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Executive Summary

High-quality early learning has the potential to narrow disparities in children's learning and development prior to kindergarten entry, particularly for children from families with low incomes and children who are multilingual learners. However, studies have shown that only programs that are of high quality are likely to close gaps in children's learning and development.

California has several publicly funded early learning programs to support young children. To provide all families with information about program quality and to support program improvement, the state has developed Quality Counts California (QCC), a system that provides ratings on several dimensions of program quality. However, questions have emerged about how best to measure quality and the degree to which the current rating system generates accurate and useful information about the quality elements that support equitable learning and development. Thus, in this study we asked: Do children in higher-quality-rated programs exhibit greater learning and development than children in lower-rated programs? If so, does this pattern hold for children who are multilingual learners, children with disabilities, and children from different racial/ethnic groups?

This study investigates the relationships between preschool quality and children's learning and development from fall to spring of 1 school year through the analysis of child- and program-level data from approximately 70,000 children, ranging in age from 4.5 to 5.5 years old, in 1,700 QCC-rated preschool programs, the majority of which were center-based California State Preschool Programs. Learning and development was assessed using children's fall and spring scores on three domains of the Desired Results Developmental Profile, a developmental assessment administered by children's classroom teachers. We used multiple regression models to estimate the additional months of learning and development associated with attending a higher-rated program (Tier 4 or Tier 5) above and beyond the months of learning and development projected for a child attending a program rated Tier 3. The relatively small number of programs rated Tiers 1 and 2 were excluded from the analysis.

Key findings include the following:

- **Children in higher-tier programs showed more learning and development than those in lower-tier programs.** From fall to spring of the given study year, compared to children in Tier 3 programs, children in Tier 4 programs gained an additional 1.2–1.7 months of learning and development, and those in Tier 5 programs gained an additional 2.2–2.5 months. The gains are educationally meaningful: Giving all of California's children access to high-quality programs could substantially improve their early learning and development.
- **Multilingual learners, children with disabilities, and children from all racial/ethnic groups exhibited more learning and development in higher-tier programs.** Multilingual learners in Tier 5 programs gained an additional 2.6–2.8 months of learning and development compared to their peers in Tier 3 programs. The benefits associated with attending a higher-tier program were larger for multilingual learners than non-multilingual learners in each area of development. Children with disabilities in Tier 5 programs were projected to show 2.9–3.2 more months of learning and development than their peers in Tier 3 programs. Children with disabilities benefited more from attending a higher-quality

program than children without disabilities in each area of development. Children from all racial/ethnic groups were projected to experience greater learning and development when attending Tier 4 and 5 programs, compared to Tier 3, although most differences were not statistically significant.

- **Preschool children who are Black, Hispanic/Latino/a, or Multiracial were underrepresented in higher-quality programs.** These children were more likely to attend lower-tier programs (Tier 3) and less likely to attend higher-tier programs (Tier 4 and Tier 5) than children who are Asian/Pacific Islander, White, or Native American. Indeed, children who are Black were more likely to be in lower-quality (Tier 3) programs and less likely to be in highest-quality (Tier 5) programs than children from any other racial/ethnic group. The systematic underrepresentation of certain children of color in higher-quality programs is a significant equity concern.

This study suggests that attending a higher-quality-rated program is associated with greater learning and development than attending a lower-quality-rated program. Future research should explore the extent to which all children have access to high-quality programs, based on where they live, their family income, and the hours of care they need for a full day of care, to understand the degree to which some children have systematically less access to high-quality programs. A similar study could examine these questions for early learning programs serving younger children (birth through age 3) and those in home-based settings. Researchers should also conduct more detailed studies about how classroom or program practices relate to children's learning and development, and how this may vary in different types of programs for different groups of children.

Introduction

Research shows concerning disparities in California children's knowledge and skills at kindergarten entry—a gap that persists through their later schooling.[1] High-quality preschool can help narrow this gap.[2] Evidence shows that when supported with high-quality early learning, children from all sociodemographic groups can acquire the knowledge and skills necessary for school success throughout elementary school and beyond.[3] However, many California children do not have access to early learning programs, and the existing publicly funded early learning options vary widely in funding and quality standards.[4]

Over the past decade, California has developed a quality rating and improvement system to support and evaluate program quality across a diverse system and inform families seeking care. This system, called Quality Counts California (QCC),[5] is a collaboration between three state agencies: First 5 California, the California Department of Education, and the California Department of Social Services. It uses a multifaceted approach to assess and improve the level of quality in early learning and care programs.[6] Early learning and care sites are rated on seven elements and assigned a final quality rating in a tiering system that ranges from Tier 1 (the lowest overall rating) to Tier 5 (the highest overall rating). Participation in QCC is voluntary, with 28% of licensed early learning centers participating in QCC during the 2020–21 funding year.[7]

The seven QCC elements are: (1) child observation, (2) developmental and health screenings, (3) lead teacher qualifications, (4) teacher–child interactions, (5) teacher–child ratios and group size, (6) program environment rating scales, and (7) director qualifications. Ratings are assigned by trained assessors based on program documentation and classroom observations. (See the Quality Counts California Rating Matrix.)[8]

As California expands access to early childhood education, questions have emerged about how the rating system measures quality and the extent to which programs that receive high ratings benefit different groups of children. Some research suggests that assessed program quality is associated with child learning and outcomes, but other studies have found weak or no relationship between quality assessments and child outcomes.[9] Given major investments in QCC, and incentives for programs to improve their ratings, it is important to know the ways in which California's quality rating system measures elements of quality that support all children's learning and development. To address this issue, we asked the following questions: Do children in higher-quality-rated programs exhibit greater learning and development than children in lower-rated programs? And if so, does this pattern hold for children who are multilingual learners, children with disabilities, and children from different racial/ethnic groups?

This study provides new information about the association between program quality ratings and child-level data from publicly supported preschools in California. QCC program quality data were analyzed with child-level data about children's learning and development from the Desired Results Developmental Profile (DRDP), a developmental assessment administered by children's classroom teachers. The DRDP is completed based on teacher and family observations in five essential readiness domains (social and emotional development, language and literacy development, mathematics, approaches to learning–self-regulation, and physical development), and several optional domains. The DRDP is completed in the fall and spring in many ECE programs, including the California State Preschool Program, and thus provides an opportunity to understand how much children learn and develop over the course of the preschool year. Empirical research demonstrates that the assessment is

valid for formative and summative assessment with diverse groups of children, including those identified as multilingual learners,[10] children with disabilities,[11] and those from different racial/ethnic groups.[12]

In this study, we find that programs with higher-quality ratings do indeed appear to be associated with children's learning and developmental progress, and that the benefits of high-quality programs are significant for preschool children with disabilities and multilingual learners, and across most demographic groups. However, we also find that children who are Black, Hispanic/Latino/a, or Multiracial are less likely to attend higher-rated programs, which has important implications for equity.

Study Methods

Our analysis examined children's growth in learning and development from fall to spring on the DRDP assessment. The analytic data set included fall and spring assessment scores from approximately 70,000 children who were between 4.5 and 5.5 years old, most of whom were enrolled in center-based California State Preschool Programs throughout California in 2016–17 and 2017–18. (For more information, see Appendix A: Detailed Study Methodology.)

We examined the relationship between attending a higher-tier preschool and children's learning and development. Although children in all tiers grew from fall to spring, the statistical models estimated the additional months of learning and development associated with attending a higher-tier preschool. In other words, we calculated the "value added" for higher-quality preschools, defined as the additional months of learning and development projected for a child in a higher-tier program (Tier 4 or Tier 5) compared to the months of learning and development projected for a child in Tier 3. Tier 1–rated programs were excluded from the analysis because too few of these programs completed the DRDP.[13] Tier 2–rated programs were excluded because of the broad variability in the definition of Tier 2 across QCC consortia during initial implementation. For example, some consortia assigned Tier 2 as a temporary tier rating when data were not yet available across all rating elements. Furthermore, programs with a Tier 2 rating were observed to be the most mobile group and were likely to be in a higher tier during the following rating period.

To transform the results into months of learning and development, we divided the estimated differences between tiers by the expected growth per month calculated with simple linear regression in a large sample of 4- and 5-year-olds.[14]

The statistical models estimated the effect of preschool program tier on each child's spring assessment scores, controlling for their fall scores; the tier of their preschool program; and demographic information, including race/ethnicity, whether they were classified as a multilingual learner, whether they had an Individualized Education Plan (IEP), and gender. Furthermore, to simplify interpretation of the results, children's Tier 3 growth was the reference category, with a baseline value of zero. This allowed the Tier 4 and Tier 5 estimates to be interpreted as the "value added" associated with attending a higher-tier program, above and beyond that of Tier 3. We present the standardized effect sizes,[15] with interpretation similar to Cohen's *d*, to support cross-study comparability. (Appendix A contains additional details about the effect size calculations.)

We also explored the degree to which the benefits associated with attending a higher-tier program extended to different demographic groups. We examined the distribution of value-added scores for children identifed as multilingual learners, those with disabilities, and those from different racial/ethnic groups. Note that cross-group comparisons (e.g., multilingual learners vs. non-multilingual learners; multilingual learners vs. children with disabilities) should be made with caution, recognizing that each group has its own Tier 3 baseline, set to zero.

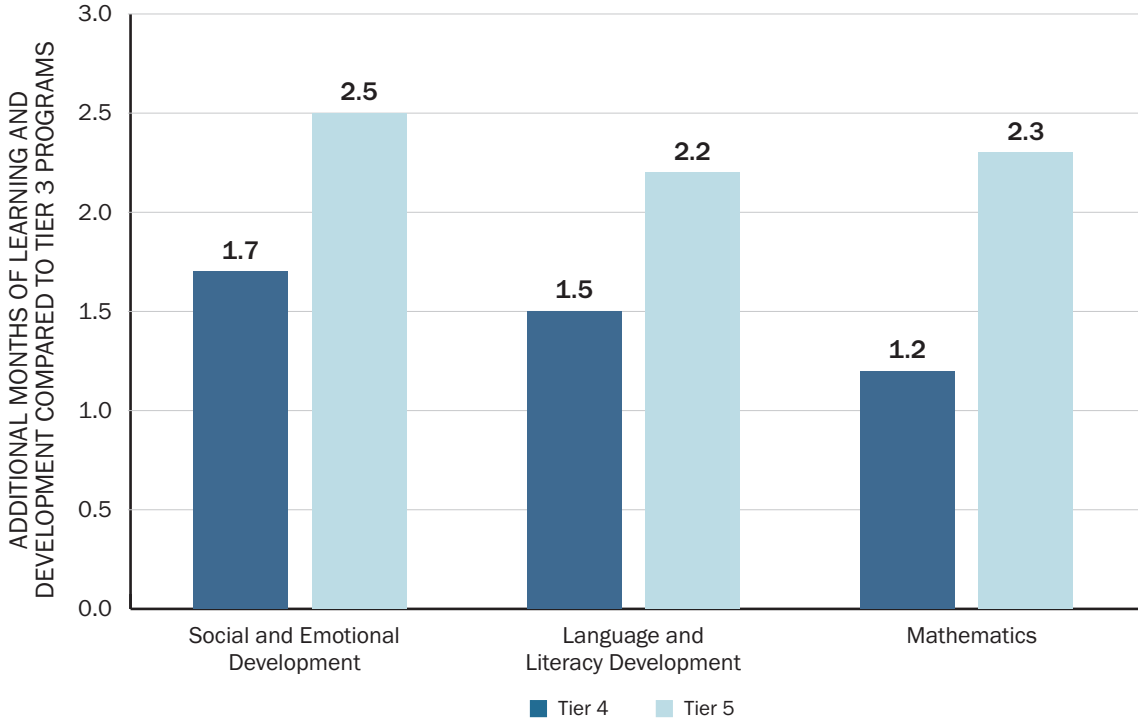
Findings

Children in Higher-Tier Programs Showed More Learning and Development Than Those in Lower-Tier Programs

On average, children who attended preschools with higher-tier ratings demonstrated greater learning and development than those attending preschools with lower-tier ratings, after controlling for other potentially confounding variables. Figure 1 shows the additional months of learning and development projected for a child in a Tier 4 or 5 program, compared to the learning and development of a child in a Tier 3 program (set to zero). (Tiers 1 and 2 were excluded for reasons described in the Study Methods section.) The figure shows learning and development in three main areas: social and emotional development, language and literacy development, and mathematics. From fall to spring of the given study year, compared to children in Tier 3 programs, children in Tier 4 programs gained an additional 1.2–1.7 months of learning and development, and those in Tier 5 programs gained an additional 2.2–2.5 months. (See Table 1.)

Prior research on the effects of preschool programs operating at scale suggests that the magnitude of the reported effect sizes for the differences between tiers (i.e., incremental increases in program quality)—ranging from 0.08 to 0.16 standard deviations—should be interpreted as modest but educationally meaningful gains in children's learning and development.[16]

Figure 1
Learning and Development in Tier 4 and Tier 5 Programs, Compared to Tier 3 Programs



Data sources: Desired Results Developmental Profile data, California Department of Education and California Department of Social Services, 2016–18; Quality Counts California data, First 5 California, 2016–18.

Table 1
Learning and Development by Dimension and Program Tier

Dimension	Tier	Est.	Robust Std. Err.	*p* value (vs. Tier 3)	*p* value (vs. Tier 4)	Effect Size *(SD)*
Social and Emotional Development	3	*Baseline*	0.47			
	4	1.71	0.26	0.001		0.10
	5	2.47	0.41	< 0.001	0.110	0.14
Language and Literacy Development	3	*Baseline*	0.40			
	4	1.45	0.22	0.001		0.10
	5	2.21	0.36	< 0.001	0.066	0.15
Mathematics	3	*Baseline*	0.41			
	4	1.16	0.23	0.013		0.08
	5	2.31	0.36	< 0.001	0.005	0.16

Note: Tier 3, the baseline, is fixed to zero. Tier 4 and Tier 5 estimates reflect the additional months of learning and development compared to Tier 3 programs.

Data sources: Desired Results Developmental Profile data, California Department of Education and California Department of Social Services, 2016–18; Quality Counts California data, First 5 California, 2016–18.

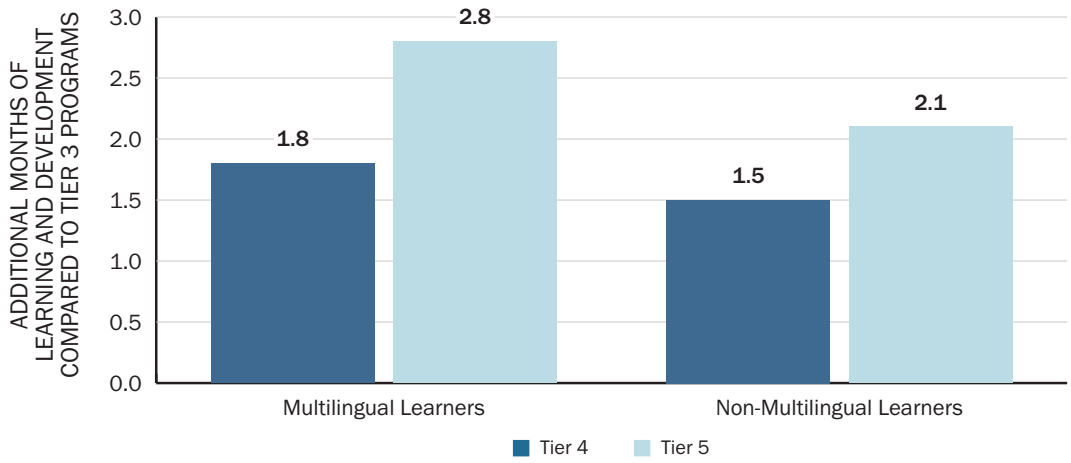
Multilingual Learners, Children With Disabilities, and Children From All Racial/Ethnic Groups Exhibited More Learning and Development in Higher-Tier Programs

All groups of children benefited from attending higher-tier programs, and for most groups the differences were statistically significant. Specifically, for multilingual learners, children with disabilities, and children from various racial/ethnic groups, attendance in a higher-tier program (Tier 4 or Tier 5) was associated with significantly greater learning and development from fall to spring. The following analyses examine each demographic group's projected additional months of learning and development from attending higher-tier programs compared to attending Tier 3 programs.

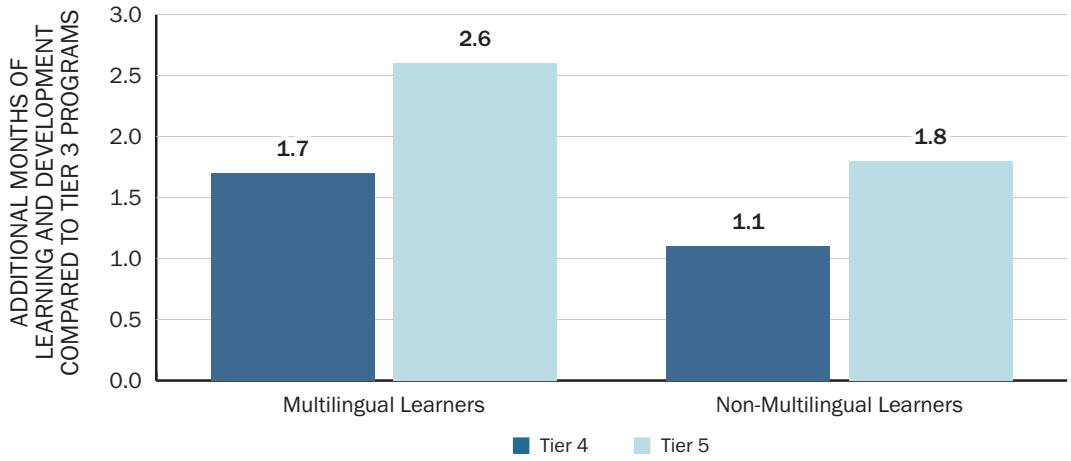
Multilingual Learners: Both multilingual learners and non-multilingual learners exhibited more learning and development in Tier 4 and Tier 5 programs than their peers in Tier 3 programs. (See Figure 2.) Multilingual learners in Tier 5 programs gained an additional 2.6–2.8 months of learning and development compared to multilingual learners in Tier 3 programs. In addition, attendance in a higher-tier program was associated with relatively larger gains for multilingual learners than non-multilingual learners in each area, with gaps between multilingual learners and non-multilingual learners closing most for children in Tier 5 programs. (Tier 5 estimates ranged from 2.6 to 2.8 months of learning and development for multilingual learners and 1.8 to 2.1 months for non-multilingual learners). Such a consistent pattern, although not statistically significant,[17] suggests that attending a higher-tier program may be associated with smaller gaps between multilingual learners and non-multilingual learners in learning and development during preschool. (See Table 2 for more detail.) The results were similar for multilingual learners from both Hispanic/Latino/a and Asian/Pacific Islander groups.

Figure 2
Learning and Development by Multilingual Learner Status and Program Tier

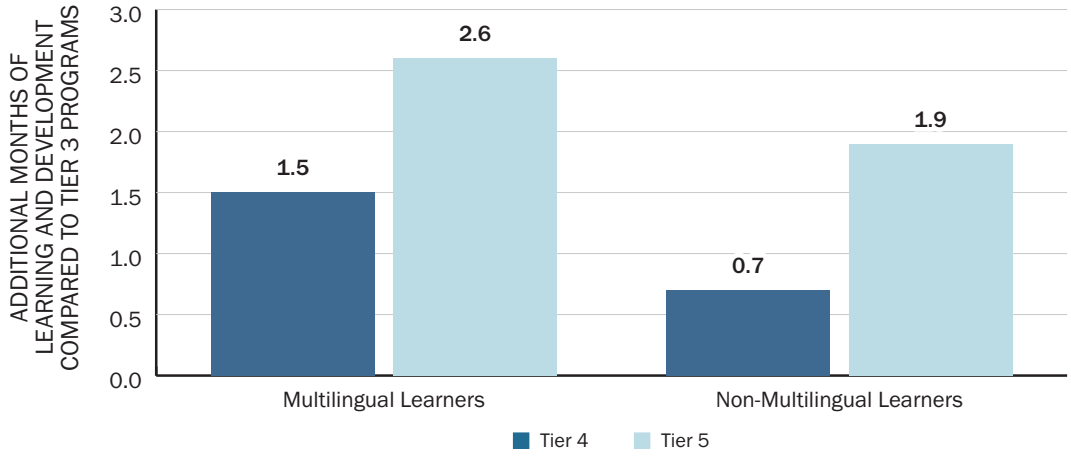
Social and Emotional Development



Language and Literacy Development



Mathematics



Data sources: Desired Results Developmental Profile data, California Department of Education and California Department of Social Services, 2016–18; Quality Counts California data, First 5 California, 2016–18.

Table 2
Learning and Development by Multilingual Learner Status, Dimension, and Tier

Group	Dimension	Tier	Est.	Robust Std. Err.	*p* value		Effect Size (*SD*)
					vs. Tier 3	vs. Tier 4	
Multilingual Learners	Social and Emotional Development	3	*Baseline*	0.58			
		4	1.84	0.31	0.005		0.11
		5	2.77	0.46	< 0.001	0.084	0.16
	Language and Literacy Development	3	*Baseline*	0.48			
		4	1.73	0.25	0.001		0.12
		5	2.58	0.38	< 0.001	0.060	0.18
	Mathematics	3	*Baseline*	0.50			
		4	1.50	0.26	0.007		0.11
		5	2.64	0.39	< 0.001	0.012	0.19
Non-Multilingual Learners	Social and Emotional Development	3	*Baseline*	0.51			
		4	1.55	0.30	0.007		0.09
		5	2.09	0.48	0.003	0.323	0.12
	Language and Literacy Development	3	*Baseline*	0.45			
		4	1.11	0.27	0.028		0.08
		5	1.75	0.43	0.004	0.190	0.12
	Mathematics	3	*Baseline*	0.47			
		4	0.74	0.28	0.167		0.05
		5	1.91	0.43	0.002	0.017	0.13

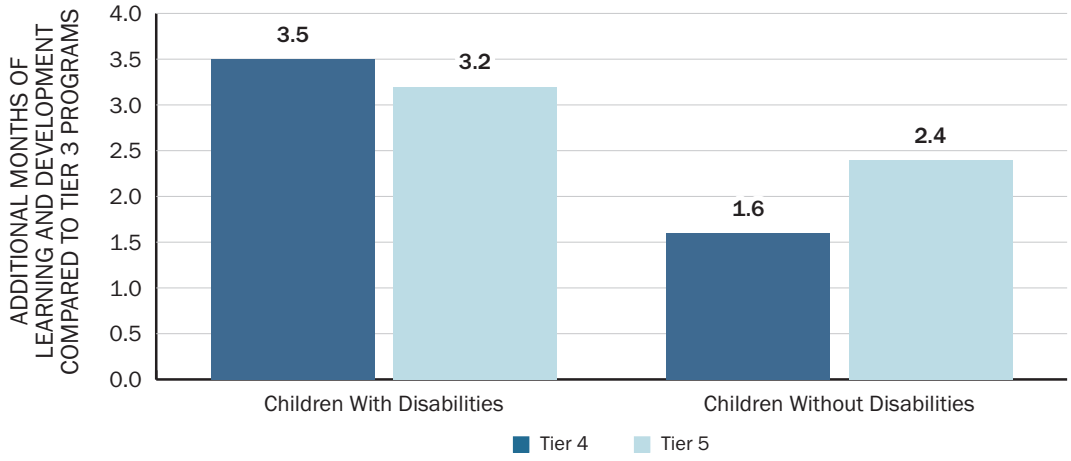
Note: Tier 3, the baseline, is fixed to zero. Tier 4 and Tier 5 estimates reflect the additional months of learning and development compared to Tier 3 programs.

Data sources: Desired Results Developmental Profile data, California Department of Education and California Department of Social Services, 2016–18; Quality Counts California data, First 5 California, 2016–18.

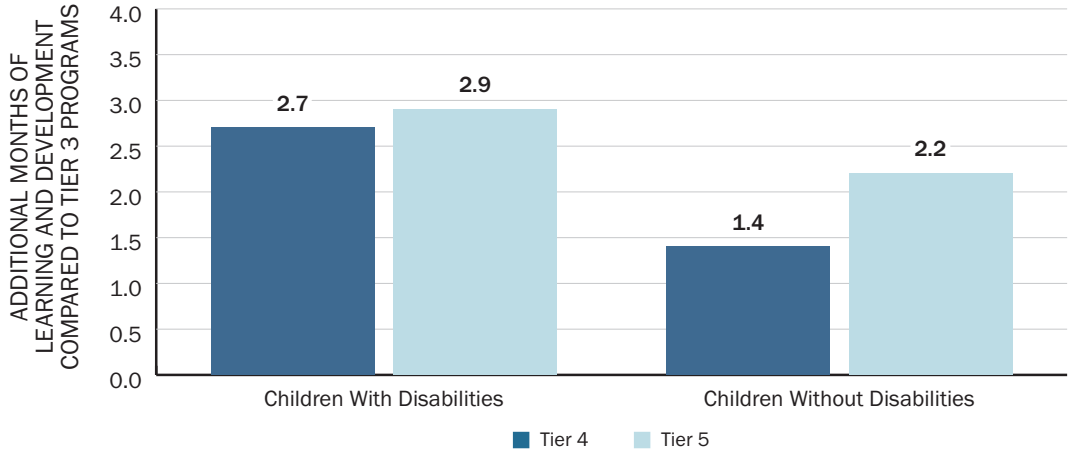
Special Education Status: Children with disabilities (reported by the teacher as having an IEP) who attended Tier 4 and Tier 5 programs experienced greater learning and development than their peers in Tier 3 programs. On average, the amount of growth associated with higher tiers was greater for children with identified disabilities than for those without. Across the three areas studied (social and emotional development, language and literacy development, and mathematics), the additional learning and development associated with attending a TIer 4 program ranged from 2.4 to 3.5 months for children with disabilities and 1.1 to 1.6 months for children without identified disabilities. Likewise, the effects associated with Tier 5 ranged between 2.9 and 3.2 months of additional learning and development for children with disabilities and 2.2 and 2.4 months for children without identified disabilities (see Figure 3). These findings suggest that, as with multilingual learners, attending a higher-tier program was associated with shrinking gaps in learning and development for children with disabilities compared to their peers. (See Table 3 for more detail.)

Figure 3
Learning and Development by Disability (IEP) Status and Program Tier

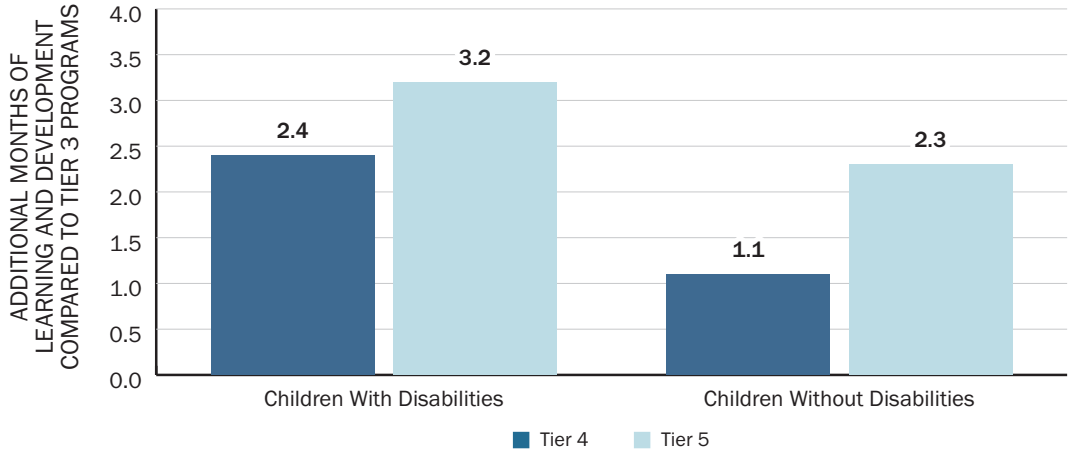
Social and Emotional Development



Language and Literacy Development



Mathematics



Data sources: Desired Results Developmental Profile data, California Department of Education and California Department of Social Services, 2016–18; Quality Counts California data, First 5 California, 2016–18.

Table 3
Learning and Development by Disability (IEP) Status, Dimension, and Tier

Group	Dimension	Tier	Est.	Robust Std. Err.	*p* value		Effect Size (*SD*)
					vs. Tier 3	vs. Tier 4	
Children With Disabilities	Social and Emotional Development	3	*Baseline*	0.89			
		4	3.48	0.49	< 0.001		0.20
		5	3.22	0.58	0.003	0.734	0.19
	Language and Literacy Development	3	*Baseline*	0.62			
		4	2.68	0.39	< 0.001		0.19
		5	2.88	0.49	< 0.001	0.745	0.20
	Mathematics	3	*Baseline*	0.68			
		4	2.37	0.38	0.002		0.17
		5	3.22	0.46	< 0.001	0.156	0.23
Children Without Disabilities	Social and Emotional Development	3	*Baseline*	0.48			
		4	1.62	0.27	0.003		0.10
		5	2.44	0.42	< 0.001	0.086	0.14
	Language and Literacy Development	3	*Baseline*	0.41			
		4	1.39	0.23	0.002		0.10
		5	2.18	0.37	< 0.001	0.058	0.15
	Mathematics	3	*Baseline*	0.42			
		4	1.10	0.24	0.020		0.08
		5	2.27	0.36	< 0.001	0.005	0.16

Note: Tier 3, the baseline, is fixed to zero. Tier 4 and Tier 5 estimates reflect the additional months of learning and development compared to Tier 3 programs.

Data sources: Desired Results Developmental Profile data, California Department of Education and California Department of Social Services, 2016–18; Quality Counts California data, First 5 California, 2016–18.

Race/Ethnicity: Figure 4 shows the projected additional months of learning and development by tier for children from different racial/ethnic groups. Overall, compared to their peers in Tier 3, all racial/ethnic groups of children were projected to experience more months of learning and development when attending Tier 4 and Tier 5 programs. The direction of the association between tier and growth consistently showed the benefits of higher-tier programs in almost all cases, but results were statistically significant only for preschool children who are Hispanic/Latino/a and, for a few domains, children who are Multiracial (see Table 4).

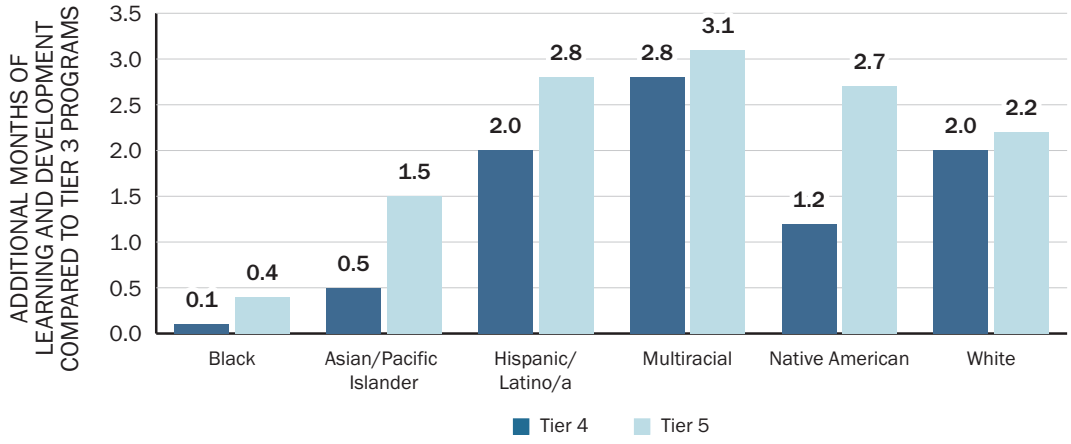
One anomalous negative association was found in mathematics for children who are Native American; in this group, children in Tier 4 programs experienced slightly fewer months of learning and development than their peers in Tier 3. One potential reason for this finding is

that the sample size for Tier 3 was small (n = 75), and this group demonstrated relatively strong growth. For children who are Black or Asian/Pacific Islander, the magnitude of the additional gains from being in a Tier 4 or Tier 5 program was smaller than what was found for students in other racial/ethnic groups in social and emotional development. This was also the case in language and literacy development for children who are Black. However, for both groups, the pattern of successively higher gains in successively higher-quality programs held across all areas of learning and development.

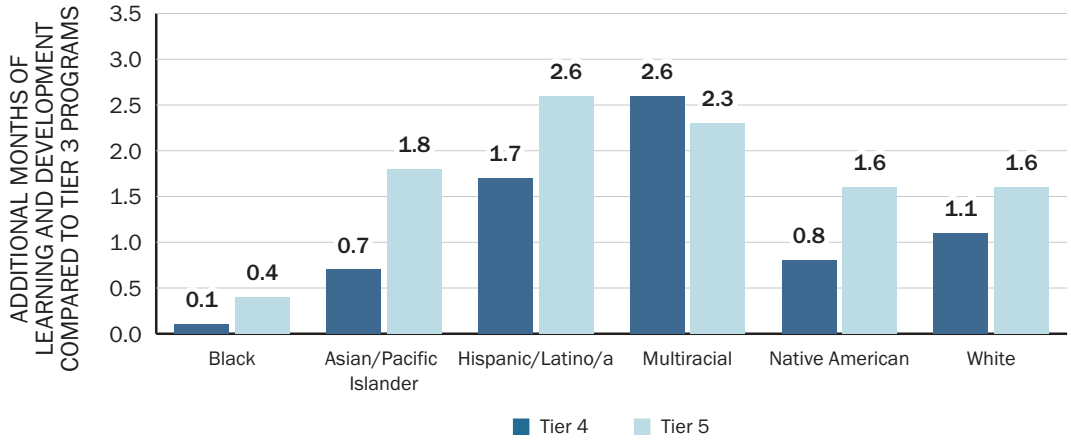
Small sample sizes for groups of children in particular program tiers likely contributed to the statistical nonsignificance of the results for several racial/ethnic subgroups. (See Appendix B.) As a result, even the 1.7 months estimated value added in mathematics for children in Tier 5 who are Black—an educationally meaningful amount of growth by conventional accounts—was below the level that would be statistically significant (see Limitations and Areas for Future Study for additional discussion).

Figure 4
Learning and Development by Race/Ethnicity and Tier

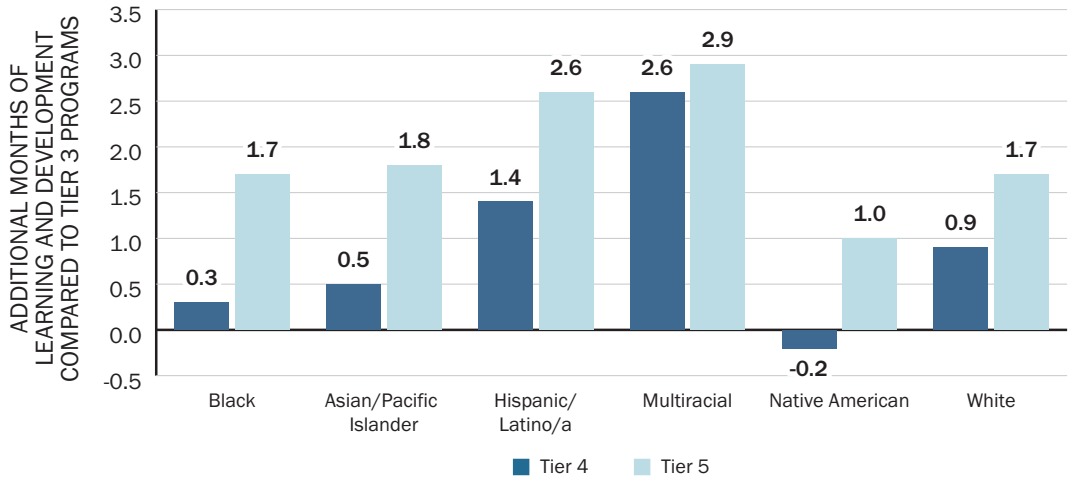
Social and Emotional Development



Language and Literacy Development



Mathematics



Data sources: Desired Results Developmental Profile data, California Department of Education and California Department of Social Services, 2016–18; Quality Counts California data, First 5 California, 2016–18.

Table 4
Learning and Development by Race/Ethnicity, Dimension, and Tier

Group	Dimension	Tier	Est.	Robust Std. Err.	*p* value		Effect Size (*SD*)
					vs. Tier 3	vs. Tier 4	
Black	Social and Emotional Development	3	*Baseline*	1.08			
		4	0.06	0.44	0.955		<0.01
		5	0.43	0.83	0.751	0.693	0.03
	Language and Literacy Development	3	*Baseline*	0.93			
		4	0.11	0.39	0.910		0.01
		5	0.41	0.73	0.727	0.715	0.03
	Mathematics	3	*Baseline*	0.99			
		4	0.29	0.45	0.783		0.02
		5	1.72	0.78	0.170	0.110	0.12
Asian/ Pacific Islander	Social and Emotional Development	3	*Baseline*	1.06			
		4	0.56	0.46	0.625		0.03
		5	1.56	0.71	0.222	0.233	0.09
	Language and Literacy Development	3	*Baseline*	0.86			
		4	0.67	0.38	0.473		0.05
		5	1.83	0.6	0.080	0.097	0.13
	Mathematics	3	*Baseline*	0.74			
		4	0.54	0.41	0.518		0.04
		5	1.84	0.68	0.066	0.093	0.13
Hispanic/ Latino/a	Social and Emotional Development	3	*Baseline*	0.51			
		4	1.98	0.32	< 0.001		0.12
		5	2.79	0.43	< 0.001	0.122	0.16
	Language and Literacy Development	3	*Baseline*	0.43			
		4	1.74	0.27	< 0.001		0.12
		5	2.55	0.39	< 0.001	0.085	0.18
	Mathematics	3	*Baseline*	0.44			
		4	1.35	0.27	0.008		0.09
		5	2.56	0.39	< 0.001	0.010	0.18

Group	Dimension	Tier	Est.	Robust Std. Err.	*p* value		Effect Size (*SD*)
					vs. Tier 3	vs. Tier 4	
Multiracial	**Social and Emotional Development**	3	*Baseline*	1.28			
		4	2.78	0.64	0.043		0.16
		5	2.98	1.27	0.095	0.886	0.18
	Language and Literacy Development	3	*Baseline*	1.21			
		4	2.54	0.51	0.044		0.18
		5	2.23	1.04	0.159	0.793	0.15
	Mathematics	3	*Baseline*	1.06			
		4	2.61	0.56	0.027		0.18
		5	2.77	1.05	0.062	0.895	0.19
Native American	**Social and Emotional Development**	3	*Baseline*	2.21			
		4	1.24	0.79	0.598		0.07
		5	2.69	1.48	0.313	0.352	0.16
	Language and Literacy Development	3	*Baseline*	1.73			
		4	0.81	0.69	0.665		0.06
		5	1.60	1.25	0.456	0.542	0.11
	Mathematics	3	*Baseline*	1.67			
		4	-0.16	0.70	0.931		-0.01
		5	1.00	1.24	0.630	0.377	0.07
White	**Social and Emotional Development**	3	*Baseline*	0.89			
		4	2.02	0.42	0.030		0.12
		5	2.15	0.78	0.063	0.878	0.13
	Language and Literacy Development	3	*Baseline*	0.81			
		4	1.07	0.35	0.203		0.07
		5	1.56	0.59	0.114	0.458	0.11
	Mathematics	3	*Baseline*	0.92			
		4	0.86	0.39	0.373		0.06
		5	1.65	0.50	0.116	0.206	0.12

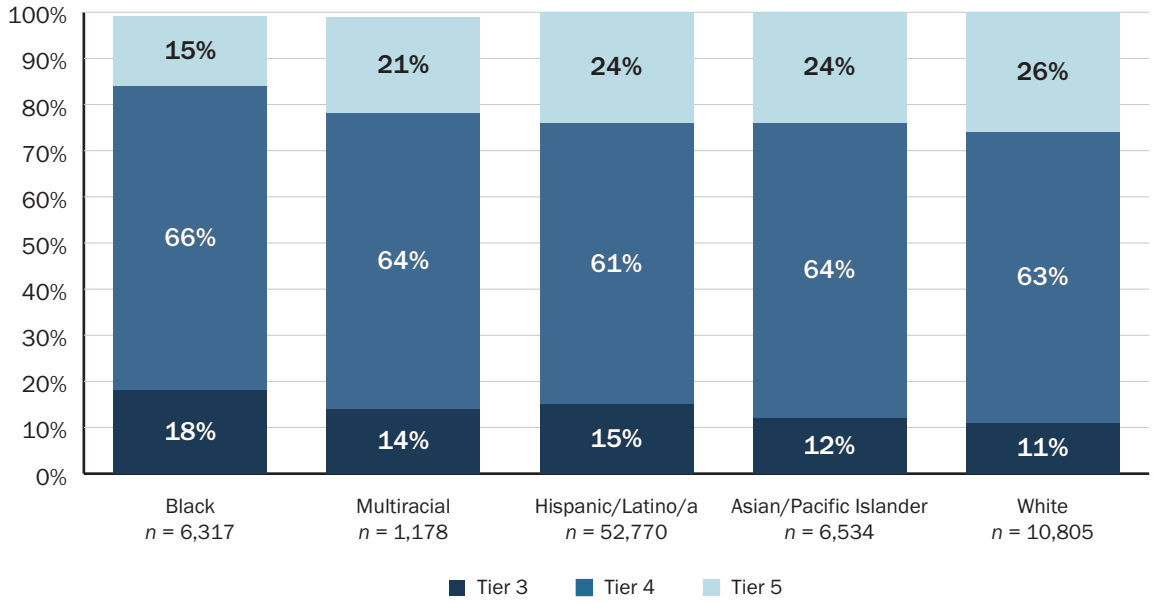
Note: Tier 3, the baseline, is fixed to zero. Tier 4 and Tier 5 estimates reflect the additional months of learning and development compared to Tier 3 programs.

Data sources: Desired Results Developmental Profile data, California Department of Education and California Department of Social Services, 2016–18; Quality Counts California data, First 5 California, 2016–18.

Preschool Children Who Are Black, Hispanic/Latino/a, or Multiracial Were Underrepresented in Higher-Tier Programs

Concerningly, children who are Black, Hispanic/Latino/a, or Multiracial appear proportionately more likely to attend lower-tier programs (Tier 3) than children who are White, Asian/Pacific Islander, or Native American.[18] Figure 5 shows the percentage of children from different racial/ethnic groups who attended programs in each tier. Overall, 14% of children in the sample were in Tier 3 programs, 63% in Tier 4, and 23% in Tier 5. (See also Appendix B.) Children who are Black were more likely to be in Tier 3 programs and less likely to be in Tier 5 programs than children from any other racial/ethnic group.[19] If high-quality-rated preschools indeed offer more equitable opportunities for learning and development than lower-quality-rated preschools, the systematic underrepresentation of many children of color—particularly children who are Black—in Tier 5 programs is a significant equity concern.

Figure 5
Prevalence of Children in High-Quality Programs, by Race/Ethnicity



Data sources: Desired Results Developmental Profile data, California Department of Education and California Department of Social Services, 2016–18; Quality Counts California data, First 5 California, 2016–18.

Limitations and Areas for Future Study

This study suggests that children attending higher-quality-rated programs demonstrate greater progress in learning and development than children attending lower-quality programs. This trend holds for multilingual learners, children with disabilities, and children from different racial/ethnic groups.

There are a few key limitations of this study that limit the generalizability of the results and warrant further study.

One limitation is that the analytic data set lacked information about how families selected preschool programs for their children. We do not know the extent to which children and families who attended higher-tier programs are systematically different from children and families who attended lower-tier programs, or whether certain groups of children have systematically less access to highly rated programs. However, we believe the QCC tier rating was unlikely to be a consideration in preschool choice because rating information was not generally available to families before they enrolled their child in the program. We suspect that eligibility, geography, and hours of care may be the most influential factors when selecting a preschool; however, additional study is needed. Future research might examine how and why different families choose different programs, as well as the relationship between where children live and the programs to which they have access, to evaluate the potential effects of residential segregation by poverty and race.

In addition, the currently available data sources lacked information about family income or family socioeconomic status. It is possible that omitting family income induced a spurious positive relationship between tier and growth in our analyses, although four factors mitigate this possibility. First, since state preschool eligibility is limited to children whose families earn less than 85% of State Median Income, we expect that most of the children in the study come from families with low incomes. Second, families with the lowest incomes have a path to high-quality programs through eligibility for Head Start programs that tend be ranked in higher tiers than other programs.[20] Third, statistically controlling for each child's fall score mitigated the potential effects of omitted variables on the same outcome measured in the spring. Finally, statistical sensitivity analyses suggest that an omitted variable is unlikely to be powerful enough to invalidate the findings (see Appendix A). In the future, we plan to examine the relationships between socioeconomic status and outcomes by linking income eligibility and home zip code data to the current data set.

Another limitation is that the children studied were not a representative sample of children in California, so the results might not be extrapolated to programs serving all children. Specifically, a disproportionate number of children in this study were non-White multilingual learners from families with low incomes. Children were predominately around 5 years old and enrolled in publicly supported center-based programs (see Appendix B). Further studies might examine the relationship between quality rating and child outcomes in other types of programs, including family child care homes, programs that do not qualify for public funding, and those that serve younger children.

The measures used to assess program quality and those used to assess learning and development are also imperfect. QCC tier level is a rough approximation of quality that leaves open many questions about which elements of quality matter most for supporting children's growth, and emerging literature suggests that complex relationships exist between different aspects of quality and child outcomes.[21] In the future, researchers could conduct more detailed studies about

classroom or program practices and children's early learning experiences that relate to children's learning and development. Such a study could look at the varying experiences of children from different backgrounds in different settings to understand how they experience particular programs.

We also recognize that the DRDP, as an observational assessment, might be subject to concern about teachers' reliability as assessors.[22] It is not a perfect assessment; however, we note that the DRDP is well validated,[23] and that reliability and validity concerns exist with all forms of child assessment, including direct assessments[24] and on-demand task performance assessments[25]—especially for children with developmental delays[26] and children who are multilingual learners.[27] In terms of fairness, psychometric studies of the DRDP have examined assessment bias for children from different racial/ethnic groups, for multilingual learners, for children with disabilities, and for other groups and failed to find meaningful differences indicative of bias.[28]

Finally, the sample sizes of children who identified as Black and Native American are much smaller than those of the other groups, and the results for these groups should be interpreted cautiously. The statistically nonsignificant findings in Table 4 may be explained, at least in part, by small sample sizes (after disaggregation by race/ethnicity and cluster-adjusted standard errors) that decreased the minimum detectible difference between tiers.

Conclusion

This study provides new information about the association between preschool quality ratings and children's learning and development. The study results suggest that children in higher-quality-rated programs showed more learning and development compared to children in lower-tier programs. These differences were educationally meaningful and extended to most demographic groups of children, including multilingual learners, children with disabilities, and children from most racial/ethnic groups. The results suggest that attending higher-quality programs could be associated with more equitable outcomes for children who are multilingual learners and children with disabilities, and that differences between groups may narrow when all children are in high-quality programs. Although higher-rated programs appeared to benefit children across racial/ethnic groups, preschool children who are Black, multiracial, or Latino/a were underrepresented in Tier 4 and 5 programs, which is an equity concern.

Appendix A: Detailed Study Methodology

This study examined the relationship between preschool quality and child development using regression-based statistical methods.

Sample and Assessment

We analyzed data from preschool programs throughout California that were rated Tier 3, 4, and 5, most of which were supported by state or federal funds. The sample includes 86,464 children who were ages 4.5 to 5.5 in the spring of 2017 or 2018. All children were assessed with the Desired Results Developmental Profile and were enrolled in a program with a Quality Counts California tier rating.[29] Early childhood educators entered information about the children's race/ethnicity, status as a multilingual learner, whether the child had an Individualized Education Plan (IEP), and the child's gender into an online database. The sample was representative of the geographic and racial/ethnic diversity of children in state preschool throughout California and therefore also represented higher percentages of children of color, multilingual learners, children with disabilities, and children from families with low-socioeconomic status as compared to the general population.

Only children with both fall and spring scaled scores in the relevant DRDP domain of learning and development were included in the regression analyses. The scaled scores were from three out of the five DRDP essential readiness domains—domains that align to the National Education Goals Panel and Race to the Top–Early Learning Challenge domains of readiness: social and emotional development, approaches to learning/self-regulation, language and literacy, cognition (of which mathematics is a subset), and physical development. The final sample sizes for the regression analyses were between 69,308 and 69,895 children within 1,725 unique programs.

Teachers completed the DRDP based on observations of children's relevant skills, knowledge, and behaviors demonstrated during children's authentic learning experiences. To complete the DRDP, teachers collected documentation about the developmental competencies they observed children demonstrating over a 6-week period. They then made rating determinations for each DRDP item, called a measure, and entered the ratings into the DRDP online software system. After the close of the data entry period in spring 2017 or spring 2018, fall and spring data were extracted from the data system and cleaned for analyses. Records were extracted for further analysis that included only children who were around 60 months of age at the time of the spring 2017 or spring 2018 assessment, defined as children who were between 54 and 66 months of age and who would likely enter kindergarten in fall 2017 or fall 2018, respectively.

Statistical Methods

We fit regression models to estimate the average fall-to-spring gain on the DRDP. Our outcome variables were each child's spring scores on three DRDP subscales: social and emotional development, language and literacy development, and mathematics. Our predictor variables included six measures: (1) the quality of their preschool (the program's QCC tier rating); (2) race/ethnicity; (3) status as a multilingual learner; and (4) special education status/eligibility (presence of an IEP), controlling for (5) their fall score and (6) their gender. The regression models allowed us to segment the data into various comparison groups with identical metrics—e.g., Multiracial, female, non-multilingual learner, non-special education learner—with similar fall DRDP scores. In this way, intragroup comparisons were able

to isolate the association between preschool quality and change (or growth) in DRDP subscale scores from fall to spring by controlling for the effects of the other variables. The models accounted for the multilevel structure of the data (children nested in sites) using cluster robust standard errors (for N = 1,725 clusters in the analytic data). We did not have the data to disaggregate analyses at the classroom level, though adjusting at the highest level of aggregation produces accurate standard errors.

Months of learning and development was calculated independently for each of the three DRDP scales. The expected growth per month was the marginal linear growth in DRDP scaled scores for a large sample (N = 175,000) of 5-year-olds based on simple regression of DRDP score on child age in months (continuous). The standardized effect sizes reported in Tables 1–4 were calculated using the estimated difference between tiers divided by the standard deviation of the DRDP scores in the fall and the spring (calculated separately for each of the three DRDP scales as the simple average of the standard deviation for the fall DRDP scores and the standard deviation of the spring DRDP scores).

For the analyses, first we analyzed the overall relationship between QCC tier rating and the gains in DRDP scores (i.e., predicted spring scores controlling for fall scores). This analysis included all the children with complete records as described above. Second, we examined whether gains in each of the QCC tiers differed by multilingual learner status, special education status, and race/ethnicity. Finally, we sought to understand the distribution of children within each of the quality tiers (i.e., the degree to which different groups of children have a similar probability of attending high-quality programs). We calculated the proportion of children from each racial/ethnic group who were enrolled in each of the preschool quality tiers. Then, to statistically compare these proportions, we used logistic regression (single level), controlling for multilingual learner status, special education status, and gender.

Sensitivity Analyses

We aimed to quantify the magnitude of the relationship that a potential omitted variable (e.g., socioeconomic status) would need to have with (a) tier and (b) spring DRDP score (in social and emotional development, language and literacy development, or mathematics) to invalidate the current findings. We did this by inducing a spurious correlation through an omitted variable between tier and spring DRDP outcome, using a statistical method for sensitivity analysis.[30] To invalidate our findings regarding the contrast between tier levels 3–5, the partial correlation between the omitted variable and tier needed to be equal to or greater than 0.32, *and* the partial correlation between the omitted variable and spring DRDP also needed to be equal to or greater than 0.32. For context, we compared this value with that of the partial correlation between fall DRDP score and spring DRDP score. The effect of the omitted variable needed to be at least 61% as large as the partial correlation between fall DRDP score and spring DRDP score. In the context of education research, the low-socioeconomic-status sample, and our statistical model that already controls for fall scores and race/ethnicity, a partial correlation of such magnitude is unlikely. We thus concluded that our models were adequately robust to omitted confounding variables.

Appendix B: Number of Programs and Children by Tier, Demographic Group, and Setting

Table B1: Number of Programs and Children in Each Tier

Tier	# Programs	% Programs	Children	% Children
1	–	–	–	–
2	96	5.3	3,538	3.9
3	280	15.4	12,143	13.5
4	1,062	58.3	54,174	60.2
5	385	21.1	20,147	22.4
Total	**1,823**	**100.0**	**90,002**	**100.0**

Note: Tier 1 programs were not included in the data set. Children in Tier 1–rated programs constitute < 0.5% of children in QCC-rated programs systemwide. Children in Tier 2 programs were included in this table but were dropped from the analytic data set. There were 1,725 programs in Tiers 3–5 that enrolled children whose scores were included in the analysis.

Table B2: Number of Children in Each Tier, by Race/Ethnicity

	Tier				
Race/Ethnicity	2	3	4	5	Total
Black	412	1,163	4,199	955	6,729
Asian/Pacific Islander	118	758	4,185	1,591	6,652
Hispanic/Latino/a	2,657	8,100	32,256	12,414	55,427
Multiracial	18	169	757	252	1,196
Native American	14	75	3,118	1,364	4,571
White	167	1,192	6,776	2,837	10,972
Unspecified	152	686	2,883	734	4,455
Total	**3,538**	**12,143**	**54,174**	**20,147**	**90,002**

Note: Children in Tier 2 programs were included in the table but were dropped from the analytic data set.

Table B3: Number of Children in Each Tier, by Multilingual Learner Status

	Tier			
Group	3	4	5	Total
Multilingual Learners	6,492	27,951	11,424	45,867
Non-Multilingual Learners	5,651	26,223	8,723	40,597
Total	**12,143**	**54,174**	**20,147**	**86,464**

Table B4: Number of Children in Each Tier, by Disability (IEP) Status

Group	Tier			Total
	3	4	5	
Children With Disabilities	553	3,025	1,375	4,953
Children Without Disabilities	11,590	51,149	18,772	81,511
Total	**12,143**	**54,174**	**20,147**	**86,464**

Table B5: Number of Children in Each Tier, by Program Setting

Setting	Tier				Total
	2	3	4	5	
State Preschool	1,195	6,808	38,484	15,389	61,876
Head Start	76	505	5,887	1,755	8,223
Child Care Center	1,578	2,121	3,175	750	7,624
Other (unspecified)	353	1,132	2,039	334	3,858
First 5 Local Funding	0	26	470	345	841
Title I	14	128	154	8	304
Migrant	0	77	90	26	193
Family Child Care	4	7	15	9	35
Tribal Head Start	0	1	3	0	4
Unspecified	318	1,338	3,857	1,531	7,044
Total	**3,538**	**12,143**	**54,174**	**20,147**	**90,002**

Note: Children in Tier 2 programs were included in the table but were dropped from the analytic data set.

Data sources for all tables in appendix: Desired Results Developmental Profile data, California Department of Education and California Department of Social Services, 2016–18; Quality Counts California data, First 5 California, 2016–18.

Appendix C: Estimated Regression Coefficients

This section contains regression results in the scaled score metric of the DRDP assessment (i.e., prior to conversion into months of development). There are four tables of regression estimates that correspond to the analysis by Tier (Table C1), Tier * Multilingual Learner Status (Table C2), Tier * Disability (IEP) Status (Table C3), and Tier * Race/Ethnicity (Table C4). Each of the tables contains the results from three separate regressions. The regressions use a child's score on one of the three DRDP scales from the spring semester as the outcome variable (social and emotional development, language and literacy development, or math) while controlling for the child's fall score on the same scale and the other variables listed in the table. The robust standard errors control for 1,725 clusters (sites) using a clustered sandwich estimator.

Table C1: Tier

	Social and Emotional		Language and Literacy		Math	
	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.
Fall score	0.52***	0.01	0.57***	0.01	0.57***	0.01
Tier 4	7.04**	2.19	6.59**	2.03	5.43*	2.17
Tier 5	10.17***	2.56	10.03***	2.42	10.85***	2.53
Asian/Pacific Islander	2.63	2.05	4.99**	1.88	9.22***	2.17
Hispanic/Latino/a	2.88	1.66	0.47	1.56	1.08	1.80
Multiracial	5.03*	2.20	5.05**	1.95	6.14**	2.16
Native American	2.58	3.38	4.50	3.21	4.57	3.41
White	0.52	1.92	1.41	1.77	2.73	1.95
Multilingual Learner	-1.38	1.04	-1.74	1.01	-0.13	1.02
Female	7.85***	0.46	5.29***	0.42	2.70***	0.44
Disability (IEP) Status	-15.35***	1.48	-15.43***	1.28	-12.33***	1.25
Constant	309		281		279	
R^2	0.32		0.36		0.33	
F	314		325		218	
n	69,895		69,563		69,308	

Note: *p<0.05, **p<0.01, ***p<0.001.

Table C2: Tier x Multilingual Learner Status

	Social and Emotional		Language and Literacy		Math	
	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.
Fall Score	0.52***	0.01	0.57***	0.01	0.57***	0.01
Tier 4	6.37**	2.36	5.06*	2.30	3.48	2.52
Tier 5	8.60**	2.85	7.95**	2.78	8.96**	2.94
Multilingual Learner	-2.84	2.35	-4.41	2.26	-3.18	2.53
Tier 4 x Multilingual Learner	1.23	2.57	2.81	2.47	3.57	2.75
Tier 5 x Multilingual Learner	2.80	2.96	3.75	2.80	3.42	3.08
Asian/Pacific Islander	2.75	2.04	5.12**	1.88	9.32***	2.16
Hispanic/Latino/a	3.01	1.66	0.60	1.56	1.18	1.79
Multiracial	5.10*	2.19	5.13**	1.95	6.20**	2.15
Native American	2.66	3.37	4.56	3.20	4.58	3.40
White	0.62	1.93	1.52	1.78	2.81	1.95
Female	7.85***	0.46	5.29***	0.42	2.70***	0.44
Disability (IEP) Status	-15.36***	1.48	-15.44***	1.28	-12.33***	1.25
Constant	310		282		281	
R^2	0.32		0.36		0.33	
F	266		276		185	
n	69895		69563		69308	

Note: *p<0.05, **p<0.01, ***p<0.001.

Table C3: Tier x Disability (IEP) Status

	Social and Emotional		Language and Literacy		Math	
	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.
Fall Score	0.52***	0.01	0.57***	0.01	0.57***	0.01
Tier 4	6.67**	2.24	6.31**	2.07	5.15*	2.22
Tier 5	10.07***	2.60	9.92***	2.46	10.65***	2.58
Disability (IEP)	-20.87***	3.67	-19.84***	2.76	-17.18***	3.21
Tier 4 x IEP	7.66	4.03	5.84	3.14	5.95	3.58
Tier 5 x IEP	3.21	4.24	3.15	3.35	4.45	3.73
Asian/Pacific Islander	2.67	2.05	5.02**	1.88	9.25***	2.17
Hispanic/ Latino/a	2.90	1.66	0.49	1.56	1.10	1.80
Multiracial	5.01*	2.20	5.04**	1.95	6.14**	2.16
Native American	2.60	3.38	4.52	3.21	4.59	3.41
White	0.55	1.92	1.43	1.77	2.76	1.95
Female	7.84***	0.46	5.28***	0.42	2.70***	0.44
Multilingual Learner	-1.37	1.04	-1.74	1.01	-0.12	1.02
Constant	309		281		280	
R^2	0.32		0.36		0.33	
F	269		283		189	
n	69895		69563		69308	

Note: *p<0.05, **p<0.01, ***p<0.001.

Table C4: Tier x Race/Ethnicity

	Social and Emotional		Language and Literacy		Math	
	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.
Fall Score	0.52***	0.01	0.57***	0.01	0.57***	0.01
Tier 4	0.25	4.51	0.50	4.45	1.35	4.91
Tier 5	1.75	5.53	1.86	5.32	8.06	5.88
Asian/Pacific Islander	0.76	5.90	2.36	5.38	8.46	5.26
Hispanic/Latino/a	-3.92	4.23	-6.02	4.03	-2.90	4.50
Multiracial	-4.01	5.35	-3.39	4.87	-1.76	5.09
Native American	-2.20	8.79	2.01	7.37	7.48	7.65
White	-5.68	5.19	-2.04	5.20	1.30	5.92
Tier 4 x Asian/Pacific Islander	2.06	6.12	2.53	5.66	1.18	5.64
Tier 4 x Hispanic/ Latino/a	7.90	4.37	7.41	4.30	4.99	4.77
Tier 4 x Multiracial	11.19	5.94	11.02*	5.34	10.89	5.61
Tier 4 x Native Am.	4.85	9.48	3.17	8.12	-2.09	8.47
Tier 4 x White	8.05	5.31	4.37	5.40	2.69	6.08
Tier 5 x Asian/Pacific Islander	4.67	7.03	6.45	6.51	0.57	6.75
Tier 5 x Hispanic/ Latino/a	9.75	5.29	9.72	5.11	3.94	5.72
Tier 5 x Multiracial	10.51	7.68	8.29	7.07	4.91	7.40
Tier 5 x Native Am.	9.31	10.79	5.41	9.46	-3.36	9.82
Tier 5 x White	7.09	6.62	5.24	6.39	-0.35	7.06
Multilingual Learner	-1.35	1.03	-1.71	1.00	-0.09	1.02
Female	7.85***	0.46	5.29***	0.42	2.70***	0.44
Disability (IEP) Status	-15.35***	1.47	-15.45***	1.28	-12.36***	1.24
Constant	315		286		282	
R^2	0.32		0.36		0.33	
F	169		173		116	
n	69895		69563		69308	

Note: *p<0.05, **p<0.01, ***p<0.001.

Data sources for all tables in appendix: Desired Results Developmental Profile data, California Department of Education and California Department of Social Services, 2016–18; Quality Counts California data, First 5 California, 2016–18.

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8. The tier ratings are based on a site's score on each of the seven QCC elements. These elements were determined through collaboration between local QCC consortia, the California Department of Education, the California Department of Social Services, First 5 California, and other interested parties. Individual elements each have a research base that indicates their importance in quality ECE, with evidence ranging from suggestive to strong. The Quality Counts California Rating Matrix can be found at https://www.cde.ca.gov/sp/cd/rt/californiaqris.asp.

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13. Less than 0.5% of children attend programs with QCC Tier 1 rating.

14. Estimates are from simple regression of DRDP score on child age in a sample of N = 175,000 children. Separate calculations were used for each of the three DRDP scales.

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17. Wald tests of differences in value added between multilingual learners and non-multilingual learners (e.g., the difference between Tier 5 value added for multilingual learners vs. that for non-multilingual learners) were not statistically significant.

18. $p < 0.001$ for all pairwise contrasts using logistic regression method.

19. $p < 0.001$ for all pairwise comparisons via logistic regression method.

20. 94% of Head Start programs were rated in Tier 4 or Tier 5 versus 65% of privately run child care centers.

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29. DRDP scaled scores were obtained from the DRDP Online™ data system. QCC tier rating data was obtained from the QCC Common Data File via upload from local QRIS data systems. The standards for determining tier ratings were established in the QCC Quality Rating Matrix and Implementation Guide, developed through a joint project of First 5 California and the California Department of Education, with input by local QCC consortia. The QCC Rating Matrix and Implementation Guide is available at https://drive.google.com/file/d/12FYjpxCyCrMT3B6crb4QWf9ALJ0r_iH7/view?usp=sharing.

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