.068	0	1
First Placed in SPED in Grade 6	0.003	0.054	0	1
Special Education Placement Rates for Students Classified as EL (N=10,535)				
First Placed in SPED Between Grades 1 and 6	0.074	0.262	0	1
First Placed in SPED in Grade 1	0.016	0.126	0	1
First Placed in SPED in Grade 2	0.013	0.114	0	1
First Placed in SPED in Grade 3	0.015	0.123	0	1
First Placed in SPED in Grade 4	0.013	0.115	0	1
First Placed in SPED in Grade 5	0.010	0.100	0	1
First Placed in SPED in Grade 6	0.006	0.080	0	1
Special Education Placement Rates for Students Classified as English-Proficient (N=2072)				
First Placed in SPED Between Grades 1 and 6	0.048	0.213	0	1
First Placed in SPED in Grade 1	0.014	0.115	0	1
First Placed in SPED in Grade 2	0.009	0.095	0	1
First Placed in SPED in Grade 3	0.007	0.085	0	1
First Placed in SPED in Grade 4	0.006	0.076	0	1
First Placed in SPED in Grade 5	0.006	0.079	0	1
First Placed in SPED in Grade 6	0.006	0.076	0	1

Source: California Longitudinal Pupil Achievement Data System (CALPADS), SY 2006-07 through SY 2018-19.

Notes: The full sample includes students from this district who took the California English Language Development Test (CELDT) for the first time in Kindergarten between SY 2006-07 and SY 2012-13, had valid covariate and outcome data, and scored above the minimum score Overall and in Listening and Speaking domains (N=12,607). Excluded from the sample are students who took the initial CELDT assessment for the first time in 1st grade or later. The intent-to-treat group includes students who scored below the cutoff (N=10,880). The control group includes students who scored above the cutoff (N=1,727).

Appendix Table B2. SPED Placement Rates by CELDT Cutoff and EL Status (Primary Language: Spanish)

Variable	Mean	Std. Dev.	Min	Max
Special Education Placement Rates for Students Scoring Below Cutoff (N=3617)				
First Placed in SPED Between Grades 1 and 6	0.114	0.317	0	1
First Placed in SPED in Grade 1	0.022	0.146	0	1
First Placed in SPED in Grade 2	0.020	0.141	0	1
First Placed in SPED in Grade 3	0.021	0.144	0	1
First Placed in SPED in Grade 4	0.022	0.147	0	1
First Placed in SPED in Grade 5	0.016	0.127	0	1
First Placed in SPED in Grade 6	0.012	0.108	0	1
Special Education Placement Rates for Students Score Above Cutoff (N=373)				
First Placed in SPED Between Grades 1 and 6	0.048	0.215	0	1
First Placed in SPED in Grade 1	0.011	0.103	0	1
First Placed in SPED in Grade 2	0.008	0.089	0	1
First Placed in SPED in Grade 3	0.013	0.115	0	1
First Placed in SPED in Grade 4	0.003	0.052	0	1
First Placed in SPED in Grade 5	0.005	0.073	0	1
First Placed in SPED in Grade 6	0.008	0.089	0	1
Special Education Placement Rates for Students Classified as EL (N=3598)				
First Placed in SPED Between Grades 1 and 6	0.114	0.317	0	1
First Placed in SPED in Grade 1	0.021	0.144	0	1
First Placed in SPED in Grade 2	0.021	0.142	0	1
First Placed in SPED in Grade 3	0.021	0.145	0	1
First Placed in SPED in Grade 4	0.022	0.147	0	1
First Placed in SPED in Grade 5	0.016	0.127	0	1
First Placed in SPED in Grade 6	0.012	0.109	0	1
Special Education Placement Rates for Students Classified as English-Proficient (N=392)				
First Placed in SPED Between Grades 1 and 6	0.051	0.220	0	1
First Placed in SPED in Grade 1	0.018	0.133	0	1
First Placed in SPED in Grade 2	0.005	0.071	0	1
First Placed in SPED in Grade 3	0.013	0.112	0	1
First Placed in SPED in Grade 4	0.003	0.051	0	1
First Placed in SPED in Grade 5	0.005	0.071	0	1
First Placed in SPED in Grade 6	0.008	0.087	0	1

Source: California Longitudinal Pupil Achievement Data System (CALPADS), SY 2006-07 through SY 2018-19.

Notes: This sample includes students from this district who indicated Spanish as their primary language, took the California English Language Development Test (CELDT) for the first time in Kindergarten between SY 2006-07 and SY 2012-13, had valid covariate and outcome data, and scored above the minimum score Overall and in Listening and Speaking domains (N=3,990). Excluded from the sample are students who took the initial CELDT assessment for the first time in 1st grade or later. The intent-to-treat group includes students who indicated Spanish as their primary language and who scored below the cutoff (N=3,617). The control group includes students who indicated Spanish as their primary language and who scored above the cutoff (N=373).

Appendix Table B3. SPED Placement Rates by CELDT Cutoff and EL Status (Primary Language: Mandarin or Cantonese)

Variable	Mean	Std. Dev.	Min	Max
Special Education Placement Rates for Students Scoring Below Cutoff (N=4096)				
First Placed in SPED Between Grades 1 and 6	0.040	0.195	0	1
First Placed in SPED in Grade 1	0.009	0.096	0	1
First Placed in SPED in Grade 2	0.009	0.095	0	1
First Placed in SPED in Grade 3	0.007	0.085	0	1
First Placed in SPED in Grade 4	0.007	0.085	0	1
First Placed in SPED in Grade 5	0.004	0.062	0	1
First Placed in SPED in Grade 6	0.003	0.052	0	1
Special Education Placement Rates for Students Score Above Cutoff (N=387)				
First Placed in SPED Between Grades 1 and 6	0.008	0.088	0	1
First Placed in SPED in Grade 1	0.003	0.051	0	1
First Placed in SPED in Grade 2	0.003	0.051	0	1
First Placed in SPED in Grade 3	0.003	0.051	0	1
First Placed in SPED in Grade 4	0	0	0	0
First Placed in SPED in Grade 5	0	0	0	0
First Placed in SPED in Grade 6	0	0	0	0
Special Education Placement Rates for Students Classified as EL (N=4089)				
First Placed in SPED Between Grades 1 and 6	0.040	0.195	0	1
First Placed in SPED in Grade 1	0.009	0.096	0	1
First Placed in SPED in Grade 2	0.009	0.095	0	1
First Placed in SPED in Grade 3	0.007	0.085	0	1
First Placed in SPED in Grade 4	0.007	0.085	0	1
First Placed in SPED in Grade 5	0.004	0.062	0	1
First Placed in SPED in Grade 6	0.003	0.052	0	1
Special Education Placement Rates for Students Classified as English-Proficient (N=394)				
First Placed in SPED Between Grades 1 and 6	0.008	0.087	0	1
First Placed in SPED in Grade 1	0.003	0.050	0	1
First Placed in SPED in Grade 2	0.003	0.050	0	1
First Placed in SPED in Grade 3	0.003	0.050	0	1
First Placed in SPED in Grade 4	0	0	0	0
First Placed in SPED in Grade 5	0	0	0	0
First Placed in SPED in Grade 6	0	0	0	0

Source: California Longitudinal Pupil Achievement Data System (CALPADS), SY 2006-07 through SY 2018-19.

Notes: This sample includes students from this district who indicated Mandarin or Cantonese as their primary langauge, took the California English Language Development Test (CELDT) for the first time in Kindergarten between SY 2006-07 and SY 2012-13, had valid covariate and outcome data, and scored above the minimum score Overall and in Listening and Speaking domains (N=4,483). Excluded from the sample are students who took the initial CELDT assessment for the first time in 1st grade or later. The intent-to-treat group includes students who indicated speaking Mandarin or Cantonese as their primary language and who scored below the cutoff (N=4,096). The control group includes students who indicated speaking Mandarin or Cantonese as their primary language and who scored above the cutoff (N=387).

Appendix Table B4. SPED Placement Rates by CELDT Cutoff and EL Status (Primary Language: Other)

Variable	Mean	Std. Dev.	Min	Max
Special Education Placement Rates for Students Scoring Below Cutoff (N=3167)				
First Placed in SPED Between Grades 1 and 6	0.082	0.275	0	1
First Placed in SPED in Grade 1	0.023	0.150	0	1
First Placed in SPED in Grade 2	0.011	0.105	0	1
First Placed in SPED in Grade 3	0.018	0.133	0	1
First Placed in SPED in Grade 4	0.012	0.109	0	1
First Placed in SPED in Grade 5	0.012	0.107	0	1
First Placed in SPED in Grade 6	0.007	0.081	0	1
Special Education Placement Rates for Students Score Above Cutoff (N=967)				
First Placed in SPED Between Grades 1 and 6	0.029	0.168	0	1
First Placed in SPED in Grade 1	0.002	0.045	0	1
First Placed in SPED in Grade 2	0.008	0.091	0	1
First Placed in SPED in Grade 3	0.006	0.079	0	1
First Placed in SPED in Grade 4	0.004	0.064	0	1
First Placed in SPED in Grade 5	0.006	0.079	0	1
First Placed in SPED in Grade 6	0.002	0.045	0	1
Special Education Placement Rates for Students Classified as EL (N=3152)				
First Placed in SPED Between Grades 1 and 6	0.082	0.274	0	1
First Placed in SPED in Grade 1	0.022	0.147	0	1
First Placed in SPED in Grade 2	0.011	0.106	0	1
First Placed in SPED in Grade 3	0.018	0.133	0	1
First Placed in SPED in Grade 4	0.012	0.108	0	1
First Placed in SPED in Grade 5	0.011	0.106	0	1
First Placed in SPED in Grade 6	0.007	0.081	0	1
Special Education Placement Rates for Students Classified as English-Proficient (N=982)				
First Placed in SPED Between Grades 1 and 6	0.033	0.178	0	1
First Placed in SPED in Grade 1	0.005	0.071	0	1
First Placed in SPED in Grade 2	0.007	0.084	0	1
First Placed in SPED in Grade 3	0.006	0.078	0	1
First Placed in SPED in Grade 4	0.005	0.071	0	1
First Placed in SPED in Grade 5	0.007	0.084	0	1
First Placed in SPED in Grade 6	0.002	0.045	0	1

Source: California Longitudinal Pupil Achievement Data System (CALPADS), SY 2006-07 through SY 2018-19.

Notes: This sample includes students from this district who indicated a language other than English, Spanish, Mandarin, or Cantonese as their primary language, took the California English Language Development Test (CELDT) for the first time in Kindergarten between SY 2006-07 and SY 2012-13, had valid covariate and outcome data, and scored above the minimum score Overall and in Listening and Speaking domains (N=4,134). Excluded from the sample are students who took the initial CELDT assessment for the first time in 1st grade or later. The intent-to-treat group includes students who indicated speaking a language other than English, Spanish, Mandarin, or Cantonese and who scored below the cutoff (N=3,167). The control group includes students who indicated speaking a language other than English, Spanish, Mandarin, or Cantonese andwho scored above the cutoff (N=967).

Appendix C: Additional Results

To further probe the validity of the RD design, we test the robustness of our findings through a series of sensitivity checks and report the results in Appendix C. First, to supplement our local linear regressions (results shown in Tables 3 and 4, Figures 3 and 4), Figure C1 shows a set of graphical analyses with linear, quadratic, cubic, and quartic models for students scoring within 32 points of the CELDT cut score. Similar to Figure 3, which depicts linear fit to the data around the CELDT cut score, the polynomial models presented in Figure C1 show a discontinuity in the probability of SPED placement at the cut score, with students below the threshold (right side) consistently having lower probability than students above the threshold (left side).

Our presentation of the findings in the main text largely focuses on 2SLS estimates of the TOT parameter. For brevity, we only included one set of reduced-form estimates in the main text (Table 3, columns 1-3), which are the estimated effects of EL eligibility on SPED placement. In Tables C1 and C2, we present additional reduced-form results. Table C1 provides the grade-by-grade estimated effects of EL eligibility on SPED placement. Table C2 presents separate estimated effects of EL eligibility on SPED placement between grades 1 and 6 by primary language. Corresponding to the first stage (0.75), these reduced-form estimates are smaller in magnitude (by about 25%) than 2SLS estimates presented in Tables 4 and 5, with similar statistical significance.

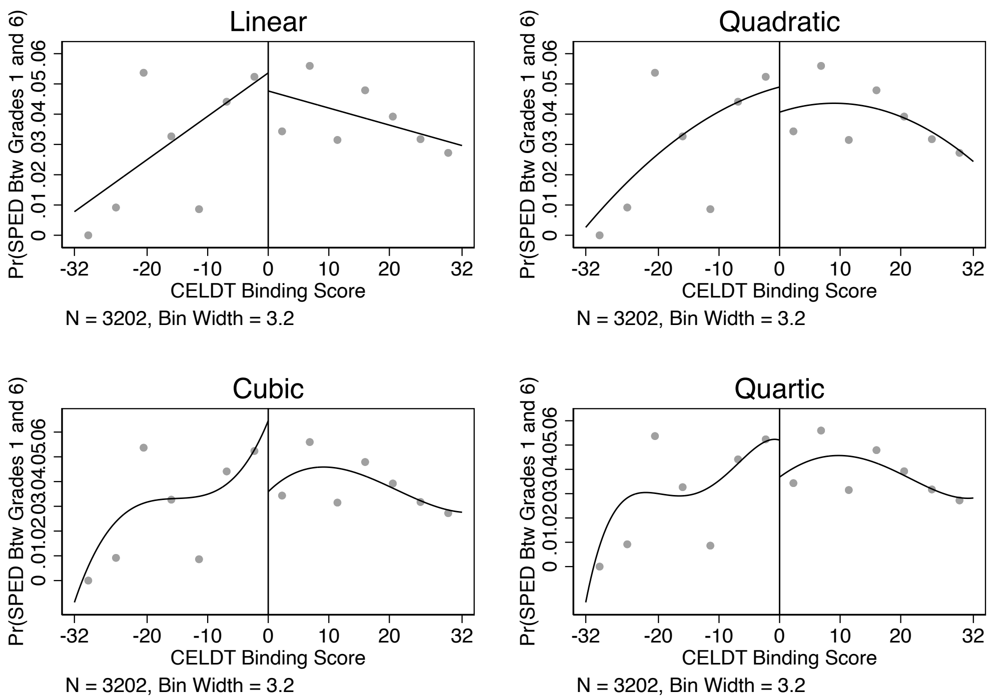
In Table C3, we extend our heterogeneity analysis by considering the grade-by-grade analysis by primary language subgroup. These 2SLS estimates suggest that the overall pattern is driven by ELs with a primary language of Spanish, and that grades 1 and 6 are times when disproportionate representation is occurring for ELs with a primary language of Spanish.

Tables C4 and C5 examine longer-term SPED placement, using OLS and RD, by extending the time frame of observation for a subsample of students. Both sets of analyses used models that include all student-level controls and school-cohort fixed effects. The regressions reported in Table C4 delineate the OLS relationship between EL status and SPED placement. Different from the main analytical sample, where we look for SPED placement between 1-6 years after EL classification, here we adjust the period of time over which we observe SPED placements. Column (1) shows SPED placement between 1-3 years after EL classification. Each subsequent column adds one year. Column (8) shows SPED placement between 1-10 years after EL classification. The underlying sample of each regression is changing. In Column (1), we include the largest number of cohorts but observe them for the shortest amount of time. In Column (8), we include the fewest number of cohorts but observe them for the longest amount of time. The relationship is always positive and the point estimates are quite stable, hovering between 2.1 and 3.5 percentage points.

Analogous to Table C4, Table C5 reports findings from RD analyses that examine the 2SLS effects of EL status on SPED placement over different time horizons. The RD specifications that include a linear spline of the transformed forcing variable, student-level controls, and school-cohort fixed effects. This table presents results as we adjust the length of time during which we observe each student and the number of cohorts we include in the sample. In Column (1), we observe the most cohorts for the shortest amount of time. In Column (8), we observe the fewest cohorts for the longest amount of time. While none of the results are not statistically significant, most of the point estimates are negative. The few positive point estimates we observe are less than or equal to 0.016. This set of evidence offers additional support for our main finding of a null effect of EL status on SPED placement.

Table C6 reports an additional sensitivity check, which tests the robustness of our 2SLS findings in Table 3 to including SPED placement in kindergarten. This check was motivated by a limitation in our data access. For the causal design to be valid, the reporting of English proficiency and EL classification needed to have happened before SPED placement. Our forcing variable, the transformed CELDT binding score, was reported from students' kindergarten year with exact dates. However, we did not observe precise dates for SPED placement. Thus, for students who were placed into SPED during the kindergarten year, we cannot be certain whether SPED placement happened before or after EL classification. To address this threat to the causal design, we exclude kindergarten SPED placement and examine SPED placement between grades 1 and 6 as our main outcome of interest (see Table 3). Recognizing that this exclusion may have influenced our estimates, we repeat the RD analysis using SPED placement between kindergarten and 6th grade as the outcome (see Table C6). The point estimates differ slightly from the main results in Table 3, but the findings remain qualitatively and statistically similar.

Appendix Figure C1. Alternative Polynomial Specifications: Probability of SPED Placement Between Grades 1 and 6, by Binding Score Forcing Variable at the CCT Optimal Bandwidth



Notes: These figures depict alternative polynomial specifications of the relationship between the transformed CELDT Binding Score and the First Placed in SPED Between Grades 1 and 6 outcome measure. All graphs are restricted to the CCT optimal bandwidth (+/- 32; N=3,202). In all graphs, bin widths are 3.2 points. In order to conform to the RD structure required by -rdrobust-, binding scores were transformed linearly in the following way: [(-1*BindingScore_isc) – 1]. Positive values denote the treatment group (students who scored below the English proficiency threshold). Negative values denote the control group (students who scored above the English proficiency threshold). Each plotted point provides a binned average.

Appendix Table C1. Reduced-Form Estimates of EL Eligibility on Other SPED Placement Outcomes, by Bandwidth

	Dependent Variable: First Placed in SPED in							
	Grades 1 through 6	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	
Bandwidth Sample	(1)	(2)	(3)	(4)	(5)	(6)	(7)	N
2*CCT (+/- 64)	-0.015	-0.003	-0.008	0.003	0.003	-0.007*	-0.001	6,793
	(0.010)	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	
CCT (+/-32)	-0.010	-0.000	-0.010	0.009	0.006	-0.009*	-0.006	3,202
	(0.013)	(0.006)	(0.006)	(0.006)	(0.004)	(0.005)	(0.005)	
0.5*CCT (+/- 16)	-0.002	-0.005	-0.003	0.000	0.005	-0.000	0.001	1,534
	(0.017)	(0.008)	(0.008)	(0.008)	(0.006)	(0.008)	(0.008)	

Notes: Robust standard errors are in parentheses. Each cell represents a separate regression. The +/- 32 bandwidth is the CCT optimal bandwidth. All results are the reduced-form specification and include a linear spline of the transformed forcing variable (see endnote 18 for details), student-level controls and school-cohort fixed effects (coefficients suppressed). The student-level controls include the following: an indicator for female; an indicator for the student's most educated parent being at least a HS graduate; an indicator for being Hispanic; an indicator for being Chinese; an indicator for declining to state race/ethnicity; and the student's age at initial assessment.

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$

Appendix Table C2. Reduced-Form Estimates of EL Eligibility on SPED Placement, by Bandwidth and Primary Language

	Dependent Variable: First Placed in SPED Between Grades 1 and 6					
	Spanish		Mandarin or Cantonese		All Other Languages	
Bandwidth Sample	(1)	N	(2)	N	(3)	N
2*CCT	-0.037	2,185	0.006	2,296	-0.008	3,826
	(0.024)		(0.010)		(0.013)	
CCT	-0.070**	906	0.005	1,028	-0.018	2,451
	(0.028)		(0.013)		(0.016)	
0.5*CCT	-0.012	411	0.005	471	-0.007	1,239
	(0.031)		(0.019)		(0.020)	

Notes: Robust standard errors are in parentheses. Each cell represents a separate regression. CCT optimal bandwidths are reported. All models are the reduced-form specification, include a linear spline of the transformed forcing variable (see endnote 18 for details), and include school-cohort fixed effects and the following student-level controls: an indicator for female; an indicator for the highest educated parent being at least a HS graduate; an indicator for being Hispanic; an indicator for being Chinese; the student's age at initial assessment (coefficients suppressed). The mean SPED placement rate between Grades 1 and 6 after the initial CELDT assessment for key subgroups are as follows: 0.108 for Spanish speakers overall; 0.114 for Spanish speakers scoring below the threshold; 0.048 for Spanish speakers score above the threshold; 0.037 for Cantonese or Mandarin speakers overall; 0.040 for Cantonese or Mandarin speakers below the threshold; 0.008 for Cantonese or Mandarin speakers above the threshld; 0.070 for speakers of all other languages overall; 0.082 for speakers of all other languages below the threshold; and 0.029 for speakers of all other langauges above the threshold.

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$

Appendix Table C3. 2SLS Estimates of EL Status on Other SPED Placement Outcomes, by Primary Language

	Dependent Variable: First Placed in SPED in							
	Grades 1 through 6	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	
CCT Optimal Bandwidth Sample	(1)	(2)	(3)	(4)	(5)	(6)	(7)	N
Full Sample	-0.013	-0.000	-0.013	0.012	0.008	-0.012*	-0.008	3,202
	(0.017)	(0.006)	(0.008)	(0.008)	(0.006)	(0.007)	(0.007)	
Spanish Speakers Only	-0.090**	-0.026	-0.021	-0.018	0.007	-0.007	-0.026*	906
	(0.036)	(0.017)	(0.017)	(0.014)	(0.011)	(0.016)	(0.016)	
Mandarin/Cantonese Speakers Only	0.007	-0.017	0.007	0.015*	-0.006	-	0.008	1,028
	(0.018)	(0.011)	(0.005)	(0.009)	(0.004)	-	(0.008)	
Other-Language Speakers Only	-0.023	0.008	-0.009	0.001	-0.008	-0.015*	-0.000	2,451
	(0.020)	(0.008)	(0.011)	(0.009)	(0.008)	(0.008)	(0.007)	

Notes: Robust standard errors are in parentheses. Each cell represents a separate regression. All models are the 2SLS specification and include a linear spline of the transformed forcing variable (see endnote 18 for details), student-level controls and school-cohort fixed effects (coefficients suppressed). The student-level controls include the following: an indicator for female; an indicator for the student's most educated parent being at least a HS graduate; an indicator for being Hispanic; an indicator for being Chinese; an indicator for declining to state race/ethnicity; and the student's age at initial assessment.

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$

Appendix Table C4. OLS: Estimated Association Between EL Assignment and SPED Placement Over Different Time Horizons

	Dependent Variable: First Placed in SPED Between Grade 1 and Grade *t*							
	t = 3	*t* = 4	*t* = *5*	*t* = 6	*t* = 7	*t* = *8*	*t* =*9*	*t* =*10*
Independent Variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Assigned EL by District	0.021***	0.029***	0.033***	0.034***	0.034***	0.035***	0.033***	0.026**
	(0.004)	(0.005)	(0.005)	(0.006)	(0.007)	(0.007)	(0.009)	(0.011)
N	17,714	15,983	14,280	12,607	10,777	8,932	7,239	5,069
R^2	0.067	0.071	0.074	0.077	0.079	0.081	0.081	0.089

Notes: Robust standard errors are in parentheses. Each model reports the OLS estimate of EL assignment on Special Education placement across a different time horizon. All models include a full set of student-level covariates and school-cohort fixed effects (coefficients suppressed). The underlying sample includes students who took the initial CELDT assessment in kindergarten between SY 2006-07 and SY 2015-16 and scored above the minimum possible score Overall and on Listening and Speaking domains. The sample size of the panel declines as the length of the time horizon increases. Cohorts with incomplete data are dropped (see Figure 1).

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$

Appendix Table C5. 2SLS Estimates of EL Status on SPED Placement Over Different Time Horizons, by Bandwidth

	Dependent Variable: First Placed in SPED between Grade 1 and Grade *t*															
	t=3		*t=4*		*t=5*		*t=6*		*t=7*		*t=8*		*t=9*		*t=10*	
Bandwidth Sample	(1)	N	(2)	N	(3)	N	(4)	N	(5)	N	(6)	N	(7)	N	(8)	N
2*CCT (+/- 64)	-0.011	9,894	-0.005	8,824	-0.016	7,791	-0.019	6,793	-0.014	5,830	-0.014	4,814	-0.022	3,848	-0.021	2,505
	(0.007)		(0.009)		(0.011)		(0.013)		(0.016)		(0.018)		(0.022)		(0.021)	
CCT (+/-32)	-0.004	4,795	0.005	4,245	-0.003	3,713	-0.013	3,202	-0.008	2,744	0.010	2,311	-0.010	1,854	-0.028	1,169
	(0.010)		(0.012)		(0.014)		(0.017)		(0.022)		(0.025)		(0.033)		(0.026)	
0.5*CCT (+/- 16)	-0.006	2,363	-0.000	2,072	0.006	1,798	-0.002	1,534	0.002	1,312	0.016	1,120	-0.019	885	-0.024	545
	(0.013)		(0.016)		(0.020)		(0.025)		(0.031)		(0.036)		(0.053)		(0.031)	

Notes: Robust standard errors are in parentheses. Each cell represents a separate regression. The +/- 32 bandwidth is the CCT optimal bandwidth. All models are the 2SLS specification and include a linear spline of the transformed forcing variable (see endnote 18 for details), school-cohort fixed effects, and the following student-level controls: an indicator for female; an indicator for the student's highest educated parent being at least a HS graduate; an indicator for being Hispanic; an indicator for being Chinese; an indicator for declining to state race/ethnicity; and the student's age at initial assessment (coefficients suppressed). Cohorts with incomplete data are dropped (see Figure 1).

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$

Appendix Table C6. 2SLS Estimates of EL Status on SPED Placement Between Kindergarten and Grade 6

	Dependent Variable: First Placed in SPED Between Kindergarten and Grade 6			
Bandwidth Sample	(1)	(2)	(3)	N
2*CCT (+/- 64)	-0.020	-0.023	-0.029*	6,793
	(0.016)	(0.016)	(0.015)	
CCT (+/-32)	-0.023	-0.024	-0.029	3,202
	(0.022)	(0.021)	(0.019)	
0.5*CCT (+/- 16)	-0.029	-0.025	-0.019	1,534
	(0.033)	(0.033)	(0.027)	
Student-Level Controls	no	yes	yes	-
Cohort-School FE	no	no	yes	-

Notes: Robust standard errors are in parentheses. All models are the 2SLS specification and include a linear spline of the transformed forcing variable (see endnote 18 for details). Each cell represents a separate regression. The +/- 32 bandwidth is the CCT optimal bandwidth. Models reported in columns (2) and (3) include the following student-level controls: an indicator for female; an indicator for the student's most educated parent being at least a HS graduate; an indicator for being Hispanic; an indicator for being Chinese; an indicator for declining to state race/ethnicity; and the student's age at initial assessment (coefficients suppressed). The model reported in column (3) also includes school-cohort fixed effects (coefficients suppressed).

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$

Appendix D: Results for students who took CELDT initially in G1-G5

An important component of our study is the focus on students who took the CELDT assessment during the *kindergarten* year. In an effort to ensure common comparisons over time, we restrict our analytical sample to this particular subset of test takers. However, it is important to note that this subset accounted for 56 percent of all initial CELDT assessments administered by the district. The remaining 44 percent were spread across students transferring into the district and taking the initial assessment at other grade levels. Importantly, these numbers were quite evenly distributed with no other grade level having more than 8 percent of the initial CELDT assessments overall. After kindergarten, the next most common grade levels for initial assessments were grade 9, grade 1, grade 10, and grade 2.

An additional RD analysis on students taking the initial CELDT assessment at other grade levels is warranted but makes interpretation of findings less straightforward. In this appendix we provide initial results for the sample of students that took the initial CELDT assessment in grades 1-5 (i.e., excluding our main cohorts of kindergarten initial CELDT assessment takers). Table D1 reports summary statistics for this additional sample. Here, we notice several key points that differentiate this sample from the set of students who enter the district in kindergarten. First, students taking the initial CELDT assessment in later grades were less likely to speak either Spanish or Mandarin/Cantonese and more likely to speak another non-English language as their primary language. Second, these students were more likely to have a parent with at least a high school diploma. Third, students in this subsample were less likely to be classified as ELs than students who took the assessment in kindergarten. Fourth, SPED identification rates were slightly higher for this subset of students.

We also explore the results from our main RD specification using this subsample of students. Importantly, the sample size is smaller than the sample included in the main panel, reducing our statistical power. Table D2 presents results from our 2SLS specifications. Column (1) reports results for being placed in SPED between 1 and 6 years after the initial CELDT assessment. In Column (2), we report results for the same outcome, but include student-level controls. In Column (3), we retain these student-level controls and also add school-cohort fixed effects. In cognate form to the results presented in Tables 3-5 of the main analysis, we report our results across three bandwidth samples, based on the CCT optimal bandwidth for this sample.

Across bandwidth samples and specifications with and without controls, our results are not statistically significant. With the exception of models (1) and (2) at the smallest bandwidth (0.5x CCT optimal, or 25.5 points), all the point estimates are negative, and our statistical precision was limited. While this result is similar to what we found for the kindergarten sample, a more detailed interrogation of the differences between these subsets across a longer period of time is worth exploring in future research.

Appendix Table D1. Summary Statistics for the Grade 1-5 Initial CELDT Taker Sample

Variable	Mean	Std. Dev.	Min	Max
Student Characteristics in Year of Initial Assessment				
Female	0.46	0.50	0	1
Hispanic	0.32	0.47	0	1
Chinese	0.24	0.43	0	1
Decline to State Race/Ethnicity	0.04	0.19	0	1
Parent's Highest Education Level ≥ High School Diploma	0.60	0.49	0	1
Age at Initial Assessment (approximation)	8.21	1.90	5.2	12.8
Primary Language: Spanish	0.26	0.44	0	1
Primary Language: Mandarin/Cantonese	0.21	0.41	0	1
Primary Language: Other	0.53	0.50	0	1
California English Language Development Test				
Binding Score	-41	70	-179	148
Centered Overall Scale Score	-40	70	-179	148
Centered Listening Scale Score	45	73	-178	197
Centered Speaking Scale Score	56	81	-177	284
Binding Section: Overall	0.96	0.20	0	1
Binding Section: Listening	0.03	0.17	0	1
Binding Section: Speaking	0.01	0.12	0	1
English Learner and Special Education				
Assigned EL by District	0.596	0.491	0	1
Eligible for EL (Binding Score < 0)	0.704	0.456	0	1
First Placed in SPED Between Grades 1 and 6	0.086	0.280	0	1
First Placed in SPED in Grade 1	0.023	0.151	0	1
First Placed in SPED in Grade 2	0.020	0.139	0	1
First Placed in SPED in Grade 3	0.019	0.136	0	1
First Placed in SPED in Grade 4	0.010	0.100	0	1
First Placed in SPED in Grade 5	0.008	0.089	0	1
First Placed in SPED in Grade 6	0.006	0.080	0	1

Source: California Longitudinal Pupil Achievement Data System (CALPADS), SY 2006-07 through SY 2018-19.

Notes: The full sample includes students from this district who took the California English Language Development Test (CELDT) for the first time in Grades 1-5 between SY 2006-07 and SY 2012-13, had valid covariate and outcome data, and scored above the minimum score Overall and in Listening and Speaking domains (N=2,500). Excluded from the sample are students who took the initial CELDT assessment for the first time in kindergarten, those under age 5 and over age 13. The intent-to-treat group includes students who scored below the cutoff (N=1,761). The control group includes students who scored above the cutoff (N=739).

Appendix Table D2. 2SLS Estimates of EL Status on SPED Placement for the Grade 1-5 Initial CELDT Taker Sample, by Bandwidth

	Dependent Variable: First Placed in SPED Between 1 and 6 Years After Initial CELDT Assessment			
Bandwidth Sample	(1)	(2)	(3)	N
2*CCT (+/- 102)	-0.086	-0.106	-0.056	1,924
	(0.121)	(0.120)	(0.095)	
CCT (+/- 51)	-0.067	-0.080	-0.058	1,147
	(0.158)	(0.154)	(0.112)	
0.5*CCT (+/- 25.5)	0.090	0.116	-0.220	583
	(0.227)	(0.219)	(0.145)	
Student-Level Controls	no	yes	yes	-
Cohort-School FE	no	no	yes	-

Notes: Robust standard errors are in parentheses. All 2SLS models include a linear spline of the transformed forcing variable (see endnote 18 for details). Each cell represents a separate regression. The CCT optimal bandwidth for this sample is +/- 51. Models reported in columns (2) and (3) include the following student-level controls: an indicator for female; an indicator for the student's most educated parent being at least a HS graduate; an indicator for being Hispanic; an indicator for being Chinese; an indicator for declining to state race/ethnicity; and the student's age at initial assessment (coefficients suppressed). The model reported in column (3) also includes school-cohort fixed effects (coefficients suppressed).

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$