

Kindergarten Impacts of the Pennsylvania Pre-K Counts Program

A Statewide Evaluation



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Kindergarten Impacts of the Pennsylvania Pre-K Counts Program: A Statewide Evaluation

Executive Summary

Pennsylvania Pre-K Counts Program Overview

Pennsylvania Pre-K Counts (PA PKC) is a state-funded prekindergarten program for 3- and 4-year-old children to help them gain school readiness skills. The goal of PA PKC is to help reduce educational disparities by providing high quality prekindergarten for children who lack opportunities or reside in environments that place them at risk of school failure. The PA PKC program guidelines define children at risk as those who are living in households below 300 percent of the federal poverty rate, are English Language Learners (ELL), or who are at risk due to community factors, academic difficulties, or economic disadvantage.

PA PKC spaces are offered in school districts, Head Start, Department of Education privately licensed nursery schools, and high quality child care settings. Children attend 180 days per year, with either half-day or full-day options. The program guidelines include a number of standards consistent with high quality, including teacher qualifications, curriculum and instruction, screening and assessment, classroom self-assessments, and family engagement.

Impact Study Purpose

This Impact Study examined the effects of participation in PA PKC on children's early academic, social, and executive function skills in kindergarten. In particular, the study focused on whether there were differences in performance for children with 1 or 2 years of enrollment in PA PKC compared to children with no ECE experience in the 2 years prior to kindergarten.

Research Questions

Two primary research questions (1 and 2) guided the study to examine the effects of participation in PA PKC. A third research question (3) examined potential moderators, or factors that might have an influence on any effects found for program participation.

1. *Do children who attended PA PKC have higher levels of academic and social skills in kindergarten than children with no prior preschool experience?*
2. *Are kindergarten skills different for children who attended PA PKC for 1 year (enrolling at age 4) or 2 years (enrolling at age 3)?*
3. *Are there differences in the effects of PA PKC based on various program characteristics – percent of 3-year-olds served, region of the state, or level of urbanicity/rurality?*

Summary of Results

- On average, children's outcome scores were similar to population means, with slightly higher scores for measures of letter-word recognition, math problem-solving, and social skills than for other outcomes.
- There were positive effects of PA PKC participation on children's language and math outcomes. In kindergarten, children who attended PA PKC had significantly higher levels of language skills (Picture Vocabulary, $d=.30$) and math skills (Applied Problems $d=.22$, Quantitative Concepts $d=.22$) compared to children who did not attend PA PKC. The results showed no differences on other literacy, executive function, and social skills measures.

- These results also showed meaningful differences in the months of learning gains related to participation in PA PKC for language skills (PV=5.02 months of gain) and math skills (AP=3.88 months of gain, QC=5.14 months of gain).
- These effects of PA PKC were not different for children who attended for 1 year (enrolling at age 4) or 2 years (enrolling at age 3).
- The effects of PA PKC on children’s outcomes did not differ based on program characteristics – the percent of 3-year-olds enrolled in PA PKC, geographic region, or urbanicity/rurality.

Conclusions

Overall, there were consistent positive effects of program attendance on children’s language and math outcomes, regardless of the initial age of enrollment in PA PKC. These findings are important given that language and math skills have been shown to be the school readiness skills that most strongly predict subsequent academic achievement. For children who participated in PA PKC, these differences were equivalent to an increase of approximately 4-5 months of learning, a substantial difference in terms of skills development, particularly for young children.

These results suggest that early prekindergarten experiences in PA PKC may provide an important buffer, particularly for children from low-income families or who are otherwise at greater risk for school failure. Given that these differences between PA PKC participants and non-participants were evident during the second half of the kindergarten year, these results further suggest that prekindergarten participation could offer a potential strategy to help mitigate summer learning loss.

While acknowledging the challenges when classrooms include children with a range of developmental levels and prior experiences, such as occurs in many PA PKC classrooms, outcomes did not differ based on age of enrollment in PA PKC. Findings from a companion Implementation Study of the PA PKC Program indicated that there was little differentiation in curriculum and instruction based on age group, although most administrators reported that differentiation was broadly based on developmental level. Results from the Implementation Study further found that PA PKC administrators who enrolled higher proportions of 3-year-olds reported higher levels of implementation challenges, including those related to staffing. Taken together, these findings suggest that greater attention to instructional practices may be warranted to ensure children are benefiting from a second year of program participation.

Further, the general lack of findings for measures of literacy skills, social skills, and executive function suggests additional areas to examine for potential professional development and quality improvement activities. It would be particularly worthwhile to consider instructional practices that are most likely to promote positive outcomes to ensure that PA PKC continues to offer a high-quality program designed to best prepare children for school success. In order to support sustaining these effects into the early elementary years, it may be important to examine the extent of P-3 alignment across grades, while continuing to base prekindergarten practices on developmentally appropriate early learning standards.

In sum, the results of this evaluation demonstrate positive benefits on language and math skills in kindergarten for children who attended PA PKC compared to similar children with no prior ECE experience in the 2 years before kindergarten. Thus, it would appear that PA PKC is well suited to promote key school readiness skills known to predict later reading and academic success.

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Effects of Prekindergarten on School Readiness

Early childhood education (ECE) plays a critical role in building school-readiness, including academic and social-emotional skills, in young children.^{i ii} State prekindergarten programs, like Pennsylvania Pre-K Counts (PA PKC), have gained popularity as mechanisms to improve equitable access to high-quality ECE and to improve opportunities for more children to achieve academic proficiency.ⁱⁱⁱ Enrollment in state prekindergarten is associated with positive short-term effects on children's language, literacy, and math skills across a number of studies.^{iv v vi vii viii ix x xi} Given these results, many states offer public prekindergarten programs to enhance access to high-quality ECE programs in an effort to improve school-readiness and reduce the income-based achievement gap.^{xii}

Most states (88%) provide a state prekindergarten program, primarily serving 4-year-olds, with fewer offering services to children as young as age 3.^{xiii} Similarly, prekindergarten expansion has focused on increasing access for children in the year prior to kindergarten. From 2002 to 2018, state prekindergarten enrollment increased from 14% to 33% for 4-year-olds, and only increased from 3% to 6% over that same time period for 3-year-olds.^{xiv} In 2018, only 5.7% of 3-year-olds were enrolled in state prekindergarten programs. Yet, children with 2 years of similarly high-quality publicly-funded programming in Head Start settings had better academic outcomes compared to children attending for 1 year.^{xv xvi} Studies of state prekindergarten programs have not focused on the effects of an additional year offered at age 3. Because PA PKC serves a substantial number of children in both age groups, this study included examination of the impact of enrollment for 1 year (as a 4-year-old) or 2 years (as a 3- and 4-year-old) on kindergarten outcomes compared to children who had no early childhood education (ECE) experiences in the 2 years prior to kindergarten.

Overview of the Pennsylvania Pre-K Counts Program

PA PKC is a state-funded prekindergarten program for 3- and 4-year-old children to help them gain school readiness skills. The goal of PA PKC is to help reduce educational disparities by providing high quality prekindergarten for children who lack opportunities or reside in environments that place them at risk of school failure. The PA PKC program guidelines define children at risk as those who are living in households below 300 percent of the federal poverty rate, are English Language Learners (ELL), or who are at risk due to community factors, academic difficulties, or economic disadvantage.^{xvii}

PA PKC is the largest of the four preschool programs overseen by the Pennsylvania Department of Education, in addition to the Ready to Learn Block Grant, Pennsylvania Head Start Supplemental Assistance Program, and the Pennsylvania Four-Year-Old Kindergarten and School-based Prekindergarten programs. A total of 30,527 children were served in state preschool programs in Pennsylvania in 2017-18 (the year children in this study attended prekindergarten), comprising 14% of all 4-year-olds and 7% of all 3-year-olds in the state.^{xviii} This number increased to 44,756 children in 2018-19, comprising 20% of 4-year-olds and 10% of 3-year-olds in the state.^{xix} The majority of these children were enrolled in PA PKC, including 20,674 in 2017-18 and 25,140 in 2018-19.

PA PKC is available to children from families earning up to 300% of the federal poverty level, with priority given to children with other risk factors. In particular, local programs prioritize enrollment (based on community need) for income-eligible children who are English language learners, homeless, have parents with low education levels, are receiving behavioral supports, are in the child welfare system, have an incarcerated parent, have an Individualized Education Program (IEP), are migrant seasonal students, have a teen mother, or have a sibling in the program. PA PKC spaces are offered in school districts, Head Start, Department of Education privately licensed nursery schools, and high quality child care settings. Children attend 180 days per year, with either half-day or full-day options. The program guidelines include a number of standards consistent with high quality, including teacher qualifications (e.g., Department of Education Early Childhood Education Instructional certification for lead teachers), curriculum and instruction (approved curriculum aligned with the state Early Learning Standards), screening and assessment (conduct developmental screenings, health-related screenings, and ongoing assessment for instructional purposes using approved tools), classroom self-assessments (required annual participation), and family engagement (develop and implement a plan).

Purpose of the Pennsylvania Pre-K Counts Impact Study

This Impact Study examined the effects of participation in PA PKC on children's early academic, social, and executive function skills in kindergarten. In particular, the study focused on whether there were differences in performance for children with 1 or 2 years of enrollment in PA PKC compared to children with no ECE experience in the 2 years prior to kindergarten. Previous internal studies of the PA PKC Program have shown positive effects from participation in PA PKC on teachers' assessments of 4-year-olds' language, literacy, math, social-emotional, and scientific thinking skills from the beginning to the end of prekindergarten.^{xx} However, to date, there has not been an independent, statewide evaluation of PA PKC.

Research Questions

Two primary research questions (1 and 2) guided the study to examine the effects of participation in PA PKC. A third research question (3) examined potential moderators, or factors that might have an influence on any effects found for program participation.

1. *Do children who attended PA PKC have higher levels of academic and social skills in kindergarten than children with no prior preschool experience?*
2. *Are kindergarten skills different for children who attended PA PKC for 1 year (enrolling at age 4) or 2 years (enrolling at age 3)?*
3. *Are there differences in the effects of PA PKC based on various program characteristics – percent of 3-year-olds served, region of the state, or level of urbanicity/rurality?*

For these questions, we hypothesized that children who attended PA PKC would have higher scores on kindergarten assessments measuring academic skills, social skills, and executive function compared to children with no prior ECE experience. We also hypothesized that there would be larger differences in kindergarten skills for children who experienced 2 years of PA PKC compared to 1 year of PA PKC. With regard to influences of program characteristics, we hypothesized that relatively greater availability (higher percentages) of PA PKC for 3-year-olds in a community, allowing more opportunities for 2 years of program participation, would be associated with greater positive effects. We also hypothesized that impacts would be greater for

children located in rural areas. We examined region of the state because it was part of the sampling plan and wanted to verify the underlying assumption that region did not interact with PA PKC exposure. We also intended to examine whether there were moderating influences for children for whom English is their second language (Spanish-speaking dual language learners), hypothesizing that they would benefit more from PA PKC than other children. However, the sample size was not sufficient to examine this characteristic.

Methods for Recruitment and Sampling

The study was conducted in kindergarten during the 2018-19 school year, and children had attended PA PKC in the 2017-18 school year. We selected a design utilizing a kindergarten sample because the study was conducted during a recompetete year for PA PKC when all programs had to apply/reapply; given the timing, it was not feasible to recruit a sample in the PA PKC programs.

The Impact Study included a total sample of 597 children in three treatment groups: (a) 240 children who participated in PA PKC for 1 year (enrolled at age 4), (b) 153 children who participated in PA PKC for 2 years (enrolled at ages 3 and 4), and (c) 204 children who had no ECE experience (center-based or family child care) in the 2 years prior to kindergarten. The sampling plan was designed to provide statewide representation across districts with students who had enrolled in PA PKC during the previous year. A three-level sampling design involved creating strata based on geographic region and urbanicity/rurality designation and using a strategy of random sampling with probability of selection proportional to size (so that the stratified sample would be self-weighted). School districts were randomly selected within each stratum, and then schools were randomly sampled within the selected districts. We attempted to recruit all kindergarten teachers in selected schools, and all children in classrooms of participating kindergarten teachers. This process resulted in a final study sample of 597 children, 178 classrooms, 51 schools, and 28 school districts.

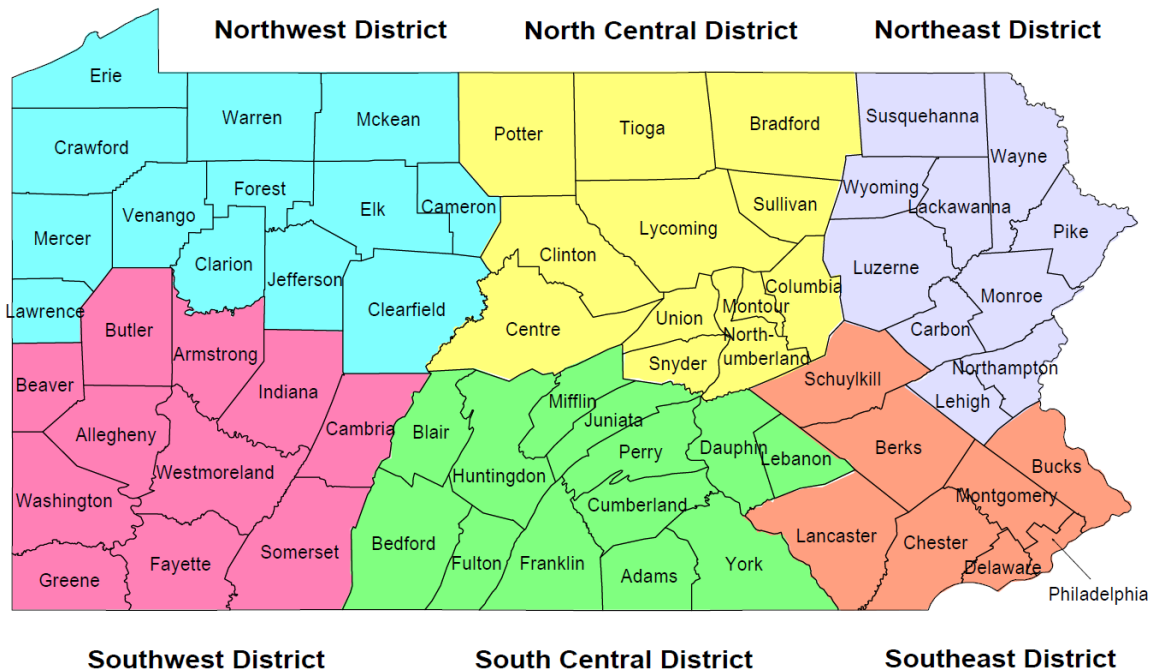
School Districts

Pennsylvania has 67 counties with a large number of school districts. The study sample was drawn from 335 of the 499 school districts that had data for children enrolled in PA PKC Programs. (An additional 282 districts consisting of solely of charter schools or other non-typical entities were excluded from the sampling pool.) To ensure the sample included children from different levels of urbanicity/rurality and the various geographic regions across the state of Pennsylvania, we first sampled school districts based on these two factors (region and urbanicity/rurality). Counties were grouped according to the six regions of the state used by the Pennsylvania Department of Education (Northwest, North Central, Northeast, Southwest, South Central, and Southeast), as shown in Figure 1. Urbanicity/rurality categories were defined by the National Center for Education Statistics (city, suburban, town, rural). A school district was assigned an urbanicity/rurality status if 50% or more of students attended schools in the same category based on the address of their school.^{xxi} We created 24 strata for the sampling matrix based on the six region and four urbanicity/rurality categories (see Appendix A for a table of the recruitment response rates by sampling strata).

To sample at least one school district from each of the region-urbanicity strata, we selected three ordered districts within each of the 24 strata to allow for additional recruitment options in the event districts refused participation. Sample selection took into account the number of children enrolled in PA PKC and in kindergarten in each school district, based on the most recent data

available at the time (2016-17 school year).^{xxiii} We used probability proportional to size (PPS) sampling within each cell using the number of PA PKC children in each district as the “size.” To determine whether districts were large enough to feasibly recruit a sample of kindergartners, we first calculated the percent of 4-year-olds enrolled in PA PKC as a proportion of all children enrolled in kindergarten. We then created district-level

Figure 1. Map of County Regions in Pennsylvania



Note: Map available at <http://www.health.state.pa.us/pdf/hpa/stats/brf-rd/map.pdf>

weights based on the number of children enrolled in kindergarten multiplied by the proportion of 4-year-olds in PA PKC in that district (i.e., weights = [N enrolled in K in district]*[p_{4y}]). First-order district-level eligibility criteria included a weight above 50, with greater than 50 children enrolled in kindergarten and greater than 50 4-year-olds in PA PKC, and were sampled according to a PPS approach within each stratum. This threshold was determined to ensure feasibility of recruiting sufficient numbers of eligible children in each school district.

Of the 335 school districts, 60 school districts met the first-order district-level eligibility criteria and were randomized using the PPS sampling strategy described above. One district was selected from each stratum. When possible, a second district from each stratum was selected as a back-up. For replacement, more than one school district was selected until a potential pool of 150 kindergarten students was identified within a given stratum. Using this approach, 20 school districts were identified that met inclusion criteria within the selected counties across 20 of the strata.

Four strata in the sampling matrix (South Central-Rural, Southwest-Rural, North Central-Suburb, Northwest-Suburb) did not contain school districts that met *a priori* first-order

eligibility criteria. To ensure distribution across regions and levels of urbanicity/rurality, we established second-order eligibility criteria to allow sampling of two-district combinations whose joint numbers met eligibility criteria. The modified criteria included district combinations with at least 50 kindergartners and more than 25 children enrolled in PA PKC that were within a geographically-related area (30-min drive) to create a feasible sample size. For three of these four strata, we were able to identify two school districts that met the second-order criteria using PPS sampling and were included in the initial sample. One stratum (North Central Suburb) had no school districts that met either first- or second-order eligibility criteria and therefore was not represented in the final sampling frame.

As seen in Table 1, a total of 58 school districts across 23 strata were contacted with a request to allow their elementary schools to participate in the study. Of these, 31 districts agreed, and 28 of those are represented in this study. The 28 districts include 21 counties (53% of districts contacted and 31% of the counties in Pennsylvania). Reasons districts provided for declining participation included concerns with teacher workload (four), time spent on other initiatives (four), recent discontinuation of PA PKC in that district (three); interest in participation at a later time (one), and no explanation provided (five). For the three districts that agreed but are not represented in the final sample, two declined at the school level, and one declined at the teacher level.

Table 1. Study Sample Recruitment Results for Kindergarten School Districts

District Sample Selection	Number Contacted	Agreed	Declined	No Response	Represented in Study
Initial Selection	26	14 (53.8%)	11 (42.3%)	1 (3.8%)	13 (50.0%)
1 st Level Replacement	21	11 (52.4%)	3 (14.3%)	7 (33.3%)	10 (47.6%)
2 nd Level Replacement	11	6 (54.5%)	3 (27.3%)	2 (18.2%)	5 (45.5%)
Total	58	31 (53.4%)	17 (29.3%)	10 (17.2%)	28 (48.3%)

Schools

School districts that agreed to participate were asked to provide a list of elementary schools where children who previously attended PA PKC were likely to attend kindergarten. The order in which those schools would be contacted for the study was then randomized using a random number generator list. The number of schools contacted in each district (or districts in the case of sampling combinations) was dependent on the kindergarten enrollment at those schools. Schools were contacted based on the random order until enough schools were identified to have at least 150 kindergarten students for recruitment or until there were no more eligible schools located in that stratum. Within the 31 recruited districts, we contacted principals of 70 schools to request their agreement for their school to participate in the study. Of these, 53 principals in 29 districts agreed for their school to participate (76% of principals contacted).

Kindergarten Teachers

All kindergarten teachers in 52 of the recruited schools were contacted for participation in the study. (One of the 53 recruited schools agreed to participate too late for teacher recruitment.)

Teachers were provided with information about the study and asked for voluntary consent for study participation. Of the 220 teachers contacted, 195 teachers at 51 schools in 28 districts agreed to participate (89% of teachers contacted).

Children and Families

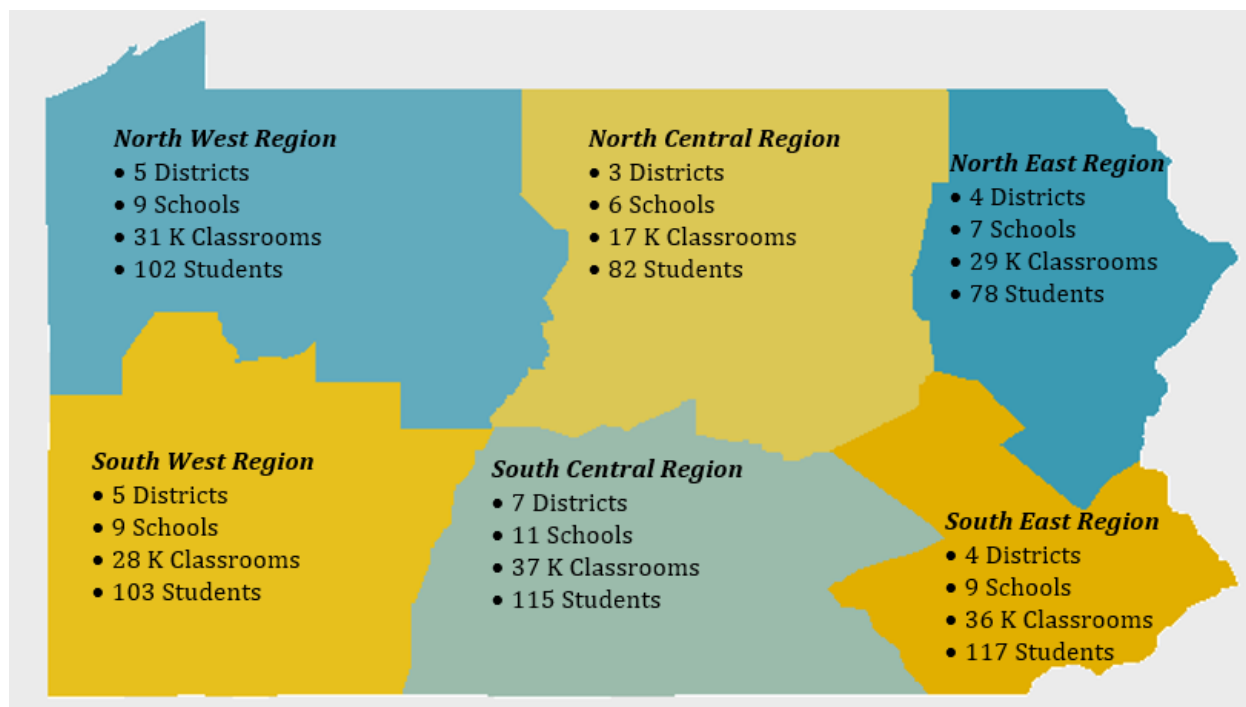
To have sufficient power to estimate differences between the treatment group (children who enrolled in PA PKC for either 1 or 2 years) and the comparison group (those with no prior ECE experience who were eligible to enroll but did not), we estimated that a sample of 500 children would be needed to detect small differences, with approximately 250 children in each group. To identify a sample of 500-600 eligible children with permission to participate in the study, we estimated that a pool of 2,000 children with permission to participate would be needed, some of whom would not meet eligibility criteria for the study. Given an expected response rate of approximately 50% based on previous studies, the initial target pool for recruitment was approximately 4,000 kindergarten students or approximately 175 students per stratum. Further, we additionally estimated power to detect differences separately between the comparison group and children enrolled in PA PKC for 1 year (age 4) or 2 years (ages 3 and 4). Power calculated *a priori* for this second analysis was sufficient to detect low to moderate effect sizes for each of these sets of comparisons.

The 195 participating teachers were asked to send home recruitment packets for each student in their classrooms, resulting in a recruitment pool of 4,090 students. Recruitment packets contained information about the study, parent/guardian permission forms, and brief surveys including family demographic information and children's prior ECE experiences. This process resulted in 1,924 students with permission to participate in the study (response rate of 47%).

Exclusions due to incomplete information used for identifying treatment groups resulted in an initial pool of 1,865 kindergarten children from 28 school districts. Children were included in the study if they (a) had permission to participate, (b) met PA PKC eligibility criteria, and (c) were confirmed as participants of PA PKC at ages 3 and 4, participants at only age 4, or having no prior ECE experience (PA PKC or any other type of center-based, family child care or home-based care in the 2 years prior to kindergarten entry). Children's enrollment in PA PKC was verified by staff at the Pennsylvania Office of Child Development and Early Learning (OCDEL) for all three treatment groups. Exclusion criteria for sample selection included age (having been retained, birthdate outside of the general eligibility window for PA PKC the previous year or the window specified by their local school district); not meeting PA PKC income-eligibility criteria; and for the comparison group, having ECE experience in the 2 years prior to kindergarten (including center-based, family child care, or home-based care).

This procedure resulted in a final eligible sample of 597 children from 178 classrooms in 51 schools within 28 districts. An overview of the final sample by geographic regions is shown in Figure 2 and a more detailed overview of the stratified sample distribution (by region and urbanicity/rurality) is presented in Appendix B. Assessments were conducted with 568 of these children from 176 classrooms in 51 schools within 28 districts. Assessments could not be conducted with 29 children (27 had moved out of the participating district, one student was absent due to chronic illness, and one student declined to participate). The resulting sample had a balance in size among the three treatment groups (2 years of PA PKC n=153, 1 year of PA PKC n=240, comparison group n=204).

Figure 2. Sample Participation by Pennsylvania Regions



Measures and Procedures

Child Assessments

Child outcome data were gathered during the second half of kindergarten for all three groups during the 2018-19 school year (1/28/19-4/5/19). Individual child assessments were conducted on site at the schools by trained data collectors, and teachers were asked to complete behavior rating scales following each assessment. All children in the study sample were administered the child assessment measures in English. Parallel assessment procedures were used with children who were Spanish-speaking dual language learners (DLLs), with a second administration of the same measures in Spanish by a bilingual data collector approximately 1 week later. However, it should be noted that due to small sample size ($n=25$), we were unable to analyze the data from the Spanish assessments.

The child outcomes battery consisted of measures appropriate for kindergartners across five primary areas—language, literacy, math, executive function, and behavior skills. See Appendix C for an overview of these measures, including key constructs and scoring. All of the child assessment measures were available in both English and Spanish; behavior skills were gathered from teacher ratings. Most of the measures used in the study were norm-referenced, so that for most outcomes, standard scores could be used. These scores take into account children’s age, so that the standardized mean score of 100 represents the expected performance for an average child at a given age.

Language and literacy skills were assessed with three subtests from the Woodcock-Johnson III Tests of Achievement (WJ III)^{xxiii} in English and the Bateria III Woodcock-Muñoz Pruebas de

Aprovechamiento (Bat III)^{xxiv} in Spanish. The Picture Vocabulary subtest measured vocabulary skills, including aspects of both receptive and expressive language. Two measures of literacy skills were used. The Letter-Word Identification subtest measured basic pre-reading and reading skills, including letter and word recognition and identification skills. The Passage Comprehension subtest measured symbolic learning and basic comprehension skills.

Math skills were assessed with two measures from the WJ III/Bat III. The Applied Problems subtest measured math problem-solving skills including simple comparisons, counting, addition, and subtraction. The Quantitative Concepts subtest measured knowledge of math concepts, symbols, and vocabulary.

Executive function was assessed using two measures, Head-Toes-Knees-Shoulders^{xxv} (HTKS) and the Pencil Tap Task^{xxvi xxvii}. The HTKS measures assessed different components of children's inhibitory control, working memory, and cognitive flexibility. The Pencil Tap Task tested inhibitory control and working memory.

Behavior skills were assessed with two subscales of the Social Skills Improvement System (SSiS)^{xxviii} completed by teachers. The Social Skills subscale involved ratings of behaviors that promote positive interactions while discouraging negative interactions. The Problem Behaviors subscale involved ratings of negative behaviors, some commonly occurring and some less commonly, that interfere with social skills development.

Teacher Surveys

Kindergarten teachers in the study sample were asked to complete electronic surveys about demographic and classroom characteristics. Teacher surveys were completed by 169 (95%) of the 178 kindergarten teachers in the study. The surveys included items about teacher demographic characteristics (gender, race, ethnicity), teacher qualifications (education, licensure, board certification, teaching experience), and classroom characteristics (class size, proportion of boys/girls, and children's home languages).

Parent Surveys

Surveys gathered from the initial sampling pool of 1,865 children/families at the time of study recruitment provided information about child, family, and household characteristics used to determine study eligibility and assignment to treatment/comparison groups. (For further details about recruitment and sampling processes, see section on Children and Families in Methods for Recruitment and Sampling). Survey information also was used for the predictive models to adjust for differences in demographic characteristics between treatment groups. Survey items included children's demographic characteristics – birthdate, gender, race, ethnicity; PA PKC risk factors – IEP; first language and language spoken at home (English, Spanish, both English and Spanish, Other), behavior supports, and vulnerabilities (homelessness, protective services, incarcerated parent, migrant seasonal student), prekindergarten experience – type of setting, hours in prekindergarten, name, location, and teacher; and family and household characteristics – household composition, primary caregivers' education, family income (using categorical ranges).

Analysis Approach

To estimate the effect of enrollment in PA PKC on children's academic and social outcomes in kindergarten, we designed the analytic plan to address the three research questions (see Research Questions in Purpose of the Pennsylvania Pre-K Counts Impact Study). The analysis strategy involved conducting descriptive analyses to characterize the sample and inferential

analyses to test the three research questions. To characterize children and schools in the analytic sample, descriptive statistics for key school, child, and family variables were calculated. The child and family demographic characteristics and child outcomes were described for children who had 2 years of PA PKC (at ages 3 and 4), 1 year of PA PKC (at age 4), and no ECE experience in the 2 years prior to kindergarten.

Inferential analyses involved hierarchical linear models. Since data were collected within school districts which are known to differ markedly in terms of demographics, analyses included district as a repeated variable to account for dependencies in the data. Each outcome was examined in separate analyses, with separate models that examined the first two questions; moderation by percent of 3-year-olds in programs within the district; moderation by urbanicity/rurality; and moderation by region. We were not able to examine moderation by home language because there were only 25 DLLs in the sample (n=13 for comparison group, n=8 for 1 year of PA PKC, n=4 for 2 years of PA PKC). Each analysis involved the treatment group as a three-level variable (no ECE experience, 1 year of PA PKC, 2 years of PA PKC), and included two sets of comparisons: (a) between the No ECE group and Any PA PKC (the combined data from the two PA PKC groups), and (b) between the 1 Year and 2 Years PA PKC groups.

The Any PA PKC group combined the 1 Year and 2 Years PA PKC groups in a way that reflected their proportional representation in the sample. General linear mixed models analyzed the child outcomes, accounting for the nesting of children in school districts and including region and urbanicity/rurality as fixed effects to account for the stratified sampling plan. The analyses included covariates to account, in part, for differences in families who chose to enroll their child in PA PKC or not. These covariates included child characteristics of sex, race (whether the child was Black), DLL status, age, and social vulnerabilities (homelessness, an incarcerated parent, enrolled in protective services, or a migrant seasonal student); and family characteristics of parent education level (less than bachelor's degree vs bachelor's degree or above) and income (percent of Federal poverty level). Analyses included Benjamini-Hochberg adjustments for each set of treatment comparisons (Any PA PKC vs No ECE, 1 Year vs 2 Years PA PKC) and each set of moderator comparisons (percent of 3-year-olds, urbanicity/rurality, region) to account for potential false positive rates in interpreting results due to the number of outcomes.

In order to estimate the relative months of gain on outcome variables for any significant PA PKC effects, the same analyses were conducted using raw or W scores. From these analyses, the coefficient for age was used to estimate how much change would be expected during a year and divided by 12 to estimate expected change in a month. The treatment coefficient was divided by the estimated change per month to calculate months of change due to the given PA PKC effect.

Analyses were conducted using the observed data because there were no missing data on covariates. Imputing missing data on outcome variables is not recommended due to potential bias, especially when the same set of individuals are missing all of the outcomes. In the present study, the number of children without teacher ratings was slightly larger than the number of children with other missing data. Because these variables were only very modestly related to the other outcomes or predictors ($.24 < R^2 < .27$), it is not clear these other data could be used to adequately impute the missing teacher ratings data.

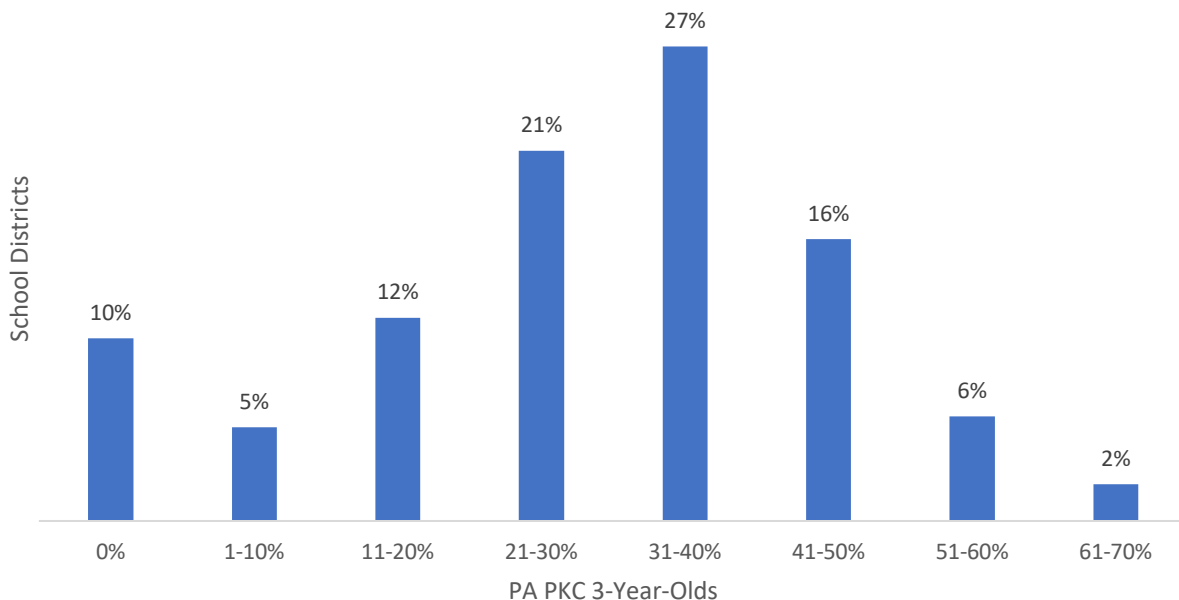
Results

Descriptive Characteristics of the Sample

Descriptive information is presented about the characteristics of the sample. Results are provided about the percentage of 3-year-olds served by PA PKC within these districts, as well as about the kindergarten teachers and classrooms to provide contextual information about the educational settings experienced by these children in the year subsequent to prekindergarten, which was the focus of the current data collection period. Information is presented about the characteristics of the children and families within each of the three treatment groups to provide comparisons of the similarities and differences.

Districts. For each district in the sample, the percent of children enrolled in PA PKC who entered as 3-year-olds (out of the total enrolled 3- and 4-year-olds) was calculated. On average, 29.4% of the children in a district's PA PKC Programs were 3-year-olds ($SD=16.3$), ranging from 0 to 66%. The distribution of school districts in the kindergarten study sample by the percentage of 3-year-olds served in PA PKC is shown in Figure 3.

Figure 3. Distribution of School Districts in Kindergarten Sample by Percentage of PA PKC 3-Year-Olds



Kindergarten Teachers/Classrooms. Information about the demographic characteristics of the kindergarten teachers of children in the study sample is presented in Table 2. All participating teachers were the lead teachers in their classroom, and most teachers were female (97%). Participating teachers had substantial experience, reporting an average of 17 years of teaching experience, with a range from 1 to 30 years. The vast majority of the kindergarten teachers in the sample were White (97%) and few were Latinx (2%). All teachers were licensed;

about two-thirds (69%) held an elementary education license and just under one-third (29%) held a Pre-K to grade 4 license, with few having other types of licenses.

Children and Families. Information from family surveys is provided about child and family characteristics for the study sample in Table 3. The three treatment groups (1 Year PA PKC, 2 Years PA PKC, No ECE Comparison) differed in the distributions for some family characteristics (percentage of the federal poverty level, parent age, parent education), child characteristics (vulnerabilities, race, ethnicity), and geographic characteristics (region and urbanicity/rurality). For example, children in the No ECE Comparison group were more likely to have lower family incomes, lower parent education, greater vulnerabilities, and to be Latinx. Children in the 1 Year PA PKC group were more likely to have younger mothers and differ more from the other sample groups in the distributions by race (less likely to be Black than 2 Year PA PKC and more likely to be White than No ECE). There also were some differences in the distributions among the sample groups by geographic region and urbanicity/rurality, but these patterns were not consistent.

Table 2. Characteristics of Kindergarten Lead Teachers

Teacher Characteristic	n=172	
	n	%
Female	167	97.1
Race		
Black/African American	1	0.6
White/European-American	166	97.1
Other	4	2.3
Latinx	3	1.7
Highest Degree		
BA/BS	20	13.2
MA/MS	132	86.8
Teacher Licensing		
PreK to Grade 4	49	28.5
Elementary	119	69.2
Special Education	3	1.7
Principal	1	0.6
Kindergarten Class	Mean	SD
Size	20.9	4.0
Proportion Boys	0.53	0.07
Proportion Girls	0.47	0.07
Children's Primary Language		
Proportion English	0.90	0.20
Proportion Spanish	0.02	0.09
Proportion Other	0.06	0.16
Teacher Experience		
Years teaching Pre-K	1.94	4.15
Years teaching any age	16.70	8.46

Table 3. Descriptive Characteristics of the Study Sample in Kindergarten

	Total		No ECE		1 Yr PKC Age 4 Only		2 Yrs PKC Ages 3 & 4	
	n=597		n=204 (34%)		n=240 (40%)		n=153 (26%)	
Family Characteristic	Mean (SD)		Mean (SD)		Mean (SD)		Mean (SD)	
Family Size	4.6	1.4	4.8	1.6	4.5	1.3	4.6	1.3
Children in Home	2.7	1.2	2.8	1.2	2.6	1.2	2.6	1.2
Adults in Home	2.0	0.7	2.1	0.8	2.0	0.7	1.9	0.5
% Federal Poverty Level	143.8	75.1	127.4	79.9	151.8	74.1	153.0	66.6
Parent BA/BS or above (proportion)	0.44	0.50	0.32	0.47	0.46	0.50	0.54	0.50
Mom Age at Birth (years)	26.8	5.5	26.9	5.7	26.1	5.1	27.7	5.7
Child Age (years)	5.5	0.3	5.5	0.3	5.5	0.3	5.5	0.3
Child Characteristic	%		%		%		%	
Assessment Language								
No assessment (n=29)	4.9		7.4		2.9		4.6	
English Only	91.0		86.3		93.8		92.8	
Spanish & English	4.2		6.4		3.3		2.6	
Female	50.4		51.5		52.9		45.1	
Vulnerability ^a	11.4		15.2		7.5		12.4	
Received Behavioral Services	6.7		3.9		7.1		9.8	
Race								
African-American/Black	12.9		13.7		8.3		19.0	
White	80.9		74.0		86.3		81.7	
Other	8.5		10.3		8.3		6.5	
Latinx	12.4		18.1		8.8		10.5	
Language Child Speaks at Home								
English	92.4		89.7		92.7		95.3	
Spanish	1.6		3.1		1.3		0	
Other	6.1		7.2		6.0		4.7	
DLL-Spanish	4.4		6.9		3.3		2.6	
Region								
North-Central	13.7		9.8		18.3		11.8	
Northeast	13.1		16.7		10.4		12.4	
Northwest	17.1		15.7		15.0		22.2	
South-Central	19.3		23.5		20.4		11.8	
Southeast	19.6		21.1		20.0		17.0	
Southwest	17.3		13.2		15.8		24.8	
Urbanicity								
City	26.1		29.4		22.5		27.5	
Suburb	23.1		21.1		18.8		32.7	
Town	19.3		18.1		26.3		9.8	
Rural	31.5		31.4		32.5		30.1	

^a Children were categorized as having a vulnerability if they met one or more of the following criteria: homelessness, protective services, incarcerated parent, migrant seasonal student.

Child Outcomes by PA PKC Groups

Average Child Outcomes Scores. Figures 4-7 illustrate average scores on child outcome measures in each of the three PA PKC groups. Most of these outcomes are based on norm-referenced measures (language, literacy, math, social skills) using age-standardized scores. For norm-referenced measures, the population mean of 100 represents average performance for a typical child at a given age. These results indicate that the means for the study sample generally were similar to the population means, with slightly higher scores for measures of letter-word recognition, math problem-solving, and social skills than for other outcomes. More detailed information for each outcome within each group (number of children with data, mean, standard deviation) is presented in Appendix D, Table D1.

Figure 4. Average Language and Literacy Scores by PA PKC Participation Levels

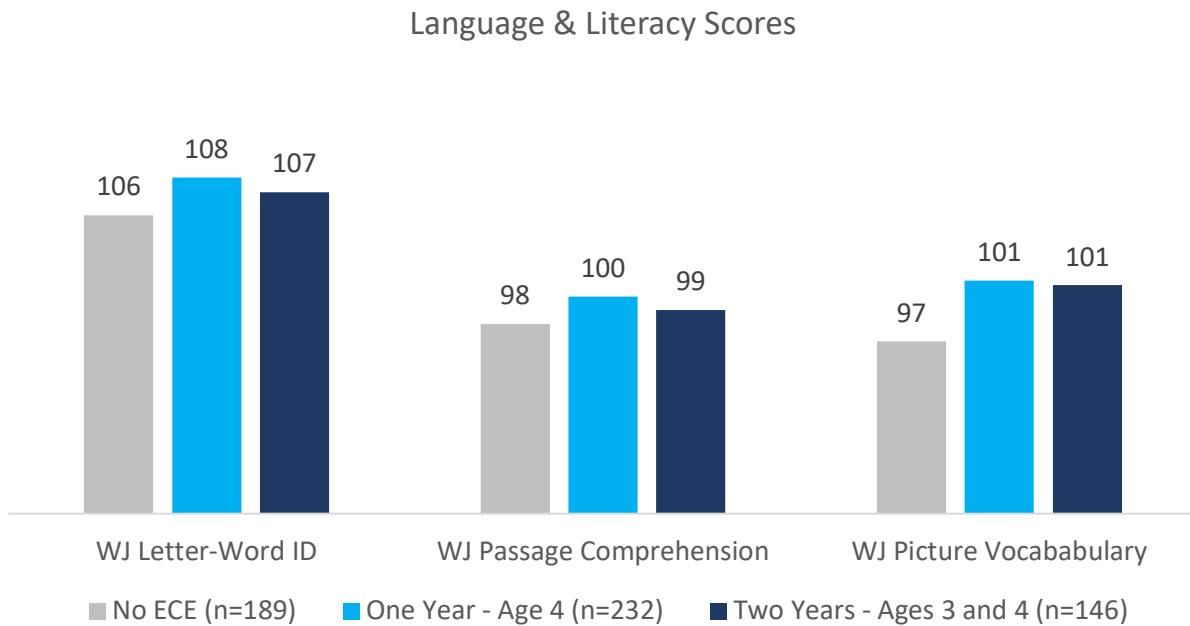


Figure 5. Average Math Scores by PA PKC Participation Levels

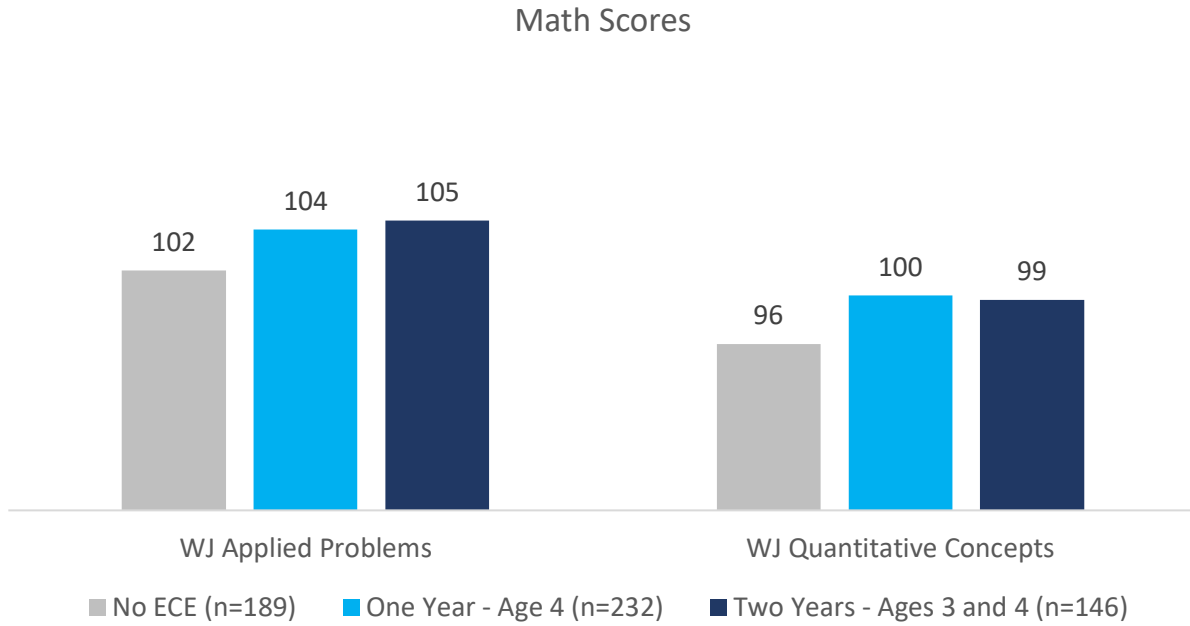


Figure 6. Average Social Skills Scores by PA PKC Participation Levels

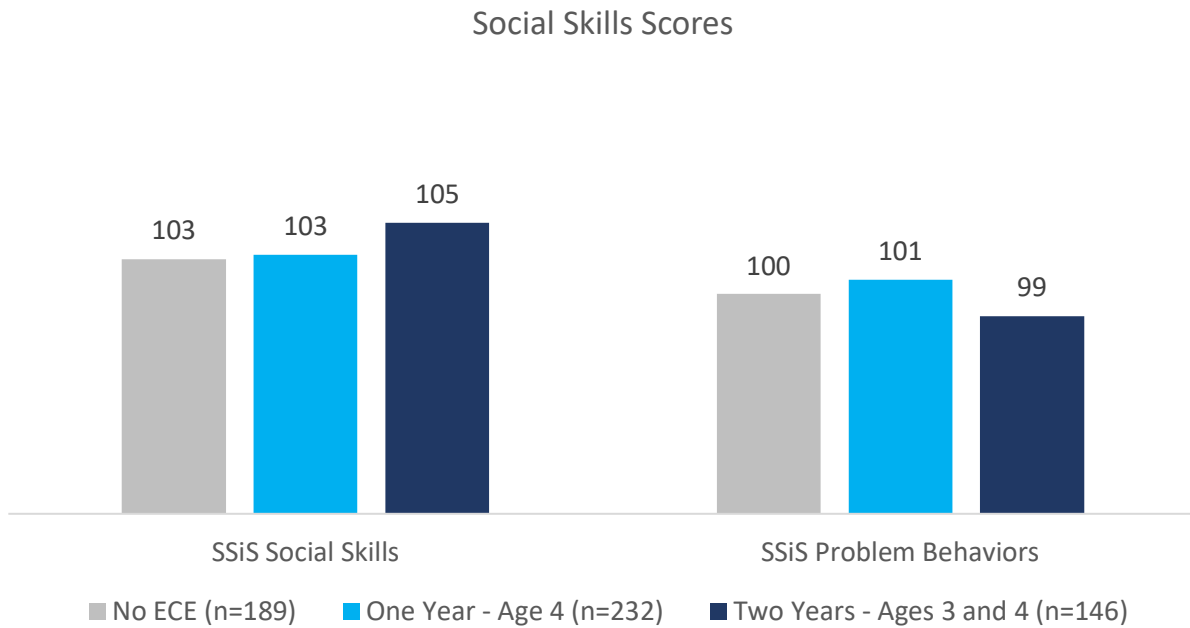
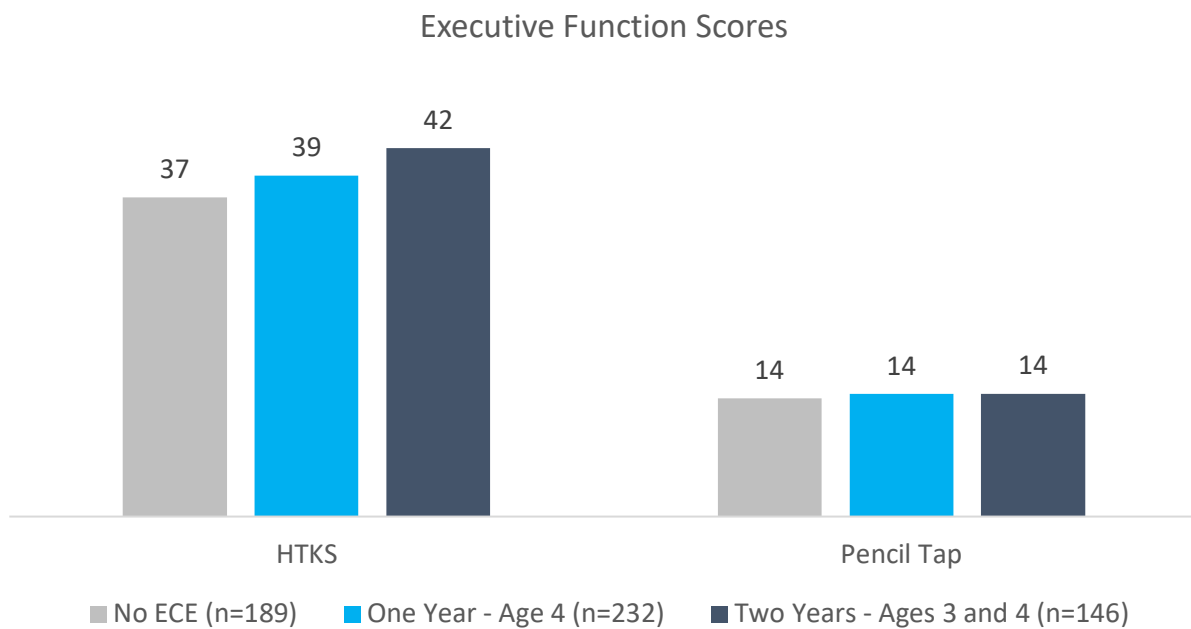


Figure 7. Average Executive Function Scores by PA PKC Participation Levels



Comparison of Any PA PKC and No ECE Groups. The first set of analyses addressed the first research question by comparing children with Any PA PKC vs No ECE, as shown in the first column of Table 4. These results indicated that in kindergarten children who attended PA PKC had significantly higher levels of language skills (Picture Vocabulary) and math skills (Applied Problems, Quantitative Concepts) compared to children who did not attend PA PKC, with a marginal effect for one language/literacy skill (Letter-Word Identification). The means for each group on the significant outcomes, adjusted for other variables in the model, also are shown in Figure 8.

The effect sizes for the comparisons of the Any PA PKC vs No ECE groups are shown in Figure 9. The magnitude of the differences for the significant effects was in the small, but meaningful range: language skills (PV $d=.30$) and math skills (AP $d=.22$, QC $d=.22$).

In order to estimate the relative months of gain on outcome variables for significant treatment effects, the same analyses were conducted using W scores. These results showed meaningful differences in the months of learning gains related to participation in PA PKC for language skills (PV=5.02 months of gain) and math skills (AP=3.88 months of gain, QC=5.14 months of gain).

Table 4. Model-Adjusted Group Differences on Child Outcome Measures

	Any PA PKC vs No ECE		1 vs 2 Yrs PA PKC		No ECE	1 Yr PA PKC	2 Yrs PA PKC			
	B	se	B	se	Adjusted mean	Adjusted se	Adjusted mean	Adjusted se	Adjusted mean	Adjusted se
Language/Literacy										
Letter-Word Identification	2.42+	0.98	-0.01	1.16	105.07	0.79	107.42	0.71	106.94	0.91
Passage Comprehension	1.77	0.99	-0.31	1.17	97.6	0.81	99.48	0.72	99.17	0.93
Picture Vocabulary	2.94**	0.86	-0.11	1.01	97.66	0.7	100.64	0.62	100.53	0.8
Math										
Applied Problems	2.39*	0.98	0.93	1.16	101.93	0.8	104	0.71	104.93	0.91
Quantitative Concepts	2.71*	1.06	-0.07	1.25	96.76	0.86	99.49	0.77	99.43	0.99
Executive Function										
Head-Toes-Knees-Shoulder	2.13	1.48	2.48	1.75	37.68	1.2	38.94	1.07	41.42	1.38
Pencil Tap	0.24	0.26	-0.05	0.31	13.68	0.21	13.94	0.19	13.89	0.24
Social Skills										
Social Skills	-0.38	1.58	0.84	1.88	103.78	1.29	103.11	1.15	103.95	1.48
Problem Behavior	1.48	1.39	-1.41	1.66	99.09	1.14	101.06	1.01	99.65	1.31

Note: ** p<.01; * p<.05; + p<.10. Models include sex, race, DLL status, whether a parent had a bachelor's degree, vulnerability, region, and urbanicity/rurality as covariates, and accounted for nesting of children in school districts. Benjamini-Hochberg adjustments were only applied to tests of any PKC vs No ECE and to 1 vs 2 years PKC.

Figure 8. Adjusted Means for Outcomes with Significant Differences between Any PA PKC and No ECE Groups

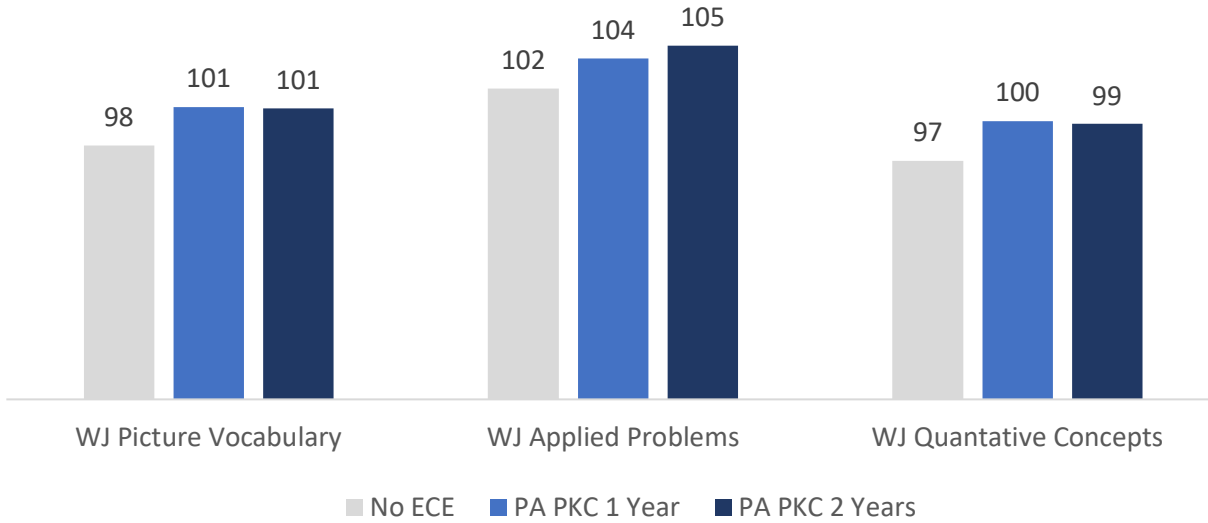
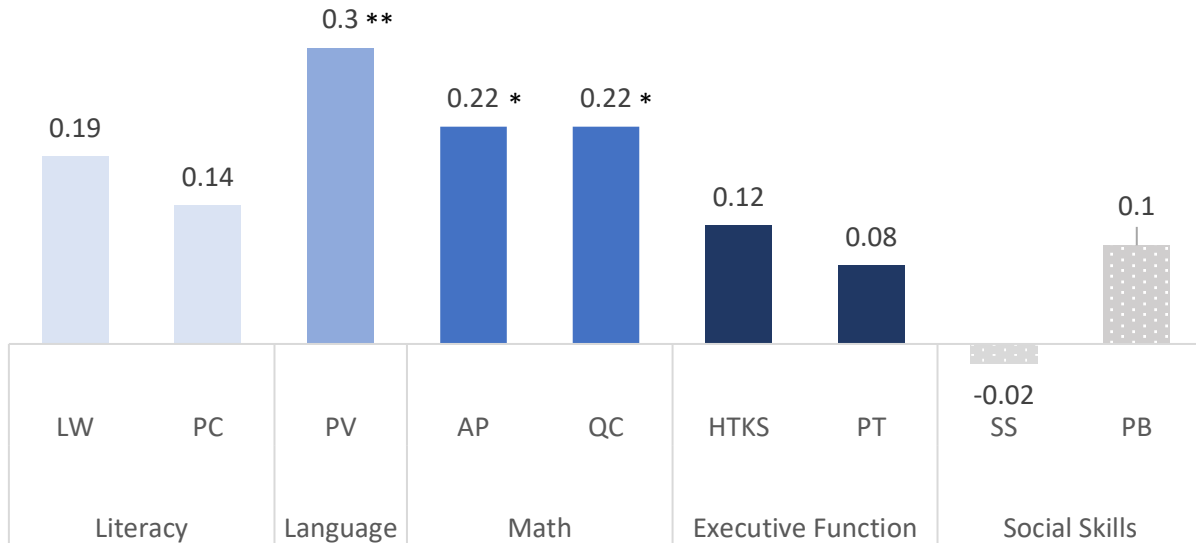


Figure 9. Child Outcome Effect Sizes for Any PA PKC vs No ECE

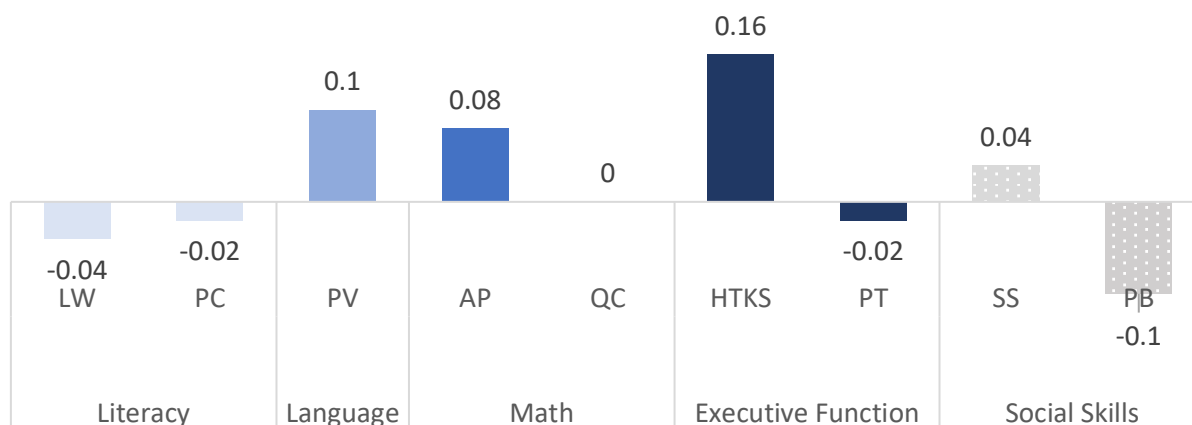


Note: LW=WJ-III Letter-Word Identification, PC=WJ-III Passage Comprehension, PV=WJ-III Picture Vocabulary, AP=WJ-III Applied Problems, QC=WJ-III Quantitative Concepts, HTKS=Head-Toes-Knees-Shoulders, PT=Pencil Tap, SS=SSiS Social Skills, PB=SSiS Problem Behaviors.

* $p < .05$, ** $p < .01$. Significant effect sizes are in the meaningful, but small range ($0.2 < ES < 0.5$).

Comparison of 1 Year and 2 Years PA PKC Groups. The next set of analyses addressed the second research question by comparing children with 1 vs 2 years of PA PKC, as shown in the second column of Table 4. No differences were detected between the two PA PKC groups. Figure 10 shows the effect sizes for these comparisons.

Figure 10. Child Outcome Effect Sizes for 1 vs 2 Years of PA PKC



Note: LW=WJ-III Letter-Word Identification, PC=WJ-III Passage Comprehension, PV=WJ-III Picture Vocabulary, AP=WJ-III Applied Problems, QC=WJ-III Quantitative Concepts, HTKS=Head-Toes-Knees-Shoulders, PT=Pencil Tap, SS=SSiS Social Skills, PB=SSiS Problem Behaviors.

Influence of 3-year-old Enrollment, Region, and Urbanicity on Group Comparisons. The next set of analyses added interactions between PA PKC groups to test whether any of the following factors moderated the effects of PA PKC: the percent of 3-year-olds enrolled in PA PKC within that child’s district, region, and urbanicity/rurality. Each of these potential moderator variables was added to the model in separate analyses. There was no evidence of moderating effects for any of these variables for comparisons between the Any PA PKC and No ECE groups or between the 1 Year and 2 Years PA PKC groups. The regression coefficients are shown in Appendix D, Tables D2-D4.

Conclusions

This study asked whether academic and social skills were higher in kindergarten for children who attended PA PKC compared to children with no ECE experience, and further, whether skills differed for children who attended PA PKC for 2 years starting as 3-year-olds compared to children who attended for 1 year starting as 4-year-olds. Overall, there were consistent positive effects of program attendance on children's language and math outcomes, regardless of the initial age of enrollment in PA PKC. These positive effects for program participation were found in comparisons of children with any PA PKC experience (either 1 or 2 years of participation) vs those with no ECE experience. When translated into months of learning, these findings represent meaningful differences in terms of children's skills development in kindergarten. For children who participated in PA PKC, these effects were equivalent to an increase of approximately 5 months of learning for vocabulary, 4 months for math problem-solving skills, and 5 months for knowledge of math concepts. The outcomes included in this study were based on norm-referenced measures, and children's average performance was similar to population means. Thus, 4-5 months represents a substantial difference between groups in terms of skills development, particularly for young children. These results suggest that early prekindergarten experiences in PA PKC may provide an important buffer, particularly for children from low-income families or who are otherwise at greater risk for school failure. Given that the differences between PA PKC participants and non-participants were evident during the second half of the kindergarten year, these results further suggest that prekindergarten participation could offer a potential strategy to help mitigate summer learning loss.

These findings are important given that language and math skills have been shown to be the school readiness skills that most strongly predict subsequent academic achievement.^{xxix xxx} Vocabulary skills at entry to kindergarten are a strong predictor of reading skills during early elementary school.^{xxxi} In addition, the math skills measured in this evaluation included both simple math problem-solving and knowledge of math concepts. Early math skills have been shown to be one of the best predictors of later school achievement, followed by reading and then attention skills.^{xxxii} Similar results for the overall effects of program participation have been found in studies of other state or large municipal Pre-K programs using regression discontinuity designs (RDD) comparing matched groups of children who attended Pre-K at entry to kindergarten to those who had not yet attended. For example, positive effects of Pre-K participation have been found for children's language, literacy, and math skills in several studies using RDD approaches, including a study of five state Pre-K programs in Michigan, New Jersey, South Carolina, Oklahoma, and West Virginia^{xxxiii}; a study of Georgia's Pre-K Program^{xxxiv}; a study of New Mexico Pre-K^{xxxv}; the Boston Public Schools Pre-K Program^{xxxvi}; and a study of the Oklahoma Pre-K Program within Tulsa^{xxxvii}. RDD approaches rely on comparing two groups – children who are entering kindergarten (and have completed the Pre-K program) and children who are just entering the Pre-K program (and have not yet received the treatment). The underlying premise of this approach is based on comparing two similar groups that differ based on a criterion for age eligibility for the Pre-K program, with a gap – or discontinuity – in the regression results between the two groups indicating a treatment effect.

In contrast, the current study enabled examination of effects of overall treatment (Any PA PKC vs No ECE) as well as 1 Year vs 2 Years of PA PKC participation. Because the current study was conducted during a recompute year when all of the PA PKC Programs had to apply/reapply, it was not possible to include a contemporary PA PKC sample. In addition, because PA PKC serves both 3- and 4-year-olds, there is not a single age criterion for program eligibility that could be

uniformly applied. Nor was it possible to utilize experimental approaches, such as a randomized controlled trial (RCT) design. Therefore, the study relied on comparisons among similarly eligible kindergarten children who had and had not participated in PA PKC. It relied on a PPS sampling approach for selecting school districts and random selection of schools to ensure representation of the PA PKC Program within the state, as well as selection criteria to ensure that all three groups were matched in terms of program eligibility and verification of program participation with state administrative records. The study found better kindergarten skills for all program participants compared to non-participants, but no evidence that these effects were stronger for children who attended PA PKC for 2 years starting as a 3-year-old than for those who attended for a single year starting as a 4-year-old. These findings differ from the results of some other studies of preschool or Head Start programs that have found stronger effects with greater program dosage.^{xxxviii xxxix}

Findings from analyses of children in a Head Start program with mixed-age classrooms suggested that children who transitioned to the state program made substantially larger gains than children who stayed for a second year.^{xl} That study may indicate how difficult it is for teachers to ensure they provide children with sufficiently challenging instruction in their second year. Such challenges are even greater when classrooms include children with a range of developmental levels and prior experiences – both 3-year-olds and 4-year-olds in their first year and 4-year-olds in their second year of participation – such as occurs in many PA PKC classrooms. Findings from an Implementation Study of PA PKC, a companion study to the current Impact Study, indicated that over 90% of administrators reported serving 3-year-olds, with most offering some mixed-age 3- and 4-year-old classrooms.^{xli} Given the widespread implementation of mixed-age classrooms, this raises questions about the extent to which teachers have the resources and capacity to differentiate instruction for 4-year-olds in their second year in the program compared to 3- or 4-year-olds in their first year, so that children experience additive benefits from a second year. The Implementation Study found that there was little differentiation in curriculum and instruction based on age group, although most administrators reported that differentiation was broadly based on developmental level. Results from the Implementation Study further found that PA PKC administrators who enrolled higher proportions of 3-year-olds reported higher levels of implementation challenges, including those related to staffing.

The effect sizes for the results from the PA PKC Impact Study evaluation were in the small, but meaningful range. These effect sizes are similar to those typically found for studies of short-term effects of prekindergarten programs on school readiness and early elementary skills.^{xlii} Moreover, these effects did not differ on the basis of various program characteristics, including the percent of 3-year-olds served, region of the state, or level of urbanicity/rurality. There also were no differences for other measures of literacy skills, including early reading and decoding skills. A similar study comparing the performance of kindergarten children who attended the NC Pre-K Program to a matched sample of children with no prekindergarten experience found positive effects on math skills, but not on language and literacy skills at the end of kindergarten.^{xliii} It may be that without a strong curricular focus on literacy-related skills designed to promote reading success in both prekindergarten and kindergarten, these effects may not be evident. Although we did not measure the curricular or instructional environment in this evaluation, studies have shown that literacy instruction, particularly targeted instruction for struggling learners, is an especially effective strategy for promoting early literacy skills^{xliv xlv} as well as math skills^{xlvi}. Given that PA PKC targets children who may be at risk, it may be particularly worthwhile to consider the use of tiered or targeted instructional approaches for

both literacy and math instruction. Further, the general lack of findings for measures of literacy, social, and executive function skills suggests additional areas to examine for potential professional development and quality improvement activities. It would be particularly worthwhile to consider instructional practices that are most likely to promote positive outcomes to ensure that PA PKC continues to offer a high-quality program designed to best prepare children for school success. In order to support sustaining these effects into the early elementary years, it may be important to examine the extent of P-3 alignment across grades, while continuing to base prekindergarten practices on developmentally appropriate early learning standards.

In sum, the results of this evaluation demonstrate positive benefits on language and math skills in kindergarten for children who attended PA PKC compared to similar children with no prior ECE experience in the 2 years before kindergarten. Thus, it would appear that PA PKC is well suited to promote key school readiness skills known to predict later reading and academic success. However, outcomes did not differ based on age of enrollment in PA PKC, suggesting that greater attention to instructional practices may be warranted to ensure children are benefiting from a second year of program participation.



Appendix A: Recruitment Response Rates Results by Sampling Strata (Districts, Schools, Teachers, Students)

	City	Rural	Suburb	Town
North Central	District: 0 / 2 = 0% Schools: N/A Teachers: N/A Students: N/A	District: 1 / 5 = 20% Schools: 2 / 2 = 100% Teachers: 8 / 8 = 100% Students: 83 / 160 = 51.9%	District: NONE ELIGIBLE Schools: N/A Teachers: N/A Students: N/A	District: 2 / 3 = 67% Schools: 4 / 4 = 100% Teachers: 10 / 10 = 100% Students: 122/206 = 59.2%
North East	District: 1 / 1 = 100% Schools: 2 / 2 = 100% Teachers: 8 / 9 = 88.9% Students: 81 / 169 = 47.9%	District: 1 / 1 = 100% Schools: 3 / 3 = 100% Teachers: 13 / 13 = 100% Students: 105 / 275 = 38.2%	District: 1 / 2 = 50% Schools: 1 / 1 = 100% Teachers: 6 / 6 = 100% Students: 47 / 161 = 29.2%	District: 1 / 4 = 25% Schools: 1 / 1 = 100% Teachers: 7 / 7 = 100% Students: 72 / 119 = 60.5%
North West	District: 1 / 1 = 100% Schools: 2 / 2 = 100% Teachers: 5 / 6 = 83.3% Students: 35 / 103 = 34%	District: 2 / 3 = 67% Schools: 3 / 3 = 100% Teachers: 9 / 10 = 90% Students: 72 / 164 = 43.9%	District: 2 / 3 = 67% Schools: 3 / 4 = 75% Teachers: 13 / 13 = 100% Students: 145 / 257 = 56.4%	District: 1 / 2 = 50% Schools: 1 / 1 = 100% Teachers: 7 / 7 = 100% Students: 53 / 175 = 30.3%
South Central	District: 2 / 3 = 67% Schools: 3 / 8 = 37.5% Teachers: 5 / 9 = 55.6% Students: 38 / 124 = 30.6%	District: 2 / 3 = 67% Schools: 5 / 5 = 100% Teachers: 14 / 14 = 100% Students: 145 / 281 = 51.6%	District: 1 / 2 = 50% Schools: 1 / 1 = 100% Teachers: 10 / 12 = 83.3% Students: 83 / 197 = 42.1%	District: 2 / 5 = 40% Schools: 2 / 2 = 100% Teachers: 10 / 13 = 76.9% Students: 97 / 199 = 48.7%
South East	District: 1 / 1 = 100% Schools: 5 / 12 = 41.6% Teachers: 20 / 21 = 95.2% Students: 216 / 582 = 37.1%	District: 1 / 5 = 20% Schools: 1 / 1 = 100% Teachers: 6 / 7 = 85.7% Students: 66 / 108 = 61.1%	District: 1 / 2 = 50% Schools: 2 / 2 = 100% Teachers: 6 / 6 = 100% Students: 59 / 115 = 51.3%	District: 3 / 4 = 75% Schools: 2 / 3 = 67% Teachers: 7 / 17 = 41.2% Students: 50 / 169 = 29.6%
South West	District: 1 / 1 = 100% Schools: 5 / 6 = 83.3% Teachers: 11 / 11 = 100% Students: 112 / 205 = 54.6%	District: 2 / 2 = 100% Schools: 2 / 3 = 67% Teachers: 6 / 6 = 100% Students: 75 / 127 = 59.1%	District: 1 / 2 = 50% Schools: 2 / 2 = 100% Teachers: 10 / 10 = 100% Students: 76 / 235 = 32.3%	District: 1 / 1 = 100% Schools: 1 / 2 = 50% Teachers: 4 / 5 = 80% Students: 33 / 69 = 47.8%

Appendix B: Study Participation Numbers by Region and Urbanicity (Districts, Schools, Classrooms, Students)

		City	Rural	Suburb	Town	TOTAL
North Central		District: 0	District: 1 Schools: 2 Teachers: 7 Students: 31	District: None eligible	District: 2 Schools: 4 Teachers: 10 Students: 51	District: 3 Schools: 6 Teachers: 17 Students: 82
North East		District: 1 Schools: 2 Teachers: 8 Students: 28	District: 1 Schools: 3 Teachers: 11 Students: 20	District: 1 Schools: 1 Teachers: 6 Students: 19	District: 1 Schools: 1 Teachers: 4 Students: 11	District: 4 Schools: 7 Teachers: 29 Students: 78
North West		District: 1 Schools: 2 Teachers: 4 Students: 8	District: 2 Schools: 3 Teachers: 8 Students: 33	District: 1 Schools: 3 Teachers: 12 Students: 39	District: 1 Schools: 1 Teachers: 7 Students: 22	District: 5 Schools: 9 Teachers: 31 Students: 102
South Central		District: 2 Schools: 3 Teachers: 5 Students: 17	District: 2 Schools: 5 Teachers: 14 Students: 57	District: 1 Schools: 1 Teachers: 8 Students: 19	District: 2 Schools: 2 Teachers: 10 Students: 22	District: 7 Schools: 11 Teachers: 37 Students: 115
South East		District: 1 Schools: 5 Teachers: 19 Students: 64	District: 1 Schools: 1 Teachers: 5 Students: 14	District: 1 Schools: 2 Teachers: 6 Students: 17	District: 1 Schools: 1 Teachers: 6 Students: 22	District: 4 Schools: 9 Teachers: 36 Students: 117
South West		District: 1 Schools: 4 Teachers: 10 Students: 39	District: 2 Schools: 2 Teachers: 6 Students: 33	District: 1 Schools: 2 Teachers: 9 Students: 22	District: 1 Schools: 1 Teachers: 3 Students: 9	District: 5 Schools: 9 Teachers: 28 Students: 103
TOTAL		District: 6 Schools: 16 Teachers: 46 Students: 156	District: 9 Schools: 16 Teachers: 51 Students: 188	District: 5 Schools: 9 Teachers: 41 Students: 116	District: 8 Schools: 10 Teachers: 40 Students: 137	District: 28 Schools: 51 Teachers: 178 Students: 597

Appendix C. Table of Measures

Measure	Scoring
<i>Language and Literacy Skills</i>	
<u>Letter-Word Identification</u>	
Woodcock-Johnson III Tests of Achievement Letter-Word Identification (Subtest 1)	Standard score
Batería III Woodcock Muñoz Pruebas de Aprovechamiento Identificación de Letras y Palabras (Prueba 1)	Mean=100, SD=15
<u>Comprehension</u>	
Woodcock-Johnson III Tests of Achievement Passage Comprehension (Subtest 9)	Standard score
Batería III Woodcock Muñoz Pruebas de Aprovechamiento Comprension de textos (Prueba 9)	Mean=100, SD=15
<u>Vocabulary</u>	
Woodcock-Johnson III Tests of Achievement Picture Vocabulary (Subtest 14)	Standard score
Batería III Woodcock Muñoz Pruebas de Aprovechamiento Vocabulario sobre dibujos (Prueba 14)	Mean=100, SD=15
<i>Math Skills</i>	
<u>Math Problem-Solving</u>	
Woodcock-Johnson III Tests of Achievement Applied Problems (Subtest 10)	Standard score
Batería III Woodcock Muñoz Pruebas de Aprovechamiento Problemas Aplicados (Prueba 10)	Mean=100, SD=15
<u>Basic Calculations</u>	
Woodcock-Johnson III Tests of Achievement Quantitative Concepts, (Tests 18A & B)	Standard score
Batería III Woodcock Muñoz Pruebas de Aprovechamiento Conceptos Cuantativos (Pruebas 18A & B)	Mean=100, SD=15
<i>Executive Function/Self-Regulation</i>	
<u>Inhibitory Control, Working Memory, Cognitive Flexibility</u>	
Head-Toes-Knees-Shoulders (HTKS) – English	Raw Score
Cabeza-Dedos Del Pie-Rodillas-Hombros (HTKS) - Spanish	1-94
<u>Inhibitory Control and Working Memory</u>	
Pencil Tap – English and Spanish	Raw Score
	1-32
<i>Social Skills</i>	
Social Skills Improvement System (SSiS) Teacher Form: Social Skills and Problem Behaviors	Raw Score
	46-230, 76-380

Appendix D. Additional Tables

Table D1. Average Scores on Child Assessments

	PA PKC Groups								
	No ECE			1 Yr PA PKC			2 Yrs PA PKC		
	n	Mean	SD	n	Mean	SD	n	Mean	SD
Language/Literacy									
WJ Letter-Word Identification	189	105.5	12.4	232	108.1	11.6	146	107.1	11.1
WJ Passage Comprehension	189	98.0	11.8	232	99.9	12.7	145	99.0	11.5
WJ Picture Vocabulary	189	96.9	12.2	232	101.0	8.6	146	100.7	8.1
Math									
WJ Applied Problems	189	101.5	11.7	232	104.3	11.4	146	104.9	9.4
WJ Quantitative Concepts	188	96.4	12.7	232	99.8	12.2	146	99.5	10.9
Executive Function									
Head-Toes-Knees-Shoulders	189	36.6	17.3	232	39.0	16.4	146	42.2	15.0
Pencil Tap	189	13.6	3.3	233	14.0	2.8	146	14.1	2.5
Social Skills									
SSiS Social Skills	180	102.5	17.3	224	102.8	17.6	136	105.0	17.5
SSiS Problem Behaviors	181	100.1	15.7	225	101.1	16.3	136	98.6	13.3

Table D2. Adjusted Means for PA PKC Groups by Region

	WJ LW	WJ PC	WJ PV	WJ AP	WJ QC	HTKS	PT	SSiS SS	SSiS PB
	Adj M (se)	Adj M (se)	Adj M (se)	Adj M (se)	Adj M (se)	Adj M (se)	Adj M (se)	Adj M (se)	Adj M (se)
NC 1 Yr PA PKC	101.61 (1.80)	94.72 (1.84)	99.38 (1.59)	101.56 (1.82)	96.93 (1.97)	36.73 (2.74)	14.29 (0.49)	99.55 (2.88)	103.27 (2.54)
NC 2 Yr PA PKC	105.74 (2.69)	98.46 (2.74)	99.55 (2.37)	104.56 (2.72)	99.31 (2.94)	40.44 (4.09)	14.35 (0.73)	100.94 (4.30)	102.18 (3.80)
NC No ECE	105.64 (2.49)	92.37 (2.54)	101.16 (2.20)	102.75 (2.52)	99.16 (2.72)	42.92 (3.79)	13.86 (0.67)	100.02 (3.98)	104.68 (3.51)
NE 1 Yr PA PKC	106.59 (2.22)	100.90 (2.26)	101.50 (1.95)	105.23 (2.24)	100.02 (2.42)	44.20 (3.29)	13.34 (0.58)	105.60 (3.72)	99.81 (3.28)
NE 2 Yr PA PKC	102.57 (2.48)	95.89 (2.53)	100.97 (2.18)	107.92 (2.50)	100.01 (2.70)	39.90 (3.77)	12.76 (0.67)	107.00 (4.15)	96.78 (3.67)
NE No ECE	100.47 (1.98)	97.59 (2.02)	94.54 (1.75)	101.07 (2.00)	96.06 (2.16)	39.80 (3.01)	12.71 (0.53)	107.19 (3.22)	96.53 (2.85)
NW 1 Yr PA PKC	106.95 (1.92)	97.99 (1.96)	103.06 (1.69)	103.27 (1.94)	99.25 (2.09)	40.94 (2.92)	14.73 (0.52)	101.16 (3.07)	102.45 (2.71)
NW 2 Yr PA PKC	106.65 (1.96)	98.31 (2.03)	100.55 (1.72)	103.75 (1.98)	98.13 (2.13)	43.66 (2.97)	14.70 (0.53)	102.81 (3.14)	101.19 (2.77)
NW No ECE	107.67 (2.03)	98.89 (2.07)	100.19 (1.79)	102.44 (2.05)	96.80 (2.22)	37.76 (3.09)	14.62 (0.55)	103.67 (3.25)	98.83 (2.87)
SC 1 Yr PA PKC	108.29 (1.59)	98.58 (1.62)	100.05 (1.40)	102.96 (1.60)	99.80 (1.73)	41.46 (2.43)	13.65 (0.43)	102.05 (2.54)	103.25 (2.24)
SC 2 Yr PA PKC	108.48 (2.71)	98.48 (2.76)	100.75 (2.39)	106.37 (2.74)	98.82 (2.96)	43.90 (4.12)	13.54 (0.73)	98.31 (4.34)	100.77 (3.83)
SC No ECE	105.16 (1.57)	95.17 (1.60)	96.91 (1.38)	102.07 (1.59)	96.26 (1.71)	37.06 (2.39)	13.43 (0.42)	100.77 (2.64)	102.66 (2.33)
SE 1 Yr PA PKC	113.47 (1.60)	105.88 (1.63)	98.90 (1.41)	103.99 (1.61)	100.21 (1.74)	34.43 (2.43)	13.95 (0.43)	103.26 (2.65)	99.78 (2.30)

	WJ LW	WJ PC	WJ PV	WJ AP	WJ QC	HTKS	PT	SSiS SS	SSiS PB
	Adj M (se)	Adj M (se)	Adj M (se)	Adj M (se)	Adj M (se)	Adj M (se)	Adj M (se)	Adj M (se)	Adj M (se)
SE 2 Yr	112.88	106.07	98.91	103.92	102.43	37.15	14.69	109.14	96.06
PA PKC	(2.16)	(2.20)	(1.90)	(2.18)	(2.36)	(3.28)	(0.58)	(3.51)	(3.10)
SE No	111.18	104.03	96.38	101.08	97.94	32.83	13.87	103.52	97.92
ECE	(1.76)	(1.79)	(1.55)	(1.77)	(1.95)	(2.67)	(0.47)	(2.86)	(2.48)
SW 1 Yr	108.84	99.43	101.88	107.34	101.36	36.94	13.83	106.79	98.47
PA PKC	(1.75)	(1.78)	(1.54)	(1.76)	(1.91)	(2.66)	(0.47)	(2.90)	(2.56)
SW 2 Yr	106.89	98.93	103.10	105.54	98.96	42.24	13.36	104.99	99.46
PA PKC	(1.82)	(1.86)	(1.61)	(1.84)	(1.99)	(2.77)	(0.49)	(3.20)	(2.82)
SW No	101.56	98.31	97.96	102.60	95.32	39.76	13.60	108.37	92.91
ECE	(2.24)	(2.28)	(1.97)	(2.26)	(2.44)	(3.41)	(0.60)	(3.83)	(3.38)

Note: NC=North Central, NE=Northeast, NW=Northwest, SC=South Central, SE=Southeast, SW=Southwest
LW=WJ-III Letter-Word Identification, PC=WJ-III Passage Comprehension, PV=WJ-III Picture Vocabulary, AP=WJ-III Applied Problems,
QC=WJ-III Quantitative Concepts, HTKS=Head-Toes-Knees-Shoulders, PT=Pencil Tap, SS=SSiS Social Skills, PB=SSiS Problem Behaviors.

Table D3. Adjusted Means for PA PKC Groups by Urbanicity/Rurality

	Language & Literacy			Math		Executive Function		Social Skills	
	WJ LW	WJ PC	WJ PV	WJ AP	WJ QC	HTKS	Pencil Tap	SSiS SS	SSiS PB
	Adj M (se)	Adj M (se)	Adj M (se)	Adj M (se)	Adj M (se)	Adj M (se)	Adj M (se)	Adj M (se)	Adj M (se)
City 1 Yr PA PKC	110.53 (1.55)	101.64 (1.57)	97.77 (1.37)	103.45 (1.56)	101.23 (1.68)	42.27 (2.35)	14.52 (0.42)	101.63 (2.55)	103.94 (2.24)
City 2 Yr PA PKC	108.15 (1.75)	98.90 (1.77)	99.04 (1.54)	104.28 (1.76)	99.98 (1.89)	40.54 (2.65)	13.85 (0.47)	103.71 (2.91)	99.90 (2.56)
City No ECE	104.43 (1.52)	96.66 (1.54)	93.84 (1.34)	99.30 (1.53)	96.51 (1.65)	39.62 (2.31)	14.07 (0.41)	107.67 (2.45)	95.41 (2.15)
Rural 1 Yr PA PKC	107.82 (1.29)	100.07 (1.30)	102.02 (1.13)	103.88 (1.30)	98.32 (1.39)	38.06 (1.96)	14.00 (0.35)	102.10 (2.08)	100.87 (1.81)
Rural 2 Yr PA PKC	105.76 (1.62)	97.40 (1.66)	101.60 (1.43)	105.21 (1.63)	96.36 (1.75)	39.67 (2.46)	14.11 (0.43)	98.78 (2.65)	101.38 (2.34)
Rural No ECE	106.78 (1.46)	99.83 (1.48)	99.58 (1.29)	103.87 (1.47)	98.29 (1.58)	37.65 (2.21)	13.94 (0.39)	99.75 (2.41)	103.10 (2.10)
Suburb 1 Yr PA PKC	104.51 (1.66)	96.14 (1.69)	101.56 (1.47)	105.84 (1.68)	100.94 (1.80)	39.40 (2.53)	13.40 (0.45)	105.55 (2.76)	98.62 (2.43)
Suburb 2 Yr PA PKC	104.80 (1.64)	97.91 (1.66)	99.26 (1.45)	104.14 (1.65)	100.37 (1.77)	42.72 (2.49)	13.53 (0.44)	109.80 (2.67)	95.12 (2.35)
Suburb No ECE	103.21 (1.73)	95.07 (1.75)	96.18 (1.53)	101.94 (1.74)	95.59 (1.87)	37.07 (2.63)	12.90 (0.47)	106.72 (2.91)	94.26 (2.56)
Town 1 Yr PA PKC	106.84 (1.53)	99.93 (1.54)	101.57 (1.34)	103.48 (1.54)	97.85 (1.65)	36.21 (2.29)	13.88 (0.41)	101.75 (2.39)	102.30 (2.11)
Town 2 Yr PA PKC	112.23 (2.88)	105.87 (2.91)	102.06 (2.54)	108.24 (2.90)	104.94 (3.11)	47.40 (4.37)	14.19 (0.77)	104.95 (4.56)	102.44 (4.02)
Town No ECE	106.25 (1.84)	98.75 (1.86)	101.63 (1.62)	102.79 (1.85)	96.22 (2.01)	36.09 (2.79)	13.78 (0.49)	99.71 (2.91)	104.53 (2.57)

Table D4. Estimated Regression Coefficients for the District Percentage of 3-year-olds by PA PKC Group

	Language & Literacy			Math		Executive Function		Social Skills	
	WJ LW	WJ PC	WJ PV	WJ AP	WJ QC	HTKS	PT	SSiS SS	SSiS PB
	B (se)	B(se)	B (se)	B (se)	B (se)	B (se)	B (se)	B (se)	B (se)
1 Yr PA PKC	-0.03 (0.09)	0.03 (0.09)	-0.15 (0.07)	-0.01 (0.08)	0.02 (0.09)	-0.01 (0.12)	0.02 (0.02)	-0.07 (0.15)	0.04 (0.13)
2 Yrs PA PKC	-0.05 (0.09)	-0.04 (0.09)	-0.16 (0.07)	-0.04 (0.08)	-0.08 (0.09)	-0.02 (0.12)	-0.01 (0.02)	0.05 (0.14)	-0.09 (0.12)
No ECE	-0.06 (0.10)	-0.03 (0.10)	-0.20 (0.08)	-0.05 (0.09)	-0.05 (0.11)	0.00 (0.14)	0.00 (0.02)	0.06 (0.16)	-0.11 (0.14)

Note: LW=WJ-III Letter-Word Identification, PC=WJ-III Passage Comprehension, PV=WJ-III Picture Vocabulary, AP=WJ-III Applied Problems, QC=WJ-III Quantitative Concepts, HTKS=Head-Toes-Knees-Shoulders, PT=Pencil Tap, SS=SSiS Social Skills, PB=SSiS Problem Behaviors.

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