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Impacts of Two Public Preschool Programs on School Readiness in San Francisco

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Abstract

We investigated the impact of a subsidized, needs-based preschool program (Study 1; N = 1,894) and California's universal but age-restricted transitional kindergarten (TK) program (Study 2; N = 1,093) on school readiness. We applied Mahalanobis matching—a quasi-experimental data analysis method used to create equivalent groups—to data from three recent kindergarten cohorts in a large, urban school district in San Francisco. We matched students in each preschool group to demographically similar kindergarteners who did not attend public preschool in the district. Students' literacy, cognitive/fine motor, and social-emotional skills were assessed by kindergarten teachers in the first six weeks of the school year. We observed substantial heterogeneity in program effects only for literacy across the needs-based program (β = 0.27) and TK (β = 0.53). For cognitive/fine motor skills, effects were similar across the needs-based program (β = 0.23) and TK (β = 0.28). Only TK had a positive effect on social-emotional skills (β = 0.12). Across these two programs, which serve students who go on to enroll in kindergarten classrooms together, we discuss the structural program differences that could explain variation in effectiveness and implications for policy as California expands its TK program to cover all four-year-olds.

Keywords: Public preschool; School readiness; Early childhood education; Pre-kindergarten; Quasi-experimental; Program evaluation

Impacts of Two Public Preschool Programs on School Readiness in San Francisco

In the U.S., public preschool refers to any center-based early childhood education programs administered by federal, state, or local governments. Quality, eligibility, and access to these programs varies by jurisdiction (Friedman-Krauss et al., 2020). Nonetheless, reviews and meta-analyses including more than 100 experimental and quasi-experimental studies spanning decades have established that, on average, preschool programs in the United States have positive impacts on academic aspects of school readiness such as literacy and numeracy (Camilli et al., 2010; Duncan & Magnuson, 2013; Kholoptseva, 2016; Phillips et al., 2017). However, due to long-term changes in the quality of alternative care arrangements available to families (Duncan & Magnuson, 2013) and in access to high-quality preschool, there is a need for new research evaluating the effects of contemporary public preschool programs. Moreover, previous research has not examined multiple public preschool programs in the same jurisdiction to understand how variation in program characteristics and eligibility requirements contributes to heterogeneity in effectiveness.

In collaboration with San Francisco Unified School District, we used three recent years of administrative data to estimate the impacts of two distinct preschool programs serving students who go on to enroll in kindergarten classrooms together in this district. We conducted two sets of Mahalanobis matching analyses. In Study 1, we matched students who attended a needs-based public preschool program with demographically similar peers who did not attend preschool in the district. In Study 2, we matched students who attended California's universal Transitional Kindergarten (TK) program in the district to demographically similar peers who did not attend preschool in the district. We examined program impacts on students' literacy, cognitive/fine

motor, and social-emotional skills, as measured by a scalable and pragmatic kindergarten readiness screener that is used annually to evaluate all students.

In our literature review, we cover three broad topics. First, we consider evidence of associations between preschool and children's academic outcomes and how these associations have changed over the historical period from the 1960s through the 2010s. Next, we review associations between preschool and non-academic outcomes such as motor and social-emotional skills. Finally, we look at heterogeneity in preschool effects on child outcomes and potential moderators of effectiveness.

Preschool Impacts over Time

Well-known, decades-old studies of the Perry Preschool Project and the Carolina Abecedarian Project have demonstrated that high-quality preschool can have large, long-term positive impacts on academic achievement in economically disadvantaged student populations (Campbell & Ramey, 1994; Schweinhart & Weikart, 1981). The economic and social return on investment from these programs far exceeded their costs (e.g., Heckman et al., 2010). Yet public preschool programs in more recent decades have had comparatively smaller effects (Gilliam & Zigler, 2000; Puma et al., 2012), and the academic benefits of attending preschool have decreased substantially since the 1960s (Duncan & Magnuson, 2013). This is true for both Head Start (the U.S. federal preschool program for children from low-income families and foster children) and non-Head Start programs (Duncan & Magnuson, 2013), suggesting that program size or scalability cannot account for the long-term decline in effectiveness.

We expect public preschool to have positive effects on school readiness to the extent that it provides a higher quality learning environment relative to what children would have experienced in the absence of public preschool (i.e., the counterfactual; Feller et al., 2016). The

effectiveness of public preschool has likely declined over time not because the quality of instruction has decreased, but instead because the average quality of the counterfactual has increased substantially in recent decades (Duncan & Magnuson, 2013). For example, the average quality of home learning environments increased between 1998 and 2010, with gains concentrated among low-income families (Bassok et al., 2016). It is important to continue tracking changes in the effectiveness of public preschool programs using contemporary data that reflect the current experiences of preschool-aged children, especially because of continued increases in public preschool enrollment. Since 2005, the percentage of three- and four-year-olds enrolled in any type of preschool has fluctuated within the narrow range of 44% to 48%, but the share of enrollment in public preschool programs relative to private preschool programs has increased substantially between 2005 and 2019 (McElrath & Bauman, 2021). This is particularly relevant in the current policy environment of California, which will progressively expand the age-eligibility for TK until the program is offered universally to all four-year-olds in the 2025–2026 school year.

There is broad consensus that public preschool has positive effects on students' academic skills at school entry (Phillips et al., 2017). For example, Duncan and Magnuson's (2013) meta-analysis of 84 "methodologically sound" experimental and quasi-experimental impact evaluation studies concluded that public preschool positively impacts students' academic skills. Drawing on data from some of the most recent evaluations of preschool programs, Barnett and colleagues (2018) used regression discontinuity (a quasi-experimental causal inference technique that compares preschool students to kindergarten students who are around the same age) to estimate the impact of eight different targeted state and local programs in the United States between 2004

and 2015. Across these studies, the average short-term (e.g., 3-month) effects were large for literacy (ES = 0.85) and moderate for math (ES = 0.56).

Although a strength of regression discontinuity is high internal validity, the approach has been criticized for producing biased estimates of effect size due to systematic differences in parental investment between students who are about to attend kindergarten relative to those about to attend preschool (Lipsey, Weiland, et al., 2015). Matching methods (Stuart, 2010) are a set of quasi-experimental analysis techniques that, unlike regression discontinuity, are not biased by cohort differences (e.g., any individual, family, or educational factors) that may differ between children who are about to enter kindergarten and their age-mates for whom this major developmental transition is still one calendar year away. In the only study we identified using data after the 2015–2016 school year, matching analyses have been used to show positive effects on literacy (ES = 0.52) and math (ES = 0.36–0.48) skills in Fairfax County, Virginia (Ansari et al., 2021). There is a need to expand the research base on preschool effects using methods that do not rely on birthdate cutoffs, such as matching.

Preschool Impacts on Non-academic Outcomes

Investments in preschool are made with the hope of improving early educational opportunities for children in order to promote greater school readiness. There is a growing recognition among researchers and policymakers of the need to examine how preschool affects non-academic aspects of school readiness such as fine motor and social-emotional skills, which have not been as widely studied as literacy and numeracy (e.g., Williams et al., 2019). To our knowledge, an evaluation of the universal preschool program in Tulsa, Oklahoma, has been the only study to date to examine motor skills as an outcome, concluding that preschool had a

moderate positive effect (ES = .24) on a composite that included both gross and fine motor skills. (Gormley & Gayer, 2005).

Motor skills are considered to be an important aspect of school readiness with implications for academic development (Cameron et al., 2016). For example, fine motor skills such as handwriting are predictive of both math and reading (Dinehart & Manfra, 2013). Growth in preschool-age children's motor skills over a one-year period have been linked with growth in both math skills and executive functions (Willoughby et al., 2021). Teachers' reports of fine motor skills were associated with students' academic knowledge and math achievement scores in early elementary school (Kim et al., 2015). Further, students' visual-motor skills in late elementary school predicted longitudinal change in executive functions and achievement test scores in English language arts (Sulik et al., 2018). Students in preschool spend a large amount of time engaged in fine motor activities (Marr et al., 2003), which provides opportunities to improve these skills through practice. Given the relevance of fine motor skills for academic achievement, more work should examine whether public preschool programs can improve these skills.

Similarly, few recent studies have examined the impacts of public preschool on cognitive, social, and emotional skills that support learning. Using regression discontinuity (Weiland & Yoshikawa, 2013) and matching analyses (Ansari et al., 2021), researchers have reported small, positive effects on direct assessments of students' executive functions (ES = 0.21–0.31) and emotion recognition (ES = 0.19), as well as assessor-reported task-orientation (ES = 0.11). A few studies that use teachers' reports of kindergarten students' learning-related behaviors have also revealed positive effects of preschool programs. Ansari and colleagues (2021) reported that preschool had positive effects on teacher-reported task orientation (ES = 0.16) in kindergarten in

Fairfax County, Virginia. In the Tulsa study of universal preschool (Gormley et al., 2011), matching analyses indicated that preschool was associated with higher teacher ratings of attentiveness in kindergarten (ES = 0.19). A randomized experiment using a waitlist control group (Lipsey, Farran, et al., 2015) indicated that the Tennessee Pre-kindergarten Program had a positive effect on kindergarten teacher reports of work-related skills (ES = 0.20) and appropriate behaviors during participation in peer activities (ES = 0.19).

However, studies often do not find positive effects of preschool on kindergarten teachers' reports of interpersonal skills. An experimental impact evaluation showed that one year of Head Start had no effect on teacher-reported social or behavioral problems in kindergarten (Puma et al., 2010). Similarly, an experimental evaluation of the Tennessee Pre-kindergarten Program revealed no effects on kindergarten teachers' reports of students' peer acceptance and behavior problems (Lipsey et al., 2018). Regression discontinuity analyses indicated that preschool in Georgia had no effect on teacher-reported social interaction skills in kindergarten (Peisner-Feinberg et al., 2014). A recent matching study also reported no effect of preschool on teacher-reported frustration tolerance, social skills, or conduct problems in kindergarten (Ansari et al., 2021). Finally, one study using an instrumental variables approach (a causal inference technique used in quasi-experimental studies) with data from the Early Childhood Longitudinal Study (Magnuson et al., 2007) showed that state preschool was actually associated with *lower* levels of teacher-reported self-control (ES = −0.13) and *more* externalizing behavior problems (ES = 0.19). Given the changing preschool landscape and the importance of non-academic skills on children's learning and well-being, there is a need to clarify whether and how strongly contemporary preschool programs are associated with positive physical and social-emotional outcomes.

Program Eligibility and Preschool Effectiveness

The benefits of preschool programs are heterogeneous and depend on the characteristics of the students being served (Ladd, 2017; Morris et al., 2018). For example, a number of studies have indicated that public preschool programs are more effective for economically disadvantaged students than for students who are not economically disadvantaged (Andrews et al., 2012; Ansari et al., 2021; Bassok et al., 2015; Coburn, 2009; Gormley & Gayer, 2005; Huston et al., 2012; Manship et al., 2017; Weiland & Yoshikawa, 2013). Because needs-based programs—by design—serve students from low-income families, we have reason to expect larger average effects relative to universal programs that enroll students from a variety of economic backgrounds.

However, there are also mechanisms that could produce larger benefits in universal programs. Previous research suggests that students benefit from having peers with strong academic skills (Mashburn et al., 2009) and executive functions (Finch et al., 2019; Weiland & Yoshikawa, 2014). Consequently, economically disadvantaged students may benefit from attending school with more affluent peers (Miller et al., 2017; Reid & Ready, 2013), who tend to have more opportunities to develop higher levels of school readiness skills outside of school (Barnett, 2010; Gormley, 2017). Because most jurisdictions offer *either* a needs-based preschool program or a universal preschool program, we have little information about the effects of these two types of programs on the school readiness of children attending public schools in the same district. Providing updated information about the benefits of different types of public preschool programs will help inform policymakers who seek to expand access to preschool in the US (Friedman-Krauss et al., 2020).

The Present Investigation

We address three gaps in the literature. First, in light of decreasing impacts of public preschool since the 1960s (Duncan & Magnuson, 2013), heterogeneity in effects across programs (Weiland, 2018), and ongoing changes in public preschool enrollment (McElrath & Bauman, 2021), there is a continuing need to investigate the contemporary effects of preschool on school readiness in a variety of jurisdictions across the United States. San Francisco has several distinctive characteristics, including a high proportion of children who are English learners, a racially/ethnically diverse population that includes a large number of Asian Americans, and a uniquely unaffordable housing market. Second, we need to better understand the impacts of preschool on motor and social-emotional aspects of school readiness—not just early academic skills such as literacy. Third, by investigating heterogeneity across public preschool programs in the same school district, we may gain insight into how program characteristics relate to differences in effectiveness. This third goal is particularly relevant in light of California AB 130, which was signed into law in July 2021 (Education Finance: Education Omnibus Budget Trailer Bill, 2021). This statute will progressively expand eligibility for California's TK program until it is universal for four-year-olds in the 2025–2026 school year. It will be helpful for policymakers to understand the impacts of different early education programs as enrollment in TK increases substantially over the next several years.

This district administers two preschool programs. Study 1 investigates a targeted, needs-based preschool program for four-year-olds that is subsidized on a graduated scale based on family size and income. Study 2 investigates transitional kindergarten (TK), a no-cost universal preschool program with strict age-eligibility criteria that prepares students to enter kindergarten the following year. All children in California who turn five during the three-month period

between September 2 and December 2 are eligible for TK. Children born in the nine-month period between December 3 and September 1 are not eligible for TK. As a result of these age restrictions, TK generally serves an older population of students compared to the needs-based preschool program. In practice, there is a small amount of overlap across programs with respect to age because children who are eligible for TK and are already enrolled in the needs-based preschool program can continue in that program for a second year instead of switching to TK.

We cannot directly compare the two programs to each other because of the age difference between them. In Study 1, we match students who attended the needs-based preschool program to demographically comparable peers who did not attend the district's preschool or TK program. In Study 2, we match students who attended TK to demographically comparable peers who did not attend the district's preschool or TK program.

Data were drawn from administrative school records for all kindergarteners in the school district. Specifically, we use three years of district data from a school readiness screener that is administered for all students by their teachers at the start of the kindergarten year. This approach allows us to compare kindergartners who attended each of the two public preschool programs in the school district to their peers who did not attend either program in the year prior to kindergarten entry.

Using earlier cohorts from the same school district, a regression discontinuity study showed that during the first two years that TK was implemented in California (2013–2014 and 2014–2015), program eligibility increased kindergarten literacy skills (ES = 0.21) relative to students who were ineligible (Doss, 2019). However, an important limitation of the study was that it focused on program eligibility, rather than enrollment. Two-thirds of the treatment group was composed of students who were eligible for TK but did not enroll. As a result, the author

acknowledged that the true treatment effect could be up to three times greater than was estimated (Doss, 2019). Further, the comparison group included a mix of students who attended the school district's needs-based preschool program and students who did not attend this program. To replicate and extend these findings, we use three cohorts of more recent data, a wider selection of dependent variables reflecting a broader range of skills, and a different quasi-experimental approach (i.e., matching) that is not subject to systematic differences in students' experiences above and below an age cut-off (Lipsey, Weiland, et al., 2015).

Method

Participants

The kindergarten sample consisted of the entire population of 12,423 kindergarten students in general education classrooms with school readiness data collected in 2017–2018 (n = 4,192), 2018–2019 (n = 4,140), and 2019–2020 (n = 4,091). These students were drawn from 36 schools in San Francisco Unified School District. Demographic data was collected from student enrollment forms. Average age at kindergarten entry was 5.47 years (SD = 0.30). Demographic characteristics by preschool group are reported in Table 1. Students were racially and ethnically diverse: 26% Asian American, 20% Latinx/Hispanic, 23% Multiracial/Other, 18% White/Caucasian, 5% Black/African American, and 7% were missing race/ethnicity data. About half (49%) of the students were girls and 9% were enrolled in special education programs. Based on California's English language assessments (California Department of Education, 2018, 2020c), 46% of students were classified as English proficient, 38% as English learners, and 15% were missing English proficiency data. Of the kindergarten students who attended pre-K, 30.6% remained at the same school; of the kindergarten students who attended TK, 22.7% remained at the same school.

Study 1: Needs-based preschool. 1,894 students in our sample attended the needs-based preschool program. This program does not have the capacity to serve all applicants. The district maintains a waitlist, with older students assigned a higher priority. Approximately 85% of the spots are reserved for families who demonstrate need. Tuition is determined based on a sliding scale that incorporates income, family size, and other factors (e.g., seeking permanent housing; parent medically incapacitated). Unsubsidized tuition is $1,350 per month, and the minimum tuition is $0. The curriculum is based on the California Preschool Learning Foundations (California Department of Education, 2020a) and the National Association for the Education of Young Children's "12 Principles of Child Development" (National Association for the Education of Young Children, 2020). Classrooms may be located in elementary schools or standalone early education schools. Five educational approaches are used: Reggio Emilia (Reggio Children Srl, 2020; 8% of schools), the Project Approach (Helm & Katz, 2016; 11% of schools), Creative Curriculum (Teaching Strategies, 2017; 72% of schools), Montessori (2013; 3% of schools), and HighScope (HighScope Educational Research Foundation, 2020; 6% of schools). Teachers must hold at least a Child Development Teacher Permit, which requires coursework in early childhood education or a related field and field experience in an early childhood education setting (State of California Commission on Teacher Credentialing, 2016). In this program, the district targets a maximum ratio of teachers to students of 8:1.

The district has two types of preschools with differing eligibility requirements. To be eligible to attend extended day preschool (6.5–10 hours per day) in an early education center during the academic year and the summer, families must demonstrate both financial need and a special circumstance, such as seeking employment or attending school, homelessness or seeking permanent housing, medical incapacitation, or receipt of Child Protective Services. Special

circumstances are not required to attend a school day preschool (6 hours per day) attached to an elementary school (which doesn't offer summer instruction).

There were 93 needs-based preschool teachers. Of these teachers, 31% had a Teaching credential (which requires a four-year college degree) and 97% had a Child Development credential. Of the 89% of teachers with non-missing data for education, 24% had less than a four-year college degree, 66% had a four-year college degree, and 10% had a graduate degree. The average amount of teaching experience was 16.63 years (*SD* = 8.98; 18% missing data).

Study 2: Transitional Kindergarten. 1,093 students in our sample attended TK. Eligibility for TK is exclusively based on age: only children who turn five in the three-month period from September 2 to December 2 may enroll in TK. School districts in California are legally required to educate all qualified TK applicants. The application and enrollment pro**c**esses are similar to those for kindergarten. The program is closely aligned with the district's elementary school program; the curriculum draws on the same content standards as the district's kindergarten curriculum and is based on both the California Preschool Learning Foundations (California Department of Education, 2020a) and the Kindergarten Common Core Standards (California Department of Education, 2020b). Similar to the district's elementary school teachers, teachers must hold Multi-Subject Credentials, which require completion of a teacher preparation program and a baccalaureate degree (State of California Commission on Teacher Credentialing, 2018). The maximum permitted ratio of students to teachers is the same as in kindergarten classrooms in this district (22:1). Similar to elementary grades, the district uses standards-based report cards and conducts parent-teacher conferences to discuss students' development in accordance with the standards. TK classrooms can be co-located in elementary schools or in standalone early education centers. There were 31 TK teachers. Of these teachers,

100% had a Teaching Credential and 33% had a Child Development Credential. Of the 87% of teachers with non-missing data for education, all had a four-year college degree. The average amount of teaching experience was 11.56 years (*SD* = 7.91; 19% missing data).

The local preschool market. The public school district that was the setting for this study has a competitive preschool market with a preschool-for-all program that provides universal subsidies (up to $4,400 annually) that all families can use toward tuition at public or approved private preschools. Additional financial support is also available for some low-income families (San Francisco Office of Early Care and Education, 2020). Nevertheless, the approved schools have limited openings, and the universal subsidy is small relative to the high annual cost of full-time preschool in San Francisco (Children's Council San Francisco, 2022). Students from low-income families may also be eligible for Head Start, a federal needs-based public preschool program that is not administered by the school district.

Measures

The same measures were used in both studies. Data were obtained from school administrative records. In accordance with the Family Educational Rights and Privacy Act (FERPA), parental consent was not obtained for analysis of de-identified educational data.

Kindergarten Readiness Inventory. The Kindergarten Readiness Inventory (KRI) includes questions from the Fountas & Pinnell Foundational Skills assessment, a common early literacy measure, and the Kindergarten Observation Form, which was used in the National Survey of Children's Health. Nine items are administered to all students by their kindergarten teachers during the first six weeks of the school year (see Table S1 in the online supplemental materials for a description of all nine items, including scoring information). The school district

does not inform kindergarten teachers about whether students attended its preschool or TK programs.

As a data reduction technique, we randomly split our sample in half and used exploratory factor analysis (EFA) followed by confirmatory factor analysis (CFA) with clustered standard errors to inform the creation of composites for use in analysis. In EFA in the first half of the sample, a two-factor model demonstrated poor fit, $\chi^2(df = 19) = 1351.31$, $p < .001$, RMSEA = .105 (90% CI [.100, .110]), CFI = .916, and a four-factor model was not identified. A 3-factor model provided adequate fit to the data, $\chi2(df = 12) = 35.14$, $p < .001$, RMSEA = .017 (90% CI [.011, .024]), CFI = .999. Further, the three-factor model fit significantly better relative to the two-factor model, $\chi^2(df = 7) = 1518.49$, $p < .001$. We confirmed the adequate fit of the 3-factor model in CFA analysis in the other half of the sample, $\chi^2(df = 23) = 844.14$, $p < .001$, RMSEA = .075 (90% CI [.071, .079]), CFI = .947.

Based on this model, we calculated three composites: literacy skills (letter recognition; letter sounds; and early literacy behaviors), cognitive/fine motor skills (pencil grip; name-writing; and counting to 20), and social-emotional skills (follows two-step directions; expresses empathy and caring for others; and demonstrates curiosity and eagerness to learn). Alpha reliability for these composites was .87 for literacy, .72 for cognitive/fine motor skills, and .75 for social-emotional skills. There were large correlations between literacy and cognitive/fine motor skills ($r = .54$) and between cognitive/fine motor and social-emotional skills ($r = .50$), and a moderate correlation between literacy and social-emotional skills ($r = .36$).

Covariates. Parents reported student-level demographic characteristics on an enrollment form. These data included students' date of birth, gender, and race/ethnicity. We calculated student age relative to a reference date of August 15, which immediately preceded the start of

instruction for all three cohorts of students. Special education status was obtained from school records. English language proficiency was assessed using the California English Language Development Test (California Department of Education, 2018) in the 2017−2018 kindergarten year and the English Language Proficiency Assessments for California (California Department of Education, 2020c) in the 2018−2019 and 2019−2020 kindergarten years.

School-level free-and-reduced-price meal (FRPM) status was obtained from publicly available administrative records reported by the district (National Center for Education Statistics, 2020). Kindergarten school quality was measured using the school-level average of California's standardized achievement test scores in grades 3 through 8. These data were obtained from the Stanford Educational Data Archive (The Educational Opportunity Project at Stanford University, 2022). We used kindergarten school-level FRPM and school quality to help substitute for individual-level socioeconomic status because this school district has a policy that prevents them from sharing student-level FRPM data with researchers.

All demographic covariates had less than 0.2% missing data except for race/ethnicity (7.5%) and English language proficiency (15.2%). Mahalanobis matching requires complete data. To ensure that students with missing data for race/ethnicity and English language proficiency were included in our analyses, we replaced the missing values for these variables with a distinct code.

Analytic Plan

In order to understand the impacts of public preschool on kindergarten readiness, we used Mahalanobis matching to ensure that each student who attended public preschool was paired with a demographically similar comparison student who did not attend public preschool in the district. In this procedure, the similarity between each student in the treatment group and each

student in the comparison group is quantified in a matrix of scores (Hansen & Klopfer, 2006). Although propensity score matching is more commonly used, we selected Mahalanobis matching because it is able to approximate a fully blocked experiment, which is less susceptible to bias (King & Nielsen, 2019). Propensity score matching is used to create balance across groups on each of the matching variables *separately*, whereas Mahalanobis distance matching pairs each treated student with a comparison student that is similar across *all* matching variables simultaneously. Unlike propensity score matching, Mahalanobis distance matching reduces bias by ensuring similarity across groups on all possible interactions among the matching variables. We based the matching on students' English language proficiency, race/ethnicity, gender, special education status, age, kindergarten school FRPM rates, and kindergarten school quality. To ensure that each pair of treatment and comparison students was closely matched, a caliper of 1.96 *SD* was used to exclude poor matches.

In Study 1, kindergarteners who attended needs-based preschool were matched to students in the comparison group. To further address socioeconomic factors and childhood exposure to risk as potential confounds in Study 1, we conducted two sensitivity analyses. We tested whether receipt of subsidy and whether participation in a full year, extended-day preschool (which is only offered to at-risk students with special circumstances) moderated program impacts on school readiness. In Study 2, kindergarteners who attended TK were matched to students in the comparison group. It was not possible directly compare the students in Study 1 to the students in Study 2 because these groups have little overlap in age.

To evaluate the impact of each public preschool program on school readiness, we used path analyses in Mplus 7.4. Standard errors were clustered at the classroom level and we used the

robust maximum likelihood estimator. In our impact analyses, we controlled for all demographic characteristics.

Results

Matching Analyses

For statistical comparisons of demographic characteristics across groups within each study, see Table 1. Students who attended needs-based preschool differed significantly from students who did not attend public preschool on English proficiency, race/ethnicity, special education status, age, and school FRPM. The same pattern of demographic differences was also found when comparing students who attended TK to students who did not attend public preschool.

As a result of using the caliper, 81 (4.0%) of the students who enrolled in needs-based preschool and 48 (4.0%) of students who enrolled in TK were excluded from our analysis sample. Relative to students with a close match, students who were excluded were more likely to be enrolled in special education. Excluding 4% of students for whom no close match was found reduces the potential for bias (e.g., due to unmodeled interactions among demographic characteristics) at the cost of decreasing the representativeness of our analysis sample.

After matching, there were no differences between students in the need-based preschool group and students in their comparison group (see Table 2). The only difference between students in TK and students in their comparison group was on age [$p < .001$, standardized mean difference (SMD) = 0.361]. On average, students in TK were seven days older than students in their comparison group. Although we consider this to be negligible difference, we controlled for age in subsequent analyses to account for this imbalance between groups.

Impact Analyses

First, we present results for the three composites. Then, because the cognitive/fine motor composite included a mix of different skills that loaded on a single factor, we present follow-up analyses on the individual items to isolate the effects of preschool on specific skills.

Study 1. Results of the impact analyses for needs-based preschool are presented in Table 3. Needs-based preschool had a positive effect on literacy ($\beta = 0.27$, $SE = 0.03$, $p < .001$) and cognitive/fine motor skills ($\beta = 0.23$, $SE = 0.03$, $p < .001$), but not on social-emotional skills ($\beta = 0.05$, $SE = 0.03$, $p = .133$). Over and above the set of covariates, needs-based preschool explained an additional 1.8% of the variance in literacy and 1.3% of the variance in cognitive/fine motor skills. When we examined impacts on the individual cognitive/fine motor items, needs-based preschool had positive effects on pencil grip (fine motor skills; $\beta = 0.18$, $SE = 0.03$, $p < .001$), name writing (fine motor skills and early literacy; $\beta = 0.22$, $SE = 0.03$, $p < .001$), and counting to 20 (numeracy; $\beta = 0.14$, $SE = 0.03$, $p < .001$).

We conducted a sensitivity analysis to investigate whether the effectiveness of needs-based preschool varied by economic disadvantage. In this moderation analysis, we tested whether receipt of a subsidy moderated the effect of attending preschool on literacy, cognitive/fine motor, or social-emotional skills. The absence of differences in preschool effectiveness by receipt of subsidy would provide additional evidence that the control and treatment groups were successfully equated on economic disadvantage. The interaction was not significant for literacy skills ($\beta = 0.01$, $SE = 0.07$, $p = .912$) or cognitive/fine motor skills ($\beta = 0.10$, $SE = 0.08$, $p = .229$), but it was for social-emotional skills ($\beta = 0.23$, $SE = 0.09$, $p = .010$). Examining the simple effects indicated that attending preschool had a positive effect on social-emotional skills for economically disadvantaged students ($\beta = 0.09$, $SE = 0.04$, $p = .014$) and was

not significantly associated for students who didn't qualify for a subsidy ($\beta = -0.14$, $SE = 0.08$, $p = .086$).

We conducted a second sensitivity analysis to better understand heterogeneity within the needs-based preschool program, which operates extended day, full year schools and school day, academic year schools. In addition to financial need, families qualify for the full-year, extended day program through exposure to additional risk factors (e.g., homeless or seeking permanent housing; parent seeking employment or enrolled as a student). The effectiveness of the full-day program for literacy was moderated by program type ($\beta = 0.12$, $SE = 0.06$, $p = .044$). The effect was positive for students in both programs, but was larger for the full-year, extended-day program ($\beta = 0.32$ $SE = 0.04$, $p < .001$) relative to the academic year, school day program ($\beta = 0.20$, $SE = 0.04$, $p < .001$). This larger effect on literacy may be a result of the increased "dosage" of preschool that students in the full-year, extended day program experience. Results did not differ across program type for cognitive/fine motor skills ($\beta = -0.05$, $SE = 0.07$, $p = .449$) or social-emotional skills ($\beta = -0.10$, $SE = 0.06$, $p = .118$).

Study 2. Results of the impact analyses for TK are presented in Table 4. TK had a positive effect on literacy ($\beta = 0.53$, $SE = 0.04$, $p < .001$), cognitive/fine motor skills ($\beta = 0.28$, $SE = 0.04$, $p < .001$), and social-emotional skills ($\beta = 0.12$, $SE = 0.04$, $p = .004$). Kernel density estimates for literacy are presented in Figure 1. Notably, many students in the TK program scored at or close to the maximum. The skewed distribution suggests that the Kindergarten Readiness Inventory, a brief screening instrument, was unable to fully capture the strength of literacy skills in the TK group, and that the true average would be even higher if the instrument could accurately measure a wider range of ability. Over and above the set of covariates, TK

explained an additional 6.8% of the variance in literacy, 1.8% of the variance in cognitive/fine motor skills, and 0.4% of the variance in social-emotional skills.

When we examined impacts on the individual cognitive/fine motor items, TK had positive effects on pencil grip ($\beta = 0.19$, $SE = 0.04$, $p < .001$), name writing ($\beta = 0.25$, $SE = 0.04$, $p < .001$), and counting to 20 ($\beta = 0.20$, $SE = 0.04$, $p < .001$). These analyses confirm the positive effects of both programs on fine motor skills.

Discussion

Public preschool programs have been framed as a promising mechanism to reduce inequality in access to educational opportunity and promote academic achievement (Friedman-Krauss et al., 2016). To justify taxpayer investments in public preschool programs, policymakers often want evidence that these programs have positive effects on student outcomes (e.g., Cascio & Schanzenbach, 2013). In a large urban public school district, we separately examined the effects of a needs-based preschool program (Study 1) and California's TK program (Study 2) on three aspects of school readiness (i.e., literacy, cognitive/fine motor, and social-emotional skills) measured using a brief, scalable screening instrument at the start of kindergarten. Using data from three recent cohorts of students, we matched kindergartners who attended each program to demographically similar kindergartners who did not attend either program.

Consistent with many previous studies showing that public preschool has positive effects on academic skills (Phillips et al., 2017), both programs had positive effects on literacy. We also observed variation in impacts on literacy across these programs: TK had a large effect, whereas needs-based preschool had a moderate effect. We are among the first studies to examine the effects of preschool on fine motor skills, an important aspect of school readiness with implications for academic and social development in elementary school (Cameron et al., 2016).

Finally, our results add to a small but growing number of studies indicating that the positive effects of public preschool on students' teacher-reported social-emotional skills are negligible.

Effect Sizes for Public Preschool

A previous study using data from the same school district adopted an "intent to treat" approach that used discontinuity to compare kindergarten students who were eligible for TK based on age to those who were not eligible (Doss, 2019). Doss (2019) suggested that the effect of treatment on the treated could be up to three times larger than his estimate because only one third of eligible students actually enrolled in TK. We analyzed students who enrolled in TK, confirming Doss' expectation: Our effect size estimate for literacy in TK was more than twice as large as this earlier study. Our effect size of TK for literacy was comparable to a number of studies public preschool using regression discontinuity (Barnett et al., 2018; Gormley & Gayer, 2005; Weiland & Yoshikawa, 2013) and matching analyses (Ansari et al., 2021). The effect size of the needs-based preschool program for literacy was smaller, and was more in line with a previous study using an experimental design (Lipsey et al., 2013).

Our effect sizes of both types of preschool program for cognitive/fine motor skills were similar to the only other study of motor skills (Gormley & Gayer, 2005). That study similarly used matching analyses but measured a mix of gross and fine motor skills. Our measure of motor skills included two aspects of fine motor skills (pencil grip and name writing) that are associated with the development of academic skills such as literacy (Cameron et al., 2016). Based on the results of factor analysis, these items were combined with a measure of numeracy (counting to 20). We conducted additional analyses with the individual items to confirm that the findings for the composite also applied to the individual items. This was particularly important for pencil grip, which is a relatively pure measure of fine motor skills relative to name writing, which

involves early literacy skills. The effects of both preschool programs on fine motor skills is notable because fine motor skills have more relevance for academic achievement than gross motor skills (Dinehart & Manfra, 2013).

Our findings for social-emotional skills were consistent with previous studies using teachers' reports of students' skills in the classroom context, which typically report either no effect or a small positive effect of preschool. In this study, participation in the needs-based preschool program was unrelated to social-emotional skills. Although TK did have a positive impact on social-emotional skills, the practical significance of the small effect size is unclear. Public preschool programs seeking to have a larger impact on social-emotional aspects of school readiness should adopt evidence-based curricula that specifically target those skills (e.g., Domitrovich et al., 2007) and use curriculum and professional development practices that support effectiveness at scale (Weiland et al., 2018).

Because the implementation of early childhood education differs widely across the U.S., updated studies from other cities and states using a variety of research designs are needed to better differentiate between methodological factors (e.g., differences between regression discontinuity and other causal inference techniques), differences in effectiveness across jurisdictions, and changes over time in the effects of preschool on school readiness (Duncan & Magnuson, 2013). More data is needed to understand how program characteristics contribute to effectiveness and to inform policy decisions (Weiland, 2018).

Implications for Policy and Practice

The brief screening instrument used to measure school readiness at the start of kindergarten represents a sustainable approach to ongoing evaluation of preschool programs. At the start of the school year, kindergarten teachers use structured observations to evaluate all of

their students' literacy, cognitive/fine motor, and social-emotional skills. By leveraging a district-administered, universal kindergarten screener, we demonstrate that is feasible to conduct impact evaluation work on ongoing basis without researcher-initiated data collection. A scalable and sustainable approach to ongoing evaluation the entire population of students has the important advantage of being able to investigate how external events (such as the COVID pandemic) and changes in program eligibility, access, and curricula may affect program effectiveness from year to year. Specifically, this approach can be used to test the expansion of TK in California under AB 130. Rather than providing a snapshot at a single point in time, this approach can be used to explore changes in the effectiveness of early childhood education over time. We provide annotated syntax in an online Appendix (see online supplemental materials) to lower the burden of conducting this kind of evaluation by research-practice partnerships or districts.

In this study, the students who attended the needs-based preschool program and students who attended TK went on to enroll in kindergarten together. Understanding how aspects of program design contribute to differences in school readiness at the start of kindergarten can help us identify ways to improve students' readiness to learn and close opportunity gaps. We speculate that three structural factors could help explain why we found a large effect on literacy for TK and only a moderate effect on literacy for the needs-based preschool program.

First, TK has more demanding credentialing requirements and commensurately higher pay than the needs-based preschool program and may therefore attract higher-quality teachers. The TK program is an exception to a general pattern of lower certification requirements and compensation among preschool teachers relative to elementary school teachers: In May 2019, the median annual wage was $30,520 for preschool teachers and $56,850 for kindergarten teachers (U.S. Bureau of Labor Statistics, 2021). Low teacher pay makes hiring and retaining qualified

teachers difficult, particularly in high-poverty schools (Garcia & Weiss, 2019). Achieving parity with elementary school teachers (as for the TK teachers in this study) could be one way to attract and retain highly qualified teachers who will have larger positive effects on student learning (Barnett, 2003).

Second, the TK curriculum closely follows the kindergarten curriculum, whereas the curriculum for the needs-based preschool program varies across sites and is not as focused on academic skills. The greater focus on academic skills in TK could result in more time spent on literacy instruction relative to the needs-based preschool program. It is notable that TK had a large effect on literacy despite a much larger ratio of students to adults—22:1 in TK vs. 8:1 in the needs-based preschool program.

Third, the population of TK students tends to be older than the population of needs-based preschool students. California's TK program is open to all four-year-olds who will turn five between September 2 and December 2. Children born outside of this three-month window may be eligible for preschool if they are younger and are instead eligible for kindergarten if they are older. The greater impact of the public TK program for literacy could be due to the greater cognitive maturity of TK students. Further, there was much less variability in age in the TK program than in the needs-based preschool program. Preschool-aged students' cognitive and social-emotional skills are developing rapidly (Kopp, 1982; Zelazo et al., 2003). Preschool classrooms that are homogeneous with respect to students' age have been shown to produce larger gains in student learning than classrooms that include students with wider age ranges (Ansari et al., 2016; Moller et al., 2008). Grouping students together by age for instruction could reduce variability in ability, making it easier for teachers to closely target the skill level of many

of their students. More research is needed to understand the potential benefits and drawbacks of homogeneous age grouping and targeted instruction for students in their final year of preschool.

Limitations

When evaluating ongoing educational programs, it is rarely feasible to conduct an experiment. Quasi-experimental methods—such as the matching approach we used in this study—offer an imperfect alternative. Our matching analyses were based age, gender, race/ethnicity, English language proficiency, special education status and school-level FRPM and achievement test scores. However, we were unable to match students based on (1) household income or other measures of socioeconomic status such as parent education because of state policy restrictions on sharing these data; or (2) kindergarten school because restricting the matching to students in the same kindergarten school would have failed to produce a good demographic match between students in the treated and control groups. These matching limitations were partially addressed by matching on school quality (as measured by standardized achievement test scores) and school-level FRPM rates in kindergarten, an approach that has been utilized in other studies of school readiness (Davies et al., 2016). Both of these school-level factors were robust predictors of school readiness scores that helped us to equate students on socioeconomic background and other unmeasured factors that contribute to differences in where students attend kindergarten. However, there is no question that measures of socioeconomic status at the individual level would have been a superior approach. To the extent that matching failed to equate groups based on unobserved characteristics, our estimates of the preschool effects may be biased; however, the inclusion of sensitivity analyses does help to mitigate this concern. Economic risk within the needs-based preschool program did not moderate program effects on literacy or cognitive/fine motor skills.

Another limitation of this study is that we lack information about the early education experiences of children who did not attend the district's public preschool programs. This limitation is common for preschool evaluation studies (Barnett et al., 2018; Doss, 2019; Gormley & Gayer, 2005; Weiland & Yoshikawa, 2013; for exceptions, see Ansari et al., 2021; Lipsey et al., 2018). Within the context of this study, the comparison group included students enrolled in Head Start as well as students who attended private preschool that was partially funded by public subsidy under San Francisco's "Preschool for All" initiative. Crucially, the effects of public preschool programs on student outcomes depend on the quality of the counterfactual early learning environments that students would otherwise experience (Feller et al., 2016). Our study provides information about the benefits of this school district's public preschool programs relative to alternatives that also include other publicly supported preschool programs. In future research, it would be valuable to make comparisons with specific alternatives, including Head Start, private preschool, and care that is not center-based.

A third limitation is that the outcome data used in this study was based entirely on teachers' reports. It is common to observe differences in parents' and teachers' reports, which may be due to contextual differences in behavior between home and school (Sulik et al., 2017). As such, relying solely on teachers' reports provides an important yet incomplete perspective on child functioning. There is also the potential for bias in teachers' reports based on knowledge of students' prior educational experiences. Although this school district does not inform kindergarten teachers about their students early childhood education experiences, teachers may have learned whether students attended pre-K or TK in the district from parents, other school personnel, or the students themselves. This potential for bias may have been partially mitigated by the use of structured observations to inform teachers' ratings in this study (see Table S1 for

information about the items), particularly for the literacy and cognitive/fine motor scores—which were based on easily observable behaviors (e.g., student uses a pencil with the proper grip) and included a detailed scoring rubric (e.g., 1 = Holds pencil with a "fist grip" in the middle or top of pencil; may create basic lines and dots; 4 = Uses pincer grip with firm pressure to make intentional lines and shapes; has enough control to complete a circle).

Finally, we may have underestimated the effectiveness of the TK program for literacy due to the presence of ceiling effects for the literacy measure, which was unable to fully capture variability in literacy skills at the high end of the scale. This measure is part of a brief screening instrument. Our descriptive findings related to the literacy measure suggest that school districts should evaluate whether their screening measures adequately capture the full range of students' knowledge in order to tailor instruction to their true skill level. Such efforts will require scalable, ongoing assessments of classroom-level processes that are brief, easy to administer, and well-validated.

Conclusions

Investments in public preschool are increasing across the United States (Friedman-Krauss et al., 2020). This study provides evidence that contemporary preschool programs continue to have positive impacts on school readiness relative to the counterfactual, even in school districts with competitive private preschool alternatives. Our results indicate that California's TK program, which is offered at no cost to all children in a limited age range, is particularly effective at improving students' academic readiness for kindergarten. In addition, our study illustrates how research-practice partnerships can contribute to a sustainable process of educational evaluation and improvement. As California expands TK into a universal program for four-year-olds, it will

be important to continue this work to understand how effectiveness changes as the program is scaled up.

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Table 1

Group Demographic Characteristics before Matching

	Comparison Group		Study 1: Needs-Based Preschool				Study 2: Transitional Kindergarten			
N	9,487		1,894				1,093			
	n	%	*n*	%	*p*	*SMD*[1]	*n*	%	*p*	*SMD*[1]
English Proficiency					< 0.001	0.257			< 0.001	0.624
English Learner	3,417	36.0	898	47.4			468	42.8		
English Proficient	4,383	46.3	782	41.3			619	56.6		
Missing	1,677	17.7	214	11.3			6	0.5		
Race/Ethnicity					< 0.001	0.475			< 0.001	0.220
Black/African American	382	4.0	169	8.9			90	8.2		
Latinx/Hispanic	1,848	19.5	483	25.5			209	19.1		
Asian	2,462	26.0	547	28.9			284	26.0		
White	1,918	20.2	141	7.4			163	14.9		
Multiracial/Other	2,241	23.6	340	18.0			258	23.6		
Missing	636	6.7	214	11.3			89	8.1		
Female	4,608	48.6	914	48.3	0.822	0.006	534	48.9	0.884	0.006
Special Education	830	7.7	286	15.1	< 0.001	0.235	112	10.2	0.004	0.089
	M	*SD*	*M*	*SD*			*M*	*SD*		
Age	5.44	0.29	5.41	0.27	< 0.001	0.102	5.83	0.07	< 0.001	1.841
School FRPM	0.50	0.22	0.57	0.22	< 0.001	0.315	0.54	0.22	< 0.001	0.166

Notes. Statistical tests for needs-based preschool and for Transitional Kindergarten show differences relative to the comparison group; SMD = Standardized Mean Difference; [1] SMD for multinomial categorical variables is based on Yang and Dalton (2012); FRPM = Free and Reduced Price Meals.

Table 2

Group Demographic Characteristics after Matching

	Study 1: Needs-Based Preschool						Study 2: Transitional Kindergarten					
	Comparison Group		Preschool Group				Comparison Group		Preschool Group			
N	1,813		1,813				1,045		1,045			
	n	%	*n*	%	*p*	*SMD*[1]	*n*	%	*n*	%	*p*	*SMD*[1]
English Proficiency					1.000	0.000					1.000	0.000
English Learner	871	48.0	871	48.0			442	42.3	442	42.3		
English Proficient	752	41.5	752	41.5			599	57.3	599	57.3		
Missing	190	10.5	190	10.5			4	0.4	4	0.4		
Race/Ethnicity					1.000	0.000					1.000	0.000
White/Caucasian	133	7.3	133	7.3			156	14.9	156	14.9		
Black/African American	146	8.1	146	8.1			83	7.9	83	7.9		
Latinx/Hispanic	473	26.1	473	26.1			200	19.1	200	19.1		
Asian	536	29.6	536	29.6			279	26.7	279	26.7		
Multiracial/Other	327	18.0	327	18.0			253	24.2	253	24.2		
Missing	198	10.9	198	10.9			74	7.1	74	7.1		
Female	873	48.2	873	48.2	1.000	0.000	514	49.2	514	49.2	1.000	0.000
Special Education	229	12.6	229	12.6	1.000	0.000	85	8.1	85	8.1	1.000	0.000
	M	*SD*	*M*	*SD*			*M*	*SD*	*M*	*SD*		
Age	5.41	0.27	5.41	0.27	0.976	0.001	5.80	0.10	5.83	0.07	< 0.001	0.361
School FRPM	0.57	0.22	0.57	0.22	0.926	0.003	0.53	0.22	0.54	0.22	0.553	0.026
School Quality	−0.14	0.50	−0.14	0.50	0.913	0.004	−0.07	0.50	−0.07	0.52	0.458	0.032

Notes. SMD = Standardized Mean Difference; [1] SMD for multinomial categorical variables is based on Yang and Dalton (2012);

FRPM = Free and Reduced Price Meals.

Table 3

Study 1: Impacts of the District's Needs-Based Preschool Program on School Readiness

	Literacy			Cognitive/Fine Motor			Social-Emotional		
	β	*SE*	*p*	β	*SE*	*p*	β	*SE*	*p*
Needs-Based Preschool	**0.27**	**0.03**	**< . 001**	**0.23**	**0.03**	**< .001**	**0.05**	**0.03**	**.133**
2018–2019[a]	-0.07	0.05	.193	-0.07	0.08	.379	0.01	0.08	.881
2019–2020 [a]	-0.11	0.05	.020	-0.12	0.07	.096	-0.08	0.08	.316
Age	0.11	0.01	< . 001	0.11	0.01	< .001	0.10	0.02	< .001
Female	0.03	0.03	0.235	0.18	0.03	< .001	0.30	0.03	< .001
English Learner[b]	-0.35	0.04	< . 001	-0.10	0.04	.023	-0.16	0.05	< .001
Missing English Proficiency[b]	-0.18	0.06	.002	-0.06	0.07	.415	-0.07	0.08	.373
Special Education	-0.29	0.05	< . 001	-0.54	0.06	< .001	-0.63	0.06	< .001
Black/African American[c]	-0.41	0.08	< . 001	-0.46	0.09	< .001	-0.37	0.10	< .001
Latinx/Hispanic[c]	-0.48	0.07	< . 001	-0.13	0.08	.091	0.01	0.09	.946
Asian[c]	0.27	0.07	< . 001	0.23	0.07	.002	0.06	0.09	.510
Multiracial/Other[c]	-0.07	0.06	.287	0.00	0.07	.980	0.04	0.08	.604
Missing Race/Ethnicity	-0.06	0.07	.422	-0.03	0.07	.719	-0.07	0.08	.425
Kindergarten School FRPM	-0.12	0.03	< . 001	-0.10	0.04	.005	-0.21	0.04	< .001
Kindergarten School Quality	0.21	0.03	< . 001	0.11	0.04	.004	-0.08	0.04	.049
R^2	34.3%			17.8%			14.0%		

Notes. FRPM = Free and Reduced Price Meals; [a] Relative to "2017–2018"; [b] Relative to "English Proficient"; [c] "Relative to "White/Caucasian"; Coefficients for categorical variables are partially standardized and coefficients are continuous variables are fully standardized.

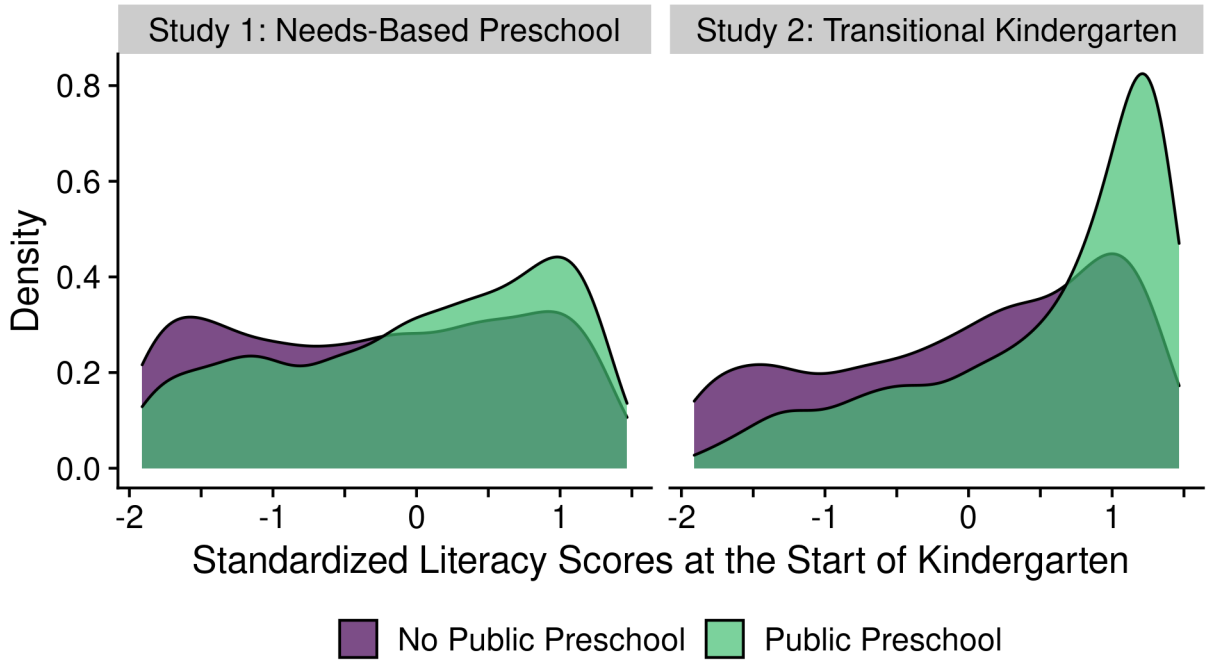
Table 4

Study 2: Impacts of the District's Transitional Kindergarten Program on School Readiness

	Literacy			Cognitive/Fine Motor			Social-Emotional		
	β	*SE*	*p*	β	*SE*	*p*	β	*SE*	*p*
Transitional Kindergarten	**0.53**	**0.04**	**< .001**	**0.28**	**0.04**	**< .001**	**0.12**	**0.04**	**.004**
2018–2019[a]	-0.06	0.05	.286	-0.06	0.07	.389	0.05	0.07	.481
2019–2020[a]	-0.11	0.06	.057	-0.15	0.08	.045	-0.11	0.08	.162
Age	0.06	0.02	.001	0.08	0.02	.001	0.07	0.02	.002
Female	0.10	0.03	.005	0.17	0.04	< .001	0.30	0.04	< .001
English Learner[b]	-0.35	0.05	< .001	-0.07	0.05	.195	-0.16	0.05	.001
Missing English Proficiency[b]	0.23	0.39	.557	-0.07	0.33	.830	0.00	0.47	.993
Special Education	-0.32	0.07	< .001	-0.66	0.09	< .001	-0.71	0.08	< .001
Black/African American[c]	-0.33	0.09	< .001	-0.39	0.11	< .001	-0.51	0.11	< .001
Latinx/Hispanic[c]	-0.48	0.07	< .001	-0.21	0.09	.015	-0.21	0.08	.011
Asian[c]	0.24	0.06	< .001	0.12	0.07	.081	-0.01	0.07	.859
Multiracial/Other[c]	0.00	0.06	.974	-0.02	0.07	.729	-0.01	0.07	.842
Missing Race/Ethnicity	-0.07	0.09	.452	-0.03	0.10	.763	-0.06	0.10	.575
Kindergarten School FRPM	-0.11	0.03	.001	-0.07	0.04	.078	-0.21	0.05	< .001
Kindergarten School Quality	0.21	0.03	< .001	0.14	0.04	.001	-0.12	0.05	.009
R^2	35.9%			17.2%			13.4%		

Notes. FRPM = Free and Reduced Price Meals; [a] Relative to "2017–2018"; [b] Relative to "English Proficient"; [c] "Relative to "White/Caucasian"; Coefficients for categorical variables are partially standardized and coefficients are continuous variables are fully standardized.

Figure 1. Kernel density estimates of literacy scores in the needs-based preschool (Study 1) and transitional kindergarten (Study 2) matched samples for students who did and did not enroll in public preschool in the district.



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Highlights

- We studied the short term impacts of two public preschool programs in California.
- Programs included needs-based preschool and Transitional Kindergarten.
- We matched students who attended preschool to otherwise similar kindergarteners.
- Both programs had positive impacts on school readiness at kindergarten entry.
- Transitional Kindergarten was especially effective for students' literacy skills.