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Contents

List of Tables 3

List of Figures 3

Purpose of the Evaluation Study 4

Overview of Georgia's Pre-K Program 4

Methods 5

Participants 5

Measures & Procedures 7

Child Outcomes 7

Covariates/Moderators 8

Analysis Approach 8

RDD Analyses 8

Supplementary Analyses 9

Moderator Analyses 9

Results 10

Treatment Effects 10

Moderator Effects 11

Conclusions 12

References 26

List of Tables

Table 1. Child Characteristics for Sample and Program 14
Table 2. Child Outcome Measures 15
Table 3. Children's English Language Proficiency Levels 16
Table 4. Child Outcome Scores 17
Table 5. Child Outcomes Regression Results—Language and Literacy 18
Table 6. Child Outcomes Regression Results—Math, General Knowledge, and Behavior Skills 19
Table 7. Effect Sizes for Treated vs. Untreated Differences 24

List of Figures

Figure 1. Letter Knowledge (Naming Letters) 20
Figure 2. Letter-Word Identification (WJ Ach Letter-Word Identification) 20
Figure 3. Phonological Awareness (WJ Ach Sound Awareness) 21
Figure 4. Phonemic Awareness (WJ Ach Word Attack) 21
Figure 5. Math Problem-Solving (WJ Ach Applied Problems) 22
Figure 6. Counting (Counting Task) 22
Figure 7. Basic Self-Knowledge (Social Awareness Task) 23
Figure 8. Phonological Awareness (WJ Ach Sound Awareness) Treatment by Language Proficiency 25

Purpose of the Evaluation Study

The purpose of the 2012–2013 Georgia's Pre-K Program Evaluation study was to investigate the effects of participation in the pre-k program on children's school readiness skills. This study utilized a regression discontinuity design (RDD), the strongest type of quasi-experimental research design for examining treatment effects[i]. This study compared two groups of children based on the existing age requirement for the pre-k program: 1) the treated group—children who had completed Georgia's Pre-K Program the previous year and were just entering kindergarten in the study year, and 2) the untreated group—children who were not eligible for Georgia's Pre-K Program the previous year and were just entering pre-k in the study year. Because the families of both groups of children chose Georgia's Pre-K, the two groups were equivalent on many important characteristics; the only difference was whether the child's birth date fell before or after the cut-off date for eligibility for the pre-k program.

The primary research questions addressed by this study were:

- Does participation in Georgia's Pre-K Program improve children's school readiness skills (language, literacy, math, general knowledge, behavior) compared to children who have not attended the program?

- Are the effects of Georgia's Pre-K Program on school readiness skills similar for different groups of children on the basis of family income, gender, or children's level of English language proficiency?

Overview of Georgia's Pre-K Program

Georgia's Pre-K Program is a state-funded universal pre-kindergarten program for 4-year-olds. The program serves children from all income levels, with no fees charged to families for program participation. Georgia was one of the first states to offer such a universal program in 1995, and currently serves over 81,000 children each year in a variety of settings across the state, including local school systems, private providers, and blended Head Start/pre-k classrooms. Georgia's Pre-K Program is based on a school-year model with instruction for 6.5 hours/day[a]. Class sizes are limited to 20–22 children with a lead and assistant teacher, with adult:child ratios of 1:11. Lead teachers are required to have at least a bachelor's degree in early childhood education or a related field (unless previously approved), and assistant teachers are required to have at least a Child Development Associate (CDA) credential. In addition, program guidelines provide minimum salary requirements for lead teachers based on credentials, 100% of which is funded by the state, as well as minimum salary requirements for assistant teachers meeting the credential requirements.

[a] Prior to 2011–2012, Georgia's Pre-K Program operated for 180 days per year, when budget restrictions led to a reduction to 160 days. In 2012–2013, the program year was increased to 170 days, and in 2013–2014, it was increased to 180 days.

Guidelines for classroom instruction are provided through *Georgia's Pre-K Program Content Standards*[ii], which are aligned with *Georgia's Early Learning Standards*[iii] and *Georgia's Kindergarten Performance Standards*[iv]. The program standards also require Georgia's Pre-K sites to use an approved curriculum; provide written lesson plans which include educational experiences in language/literacy, math, science, social studies, creative (music, art, and drama), social and emotional, and physical development; implement individual child assessments using the *Georgia's Pre-K Child Assessment—Work Sampling Online*[v], which is based on the *Work Sampling System*[vi]; offer meals, rest time, and both indoor and outdoor play time; and provide support services or referrals to families as needed. In addition, Bright from the Start: Georgia Department of Early Care and Learning (DECAL) oversees the program, and staff provide consultation, technical assistance, and monitoring visits throughout the year. (See 2012–2013 Georgia's Pre-K Program Operating Guidelines[vii] for further information.)

Methods

For the RDD study evaluating Georgia's Pre-K Program, data were gathered from two groups of children (treated and untreated) in fall 2012, including individual assessments of language, literacy, math, and general knowledge skills and teacher ratings of behavior skills. In addition, program characteristics and child demographic data were obtained from family surveys and from existing data DECAL gathered from Georgia's Pre-K Program sites.

Participants

The sample included a total of 1,181 children—611 children in the treated group (children who had completed Georgia's Pre-K Program the previous year and were entering kindergarten in the study year) and 570 children in the untreated group (children who were ineligible for Georgia's Pre-K Program the previous year and were entering pre-k in the study year). Both groups of children were recruited from the same sample of 90 randomly-selected Georgia's Pre-K classrooms (during different school years). An initial sample of 99 classrooms was originally randomly selected from the 3,992 Georgia's Pre-K classrooms operating in August 2011. Classrooms were lost from the sample for the following reasons: six classrooms were located in counties where school district officials declined to participate and three classrooms were no longer participating in Georgia's Pre-K by the time of data collection. In addition, one of the participating classrooms had children from the untreated group only; no children from the treated group had parental consent to participate.

For the untreated group, parental permission forms were distributed to all 1,727 children in the 90 randomly-selected pre-k classes at the beginning of the 2012–2013 school year (with follow-up as needed), with an overall consent rate of 77% (1,326/1,727). Data were gathered from a total of 570 children in the untreated group, representing an average of 6 pre-k children per classroom (range=5–8). Children with parental permission were randomly selected from each

classroom for inclusion in the study based on the number who could be assessed on the scheduled date for data collection. For the treated group, parental permission forms were distributed in summer 2012 (with follow-up into the early fall as needed) to all 2,006 children who attended the 90 pre-k classrooms in 2011–2012, with an overall consent rate of 45% (899/2,006). In addition, these children's elementary school districts and kindergarten teachers were contacted for agreement to participate, since the child outcomes data collection occurred during kindergarten for the treated sample. A total of 44/49 (90%) school districts agreed to participate, including 348/423 (82%) teachers. Data were gathered from all children with parental permission attending kindergarten in participating schools who could be assessed on the scheduled dates for data collection. This resulted a total of 611 children in the treated group, representing an average of 7 children per original pre-k classroom (range=0–14) and 1 child per kindergarten classroom (range=1–5).

The average age of participating untreated children was 4.5 years (SD=0.3) and the average age of participating treated children was 5.5 years (SD=0.3), as of September 1, 2012. Table 1 contains information about demographic characteristics of the sample of untreated and treated children as well as the population of children who participated in Georgia's Pre-K Program in the corresponding years during which each group attended pre-k (2011–2012 and 2012–2013, respectively).

Comparisons of the treated and untreated groups revealed that the two samples were generally similar on most demographic characteristics, including gender, ethnicity, family income, Limited English Proficiency (LEP), Individualized Education Program (IEP) status, and education level of child's primary caregiver. There were differences between the treated and untreated groups in the distribution by race [$\chi^2(5)=11.64$, $p<.05$], with the treated group having a slightly higher proportion of White/European American children and a slightly lower proportion of other races than the untreated group. There were also differences by provider type [$\chi^2(1)=19.87$, $p<.001$], with a higher proportion of children in the treated group attending local school system sites and a lower proportion attending private sites than the untreated group.

Comparisons of the treated sample with non-sample children who attended Georgia's Pre-K Program in 2011–2012 revealed that the two groups were similar on many characteristics including gender, ethnicity, family income, LEP status, and IEP status. There were slight differences in race [$\chi^2(6)=19.10$, $p<.01$], with the sample having a higher proportion of White/European American children and lower proportions of other racial groups than non-sample children. There also were differences by provider type between sample and non-sample children [$\chi^2(2)=36.13$, $p<.001$], with a higher proportion of the sample attending the program in local school system sites and a lower proportion in private sites than non-sample children.

Comparisons of the untreated sample with non-sample children who attended Georgia's Pre-K Program in 2012–2013 revealed that the two groups were similar on many characteristics, including ethnicity, race, family income, LEP status, and IEP status. There was a slightly higher

proportion of girls and a slightly lower proportion of boys among the sample than the non-sample children [$\chi^2(1)=4.44$, $p<.05$], and a slightly higher proportion of sample children attended private sites and a slightly lower proportion attended local school system sites [$\chi^2(2)=8.83$, $p<.05$].

Measures & Procedures

Child Outcomes

The child assessment battery consisted of ten measures appropriate for pre-k and kindergarten children across five primary areas—language, literacy, math, general knowledge, and behavior skills. See Table 2 for an overview of all child measures, including the key constructs and scoring. Child outcomes data were gathered by the research team on-site at each school or child care center and teachers were asked to complete rating scales after the assessments and mail them back to the research team. The individual child assessments were conducted in the fall of the 2012–2013 school year (9/21/2012–12/21/12).

Language and literacy skills

Language and literacy skills were assessed with five measures. The Naming Letters task[viii] measures children's ability to recognize and name all 26 letters of the alphabet. Four subtests from the Woodcock-Johnson III Tests of Achievement[ix] (WJ Ach) were used. The Letter-Word Identification subtest measures basic pre-reading and reading skills, including letter and word recognition and identification skills. The Picture Vocabulary subtest measures vocabulary skills, including aspects of both receptive and expressive language, and other aspects of sound awareness. The Sound Awareness subtest measures phonological awareness skills, including rhyming and other aspects of sound awareness. The Word Attack subtest measures phonemic awareness skills, including knowledge of letter sounds and sound combinations.

Math skills

Math skills were assessed with two measures. The Counting Task[x] was used to measure children's ability to count in one-to-one correspondence. The WJ Ach Applied Problems subtest was used to measure math problem-solving skills including simple comparisons, counting, addition, and subtraction.

General knowledge skills

General knowledge was assessed with the Social Awareness Task[xi] which measures whether the child knows and is able to communicate basic self-knowledge (full name, age, birthday).

Behavior skills

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

Covariates/Moderators

Other data were gathered for use as covariates and/or moderators in the analyses in order to adjust for various background characteristics and to examine whether differences in children's growth on the various outcome measures were related to these factors.

The *pre*LAS 2000[xiii] (*pre*LAS) was used to measure children's level of English oral language proficiency (1=Non-English speaker, 2–3=Limited English speaker, 4–5=Fluent English speaker). The distribution of children in the treated and untreated groups by English proficiency level is shown in Table 3. For analysis purposes, a two-level variable was created representing non-and limited English speakers (levels 1–3) vs. fluent speakers (levels 4–5).

Information on the level of the child's primary caregiver's education was obtained from demographic surveys completed by families when they agreed to participate in the study. Reported education levels were converted to years, and a continuous variable was used for analysis purposes.

Existing data gathered by DECAL from required submissions by Georgia's Pre-K Program sites provided additional information about characteristics of the children and programs. These data included provider type (local school system or private site); child gender (female or male), ethnicity (Hispanic/Latino or not), race (White/European American, Black/African-American, Asian, Native American/Alaskan Native, Native Hawaiian/Pacific Islander, Multiracial), Individualized Education Program (IEP) status (IEP or not), and Limited English Proficiency (LEP) status (LEP or not); and family income (Category One vs. Category Two status[a]). The current study includes roster data from the 2011–2012 and 2012–2013 program years (September 2011, November 2011, January 2012, March 2012, and September 2012, November 2012, January 2013, March 2013).

Analysis Approach

RDD Analyses

These analyses used methods based on an RDD approach, which provides unbiased estimates of the treatment effect. For the present study, two groups of children were compared based on a particular treatment criterion—whether or not a child was four years old by the cutoff date of September 1, 2011 in order to be eligible for the pre-k program in 2011–2012. The treated group consisted of children who completed Georgia's Pre-K in 2011–2012 (and were just entering kindergarten in the 2012–2013 study year) and the untreated group consisted of children who were not yet eligible for Georgia's Pre-K in 2011–2012 (and were just entering pre-k in the 2012–2013 study year). Both groups of children were assessed during the 2012–2013 school year.

[a] Category One represents participation in one or more of the following programs: Temporary Assistance to Needy Families (TANF), Georgia's Child Care and Parent Services (CAPS), and Peach Care for Kids.

This type of analysis relies on using a unique criterion for determining who is in the treated and untreated groups and using that variable defining the treatment condition in the model (age in months at the cutoff date in this case). The analyses were conducted as hierarchical linear models (HLM), with children nested within classrooms and random intercepts estimated for each classroom. The analyses involved the regression of age on the outcome variables, adjusting for a set of child, family, and program covariates obtained from existing data gathered by DECAL and family surveys. These covariates included child characteristics of gender (male=0, female=1), ethnicity (non-Latino=0, Latino=1), race (White/European-American, Black/African-American, other), IEP status (no IEP=0, IEP=1), English language proficiency based on *pre*LAS scores (non-/limited fluency=0, fluent=1); family characteristics of primary caregiver education (years of education) and family income (Category One=0, Category Two=1); and provider type (private site=0, local school system=1). The treatment variable—whether the child was in the treated (1) or untreated (0) group—provided the mean difference, or discontinuity, at the cutoff. The expectation is that development should be continuous over age; therefore a discontinuity or mean difference between the treated and untreated groups at the cutoff point indicates a program effect on children's outcomes. The regression of this age variable on the outcome provides the linear effect of age. Quadratic terms for age were included in the model to test for the possibility of non-linear change over time, and interactions of treatment with age and age squared were included to test whether the slope of change varied between groups.

Multiple imputation procedures were used to replace missing data. The SAS *PROC MI* procedure was applied, which uses multiple imputation via the EM algorithm to replace missing data. This method has been demonstrated to be effective in recovering the underlying population covariance matrix even when extremely large amounts of data are missing[xiv]. Twenty imputed data sets were created based on all variables in the model, including the interaction terms. Each dataset was analyzed separately; after analysis, the parameters and model estimates were recombined using SAS *PROC MIANALYZE* and these are the presented results. Effect sizes for treatment effects were calculated using Cohen's *d*.

Supplementary Analyses

Two series of supplementary analyses were conducted to test the robustness of the findings. The first set used an identical set of models to those above, but restricted the sample to children within six months of the cutoff date. These restricted ranges further focused the analyses around the point where the discontinuity would be expected, but this restriction also reduces the statistical power. The second set of supplementary analyses again built on the primary models above, but added a variable to adjust for the assessment dates, in order to account for any inconsistencies between the two groups in the range of administration dates for the child outcome measures.

Moderator Analyses

A series of follow-up analyses was conducted for outcome measures with significant treatment effects to examine whether there were any factors moderating those effects. These models

included the same variables as in the primary models above, but added the interactions of three child characteristics variables with treatment to test their effects as moderator variables. The three potential moderator variables included child characteristics relevant to both the treated and untreated groups: child gender (male=0, female=1), family income (Category One=0, Category Two=1), and child's English language proficiency (non-/limited fluency=0, fluent=1). These models were parameterized so that the interaction terms are estimated at the point of discontinuity, and thus, represent the moderation of treatment at the cutoff point.

Results

This study used an RDD approach to compare two groups of children based on the existing age requirement for the pre-k program: 1) the treated group (children who completed Georgia's Pre-K Program the previous year and were just entering kindergarten in the study year) and 2) the untreated group (children who were not eligible for Georgia's Pre-K Program the previous year and were just entering pre-k in the study year). The analyses involved the regression of age on the outcome variables, adjusting for child characteristics (gender, ethnicity, race, IEP status, English language proficiency), family characteristics (primary caregiver education and family income), and provider type (local school system or private site). The expectation is that development should be continuous over age; a discontinuity or mean difference between the treated and untreated groups indicates a program effect on children's outcomes.

Treatment Effects

Results showed that participation in Georgia's Pre-K Program significantly improved children's school readiness skills across most domains of learning. As seen in Table 4, children who had completed the pre-k program (treated group) generally scored higher than those who had not (untreated group). Average scores for children in the treated group were about half a standard deviation above the norm on most standardized measures of language, literacy, and math skills, while average scores tended to be at or slightly below the norm for the untreated group. Similarly, means on non-standardized measures were higher for the treated than the untreated group.

The results of the RDD analyses indicated significant differences (or discontinuities) between the treated and untreated groups for most measures of language and literacy skills, math skills, and general knowledge, indicating a positive effect of Georgia's Pre-K Program. (See Table 5 and Table 6.) Children in the treated group had significantly higher scores on most language and literacy measures (letter knowledge, letter-word identification, phonological awareness, phonemic awareness) compared to children in the untreated group. (See Figure 1, Figure 2, Figure 3, and Figure 4.) In contrast, no effects were found for one measure, vocabulary skills, although average scores were around the norm for both groups. Similarly, children in the treated group had significantly higher scores than children in the untreated group on both

measures of math skills (math problem-solving, counting) and the one measure of general knowledge (basic self-knowledge). (See Figure 5, Figure 6, and Figure 7.) There were no effects on children's behavior skills (social skills and problem behaviors), although the average scores were around the norm for both groups.

The effect sizes for these significant differences between the treated and untreated groups were in the medium to large range across domains of learning. There were large effects for some language and literacy skills (letter knowledge, letter-word identification, phonemic awareness) and math skills (counting), and medium effects for others (phonological awareness, math problem-solving, basic self-knowledge), suggesting that these are meaningful differences. (See Table 7.)

Two sets of supplementary analyses were conducted to confirm the robustness of these findings, both of which found no differences in the patterns of significance. The first set of analyses used a more restricted sample, only including children within 6 months of the cutoff date for program eligibility, as a more stringent test of the RDD approach for testing the effects of program participation on children's outcomes. The results from these analyses were identical to those from the analyses with the full sample in terms of the pattern of differences between the treated and untreated groups. The second set of analyses adjusted for the assessment dates, in order to account for any inconsistencies between the two groups in the range of administration dates for the child outcome measures. Similarly, these results showed no differences in the pattern of effects between the treated and untreated groups for these analyses.

Moderator Effects

A follow-up set of analyses was conducted for outcome measures with significant treatment effects to examine whether there were any factors moderating those effects. Three child characteristics that were relevant to both the treated and untreated groups were examined as potential moderators: gender, family income (Category One vs Two), and English language proficiency (non-/limited fluency vs. fluent based on *pre*LAS scores). These moderators were examined in relation to the significant measures of language and literacy (letter knowledge, letter-word identification, phonological awareness, phonemic awareness), math (math problem-solving, counting) and general knowledge (basic self-knowledge). (See moderator effects in Table 5 and Table 6.) These results indicated that there were no differences in the effects of the pre-k program for children by family income level or gender; in other words, the differences between the treated and the untreated groups were the same whether children were from low-income families or were girls or boys. There was one significant effect for English language proficiency on phonological awareness, indicating that the differences between the treated and untreated groups on this measure were only significant for children who were fluent in English; for children with no or limited fluency in English, there were no differences between the two groups. (See Figure 8.) For the other measures, however, there were no moderating effects of the level of English proficiency on the differences between the treated and untreated groups.

Conclusions

Using an RDD approach, this study found that participation in Georgia's Pre-K Program resulted in significantly better school readiness skills across domains of learning. Improvements were found across a wide range of skills, including measures of language and literacy (letter knowledge, letter-word identification, phonological awareness, phonemic awareness), math (math problem-solving, counting), and general knowledge (basic self-knowledge). The effect sizes for these results were in the moderate to large range, suggesting that these are meaningful differences. Additionally, when supplementary analyses were conducted to confirm the robustness of these findings using a more restricted sample (within 6 months of the cutoff date) or including the date of assessment, there were no differences in the patterns of significance.

This study utilized the strongest type of quasi-experimental research design for examining treatment effects, comparing two groups of children based on the existing age requirement for the pre-k program. The treated group had completed Georgia's Pre-K Program (and was just entering kindergarten in the study year) and the untreated group was not eligible for Georgia's Pre-K Program the previous year (and was just entering pre-k in the study year). Because the families of both groups of children chose Georgia's Pre-K and the children were selected from the same set of classrooms, the two groups were equivalent on many important characteristics; the only difference was whether the child's birth date fell before or after the cut-off date for eligibility for the pre-k program.

Further, there were no differences in these effects on the basis of family income or children's gender. In other words, whether or not children were from low-income families or were girls or boys, they derived similar benefits from participation in Georgia's Pre-K. Similarly, for most measures, there were no differences in terms of the effects of the program on the basis of children's level of English language proficiency. The only area where there was a difference was for phonological awareness; positive effects of program participation were found for children who were fluent in English, whereas there were no differences for children with no or limited English fluency. Phonological awareness concepts involve more complex language skills that may require a higher level of language proficiency to learn; therefore, children at lower proficiency levels may not have been developmentally ready regardless of whether they were attending pre-k.

No effects were found for vocabulary or behavior skills, although average scores were around the norm for both groups. Given that these children were scoring within the expected range for their age group, vocabulary may be an area that is relatively more difficult to alter beyond normal development during the course of a pre-k program. All children are likely to receive some level of exposure to vocabulary outside of pre-k, perhaps to a greater degree than some of the other language, literacy, and math skills that were measured. With regard to behavior skills, this was the one area that was based on teacher ratings at the start of the school year. For the treated group, these ratings were provided by their kindergarten teachers (since they had completed pre-k and were entering kindergarten) whereas for the untreated group, these

ratings were provided by their pre-k teachers (since these children were just entering the pre-k program). Both groups were performing as expected for their age; the lack of differences in the level of behavior skills between these two groups may be related to teachers' expectations for entering kindergartners vs entering pre-kindergartners. It could be that the treated group made gains in behavior skills during pre-k, an idea that is supported by findings from a recent study of Georgia's Pre-K which examined children at the beginning and end of the pre-k year[xv]; however, it may be that once children enter kindergarten, those expectations for the level of behavior skills change.

The findings from the present study are consistent with those from RDD studies of large-scale pre-k programs in other states. A study of the statewide pre-k program in North Carolina also found moderate to large effects for language, literacy, and math skills, but no effects for vocabulary skills[xvi]. Similarly, a study of the universal pre-k program in Tulsa, Oklahoma found positive effects in the areas of language, literacy, and math skills (there was no vocabulary measure)[xvii]. Both studies found positive effects for children from different income levels, consistent with the current findings. The North Carolina study also looked at the effects of English language proficiency and found no moderating effects, in accord with the findings for most measures in the present study.

In sum, these findings provide strong evidence that Georgia's Pre-K provides a beneficial experience for enhancing school readiness skills for all children—boys and girls, those from families of different income levels, and children with differing levels of English language proficiency. These results were found for most measures in the areas of language and literacy, math, and general knowledge, suggesting that participation in Georgia's Pre-K provides children with positive learning opportunities across a broad range of developmental domains.

Table 1. Child Characteristics for Sample and Program

Characteristic	Sample				Georgia's Pre-K Program[a]			
	Treated[b] (n=609)		Untreated[c] (n=569)		2011–2012[b] (n=89,149)		2012–2013[c] (n=87,819)	
	%	n	%	n	%	n	%	n
Gender								
Male	49.3	300	46.6	265	50.8	45,277	51.0	44,765
Female	50.7	309	53.4	304	49.2	43,872	49.0	43,054
Ethnicity								
Hispanic/Latino	14.5	88	13.4	76	15.1	13,481	15.0	13,191
Race								
White/European-American	55.0	335	51.5	293	49.9	44,451	49.5	43,474
Black/African-American	36.5	222	40.4	230	40.6	36,218	40.6	35,620
Asian	1.3	8	2.6	15	3.2	2,824	3.5	3,082
Native American/Alaskan Native	1.2	7	2.1	12	1.8	1,638	2.3	2,020
Multiracial	4.4	27	2.8	16	3.5	3,144	3.5	3,041
Native Hawaiian/Pacific Islander	1.6	10	0.5	3	0.9	834	0.7	582
Family Income								
Category One	58.6	357	58.4	332	58.0	51,686	58.6	51,497
Category Two	41.4	252	41.7	237	42.0	37,463	41.4	36,322
Limited English Proficiency	10.8	66	8.8	50	10.8	9,663	9.7	8,550
Individualized Education Program	4.3	26	2.3	13	3.6	3,175	3.8	3,306
Provider Type								
Local School System	55.2	336	42.2	240	43.9	39,144	44.6	39,201
Private Sites	44.8	273	57.8	329	55.0	48,992	54.2	47,595
Caregiver Education[d]								
Less than High School	11.1	61	10.5	63	—	—	—	—
High School	19.2	105	24.7	148	—	—	—	—
Associate's Degree/Some College	42.9	235	39.5	237	—	—	—	—
Bachelor's Degree	14.2	78	14.5	87	—	—	—	—
Master's/Doctorate Degree	8.6	47	8.5	51	—	—	—	—

[a] This group includes all children who attended Georgia's Pre-K Program at any time during the program year.
[b] Children in the treated group attended Georgia's Pre-K Program during 2011–2012.
[c] Children in the untreated group attended Georgia's Pre-K Program during 2012–2013.
[d] This variable represents information for child's primary caregiver and was only available for study participants. Information was not reported for 22 individuals in the 2011–2012 year and 14 individuals in the 2012–2013 year.

Table 2. Child Outcome Measures

Measure	Scoring
Language and Literacy	
Letter Knowledge	
Naming Letters	Total Score: Range=0–26
Letter-Word Identification	
Woodcock-Johnson III Tests of Achievement Letter-Word Identification (Subtest 1)	W Score: Range≈260–545[a] Standard Score: Mean=100, SD=15
Vocabulary	
Woodcock-Johnson III Tests of Achievement Picture Vocabulary (Subtest 14)	W Score: Range≈260–545[a] Standard Score: Mean=100, SD=15
Phonological Awareness	
Woodcock-Johnson III Tests of Achievement Sound Awareness (Subtest 21)	W Score: Range≈260–545[a] Standard Score: Mean=100, SD=15
Phonemic Awareness	
Woodcock-Johnson III Tests of Achievement Word Attack (Subtest 13)	W Score: Range≈260–545[a] Standard Score: Mean=100, SD=15
Math	
Math Problem-Solving	
Woodcock-Johnson III Tests of Achievement Applied Problems (Subtest 10)	W score: Range≈260–545[a] Standard Score: Mean=100, SD=15
Counting	
Counting Task	Total Score: Range=0–40
General Knowledge	
Basic Self-Knowledge	
Social Awareness Task	Total Score: Range=0–6
Behavior Skills	
Social Skills	
Social Skills Improvement System Social Skills subscale	Standard Score: Mean=100, SD=15
Problem Behaviors	
Social Skills Improvement System Problem Behaviors subscale	Standard Score: Mean=100, SD=15

[a] The precise range of the W score can vary based on the trait being measured.

Table 3. Children's English Language Proficiency Levels

	Treated (n=611)		Untreated (n=570)	
*pre*LAS Proficiency Level	%	n	%	n
Level 1—Non-English speaker	1.5	9	6.0	34
Level 2—Limited English speaker	1.3	8	4.9	28
Level 3—Limited English speaker	4.8	29	14.9	85
Level 4—Fluent English speaker	19.8	121	27.9	159
Level 5—Fluent English speaker	72.7	444	46.3	264

Table 4. Child Outcome Scores

	Treated				Untreated			
Measure	n	Mean	(SD)	Range	n	Mean	(SD)	Range
Language and Literacy								
Letter Knowledge (Naming Letters[a]) Total Score	611	24.8	3.5	0–26	569	13.7	10.1	0–26
Letter-Word Identification (WJ Ach Letter-Word Identification[b])								
W Score[c]	609	388.8	26.1	314–522	570	337.0	27.4	264–497
Standard Score[d]	609	108.9	12.3	73–168	570	101.2	13.5	69–181
Vocabulary (WJ Ach Picture Vocabulary[b])								
W Score[c]	592	471.6	12.3	397–505	567	463.0	14.2	384–494
Standard Score[d]	592	98.6	11.8	33–133	567	100.4	12.4	38–129
Phonological Awareness (WJ Ach Sound Awareness[b])								
W Score[c]	609	466.1	16.1	420–515	564	443.7	15.4	420–484
Standard Score[d]	609	107.6	20.0	47–174	564	95.2	17.1	64–149
Phonemic Awareness (WJ Ach Word Attack[b])								
W Score[c]	611	436.5	26.6	364–520	569	385.5	23.0	364–495
Standard Score[d]	600	113.0	12.8	71–152	217[e]	118.5	10.2	77–171
Math								
Math Problem-Solving (WJ Ach Applied Problems[b])								
W Score[c]	606	432.1	18.9	318–490	567	403.5	23.4	318–453
Standard Score[d]	606	104.5	12.9	23–144	567	102.7	13.1	59–142
Counting (Counting Task[f]) Total Score	609	34.6	9.0	2–40	565	18.0	11.3	1–40
General Knowledge								
Basic Self-Knowledge (Social Awareness Task[g]) Total Score	610	5.2	1.1	1–6	570	4.2	1.4	0–6
Behavior Skills								
Social Skills (SSiS) Standard Score[d]	499	100.8	15.9	51–131	545	98.9	15.7	43–130
Problem Behaviors (SSiS) Standard Score[d]	503	98.7	13.8	83–160	544	100.2	14.9	82–160

[a] Possible range=0–26.
[b] Scores reflect use of updated normative tables (2007).
[c] W scores range from ~260 to 545, but can vary based on the trait being measured.
[d] Standard scores are norm-references with mean=100, SD=15
[e] Note that standard scores could not be calculated for a substantial number of children in the untreated sample due to low scores.
[f] Possible range=0–40.
[g] Possible range=0–6.

Table 5. Child Outcomes Regression Results—Language and Literacy

	Letter Knowledge (Naming Letters) n=1,180		Letter-Word Identification (WJ Ach Letter-Word ID) n=1,179		Vocabulary (WJ Ach Picture Vocabulary) n=1,159		Phonological Awareness (WJ Ach Sound Awareness) n=1,173		Phonemic Awareness (WJ Ach Word Attack) n=1,180	
	Est[a]	(SE)	Est[a]	(SE)	Est[a]	(SE)	Est[a]	(SE)	Est[a]	(SE)
Child Characteristics										
Gender[b]	0.38	(0.41)	-0.27	(1.44)	-1.48	(0.60)	1.50	(0.80)	0.40	(1.38)
Ethnicity[c]	-0.40	(0.68)	-0.18	(2.41)	-11.01***	(1.02)	-4.18**	(1.32)	0.24	(2.30)
Race[d]										
Black/African-American	0.98	(0.47)	3.87*	(1.65)	-1.24	(0.68)	-3.84***	(0.90)	0.29	(1.56)
Other	2.75*	(0.89)	8.74**	(3.15)	-6.78**	(1.36)	-0.15	(1.72)	7.78*	(3.00)
IEP[e]	-1.03	(1.15)	-3.64	(4.05)	-2.89	(1.74)	-7.29*	(2.28)	-6.70	(3.88)
English Proficiency[f]	3.47**	(0.62)	12.71**	(2.17)	12.94**	(0.90)	13.11**	(1.20)	12.04**	(2.07)
Family Characteristics										
Caregiver Education	0.50**	(0.10)	2.66***	(0.37)	0.63**	(0.15)	1.14**	(0.20)	1.90**	(0.34)
Income[g]	0.69	(0.47)	4.19*	(1.66)	3.14***	(0.69)	3.62**	(0.91)	4.33*	(1.58)
Provider Type[h]	-0.79	(0.47)	-2.12	(1.66)	1.41*	(0.66)	-0.73	(0.87)	-2.33	(1.52)
Age	-0.56*	(0.22)	-0.20	(0.77)	-0.64	(0.32)	-0.07	(0.43)	-0.62	(0.74)
Age Squared	0.03	(0.02)	-0.07	(0.07)	0.01	(0.03)	-0.07	(0.04)	0.01	(0.06)
Treatment	8.26***	(1.04)	39.24***	(3.69)	-0.14	(1.52)	11.36***	(2.00)	42.75***	(3.49)
Treatment * Age	0.44	(0.35)	-1.41	(1.25)	0.07	(0.52)	-1.06	(0.69)	0.14	(1.20)
Treatment * Age Squared	-0.03	(0.03)	0.00	(0.10)	-0.02	(0.04)	0.04	(0.06)	0.00	(0.10)
Moderators										
Treatment x Gender	0.55	(0.81)	5.86	(2.87)	—	—	1.97	(1.57)	4.58	(2.75)
Treatment x Income	-2.35	(1.85)	1.87	(3.01)	—	—	2.55	(1.63)	1.46	(2.86)
Treatment x English Prof.	-1.70	(1.29)	2.73	(4.60)	—	—	10.21***	(2.49)	8.71	(4.35)

[a] *p< .05, **p< .01, ***p< .001.
[b] Male=0, Female=1.
[c] Non-Latino=0, Latino=1.
[d] White/European American was the reference cell.
[e] No IEP=0, IEP=1.
[f] Non-/Limited fluency=0, Fluent=1.
[g] Category One=0, Category Two=1.
[h] Private site=0, Local school system site=1.

Table 6. Child Outcomes Regression Results—Math, General Knowledge, and Behavior Skills

	Math				General Knowledge		Behavior Skills			
	Math Problem-Solving (WJ Ach Applied Problems) n=1,173		Counting (Counting Task) n=1,174		Basic Self-Knowledge (Social Awareness) n=1,180		Social Skills (SSiS) n=1,044		Problem Behaviors (SSiS) n=1,047	
	Est[a]	(SE)	Est[a]	(SE)	Est[a]	(SE)	Est[a]	(SE)	Est[a]	(SE)
Child Characteristics										
Gender[b]	0.76	(1.05)	0.45	(0.57)	0.16	(0.07)	-1.04	(0.88)	0.93	(0.78)
Ethnicity[c]	-0.66	(1.76)	0.29	(0.95)	-0.38**	(0.11)	1.51	(1.52)	-5.35**	(1.35)
Race[d]										
Black/African-American	-7.01***	(1.19)	-0.06	(0.65)	0.20*	(0.08)	-3.25*	(1.06)	1.10	(0.96)
Other	-0.37	(2.31)	1.66	(1.23)	-0.10	(0.15)	1.40	(1.93)	-1.59	(1.73)
IEP[e]	-9.64*	(2.99)	-4.56*	(1.59)	-0.10	(0.19)	-4.73	(2.54)	7.59*	(2.32)
English Proficiency[f]	23.11**	(1.59)	5.04**	(0.85)	0.89*	(0.10)	7.81**	(1.30)	-5.40**	(1.15)
Family Characteristics										
Caregiver Education	1.33**	(0.27)	0.35	(0.14)	0.05*	(0.02)	0.48	(0.23)	-0.13	(0.21)
Income[g]	2.90	(1.22)	1.42	(0.65)	0.19	(0.08)	1.57	(1.04)	-1.74	(0.92)
Provider Type[h]	-0.31	(1.14)	-1.15	(0.66)	-0.06	(0.07)	-1.34	(1.23)	-0.04	(1.17)
Age	-0.36	(0.57)	-0.21	(0.30)	0.00	(0.04)	-0.15	(0.44)	-0.43	(0.41)
Age Squared	-0.05	(0.05)	-0.03	(0.03)	0.00	(0.00)	-0.02	(0.04)	0.04	(0.03)
Treatment	13.12***	(2.66)	11.28***	(1.45)	0.57***	(0.17)	-5.28	(2.41)	1.44	(2.23)
Treatment * Age	-0.92	(0.92)	-0.41	(0.49)	-0.06	(0.06)	-0.28	(0.78)	0.81	(0.71)
Treatment * Age Squared	0.04	(0.07)	0.00	(0.04)	0.00	(0.00)	0.04	(0.06)	-0.04	(0.06)
Moderators										
Treatment x Gender	0.48	(2.11)	1.72	(1.13)	-0.11	(0.13)	—	—	—	—
Treatment x Income	-2.34	(2.19)	-1.79	(1.18)	-0.02	(0.14)	—	—	—	—
Treatment x English Prof.	1.88	(3.32)	-0.27	(1.79)	0.12	(0.21)	—	—	—	—

[a] *p< .05, **p< .01, ***p< .001.
[b] Male=0, Female=1.
[c] Non-Latino=0, Latino=1.
[d] White/European American was the reference cell.
[e] No IEP=0, IEP=1.
[f] Non-/Limited fluency=0, Fluent=1.
[g] Category One=0, Category Two=1.
[h] Private site=0, Local school system site=1.

Figure 1. Letter Knowledge (Naming Letters)

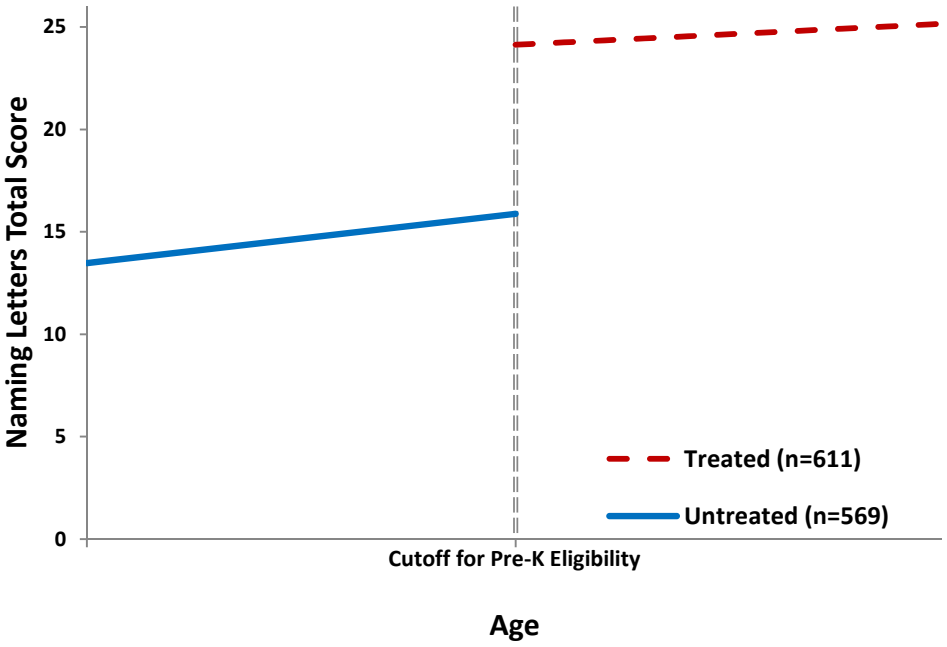


Figure 2. Letter-Word Identification (WJ Ach Letter-Word Identification)

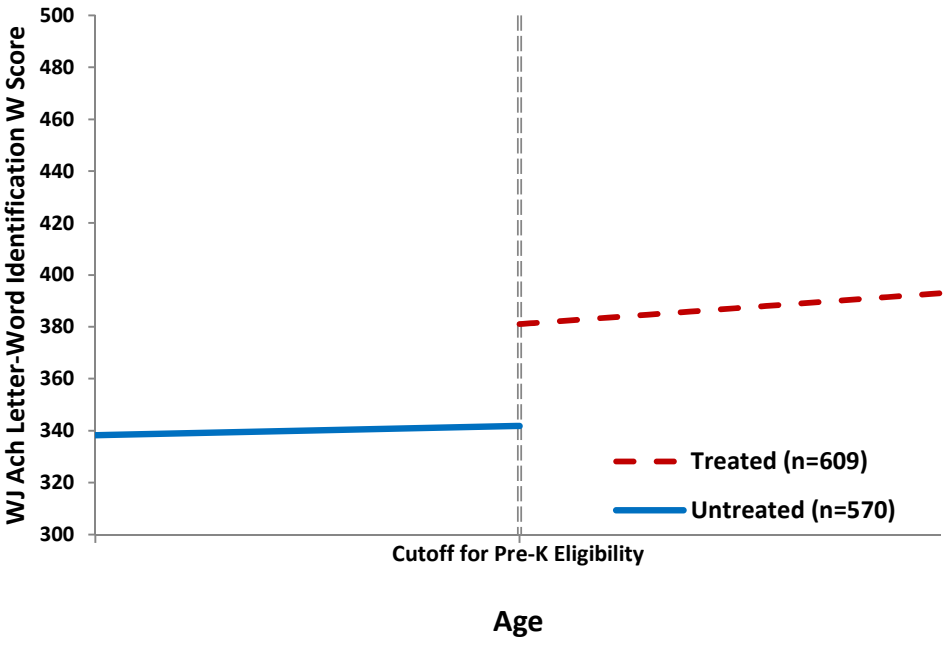


Figure 3. Phonological Awareness (WJ Ach Sound Awareness)

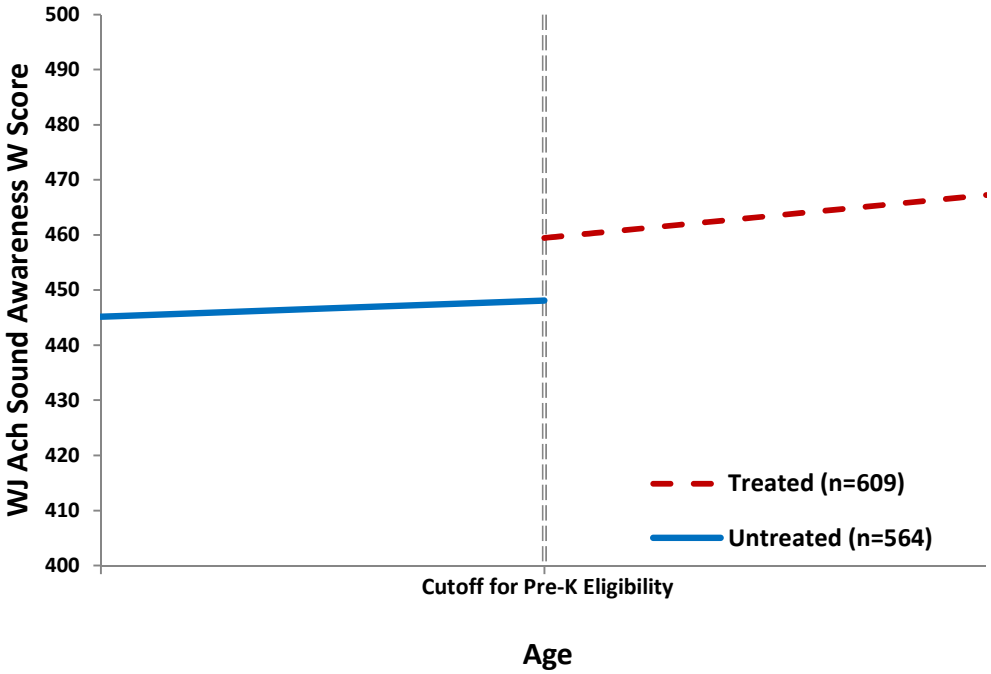


Figure 4. Phonemic Awareness (WJ Ach Word Attack)

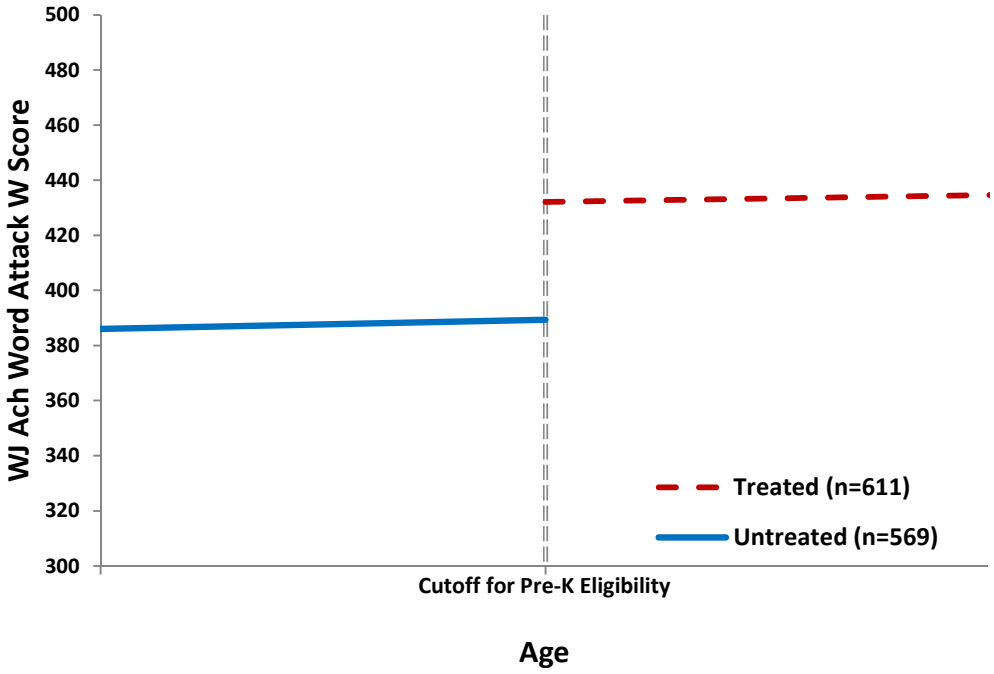


Figure 5. Math Problem-Solving (WJ Ach Applied Problems)

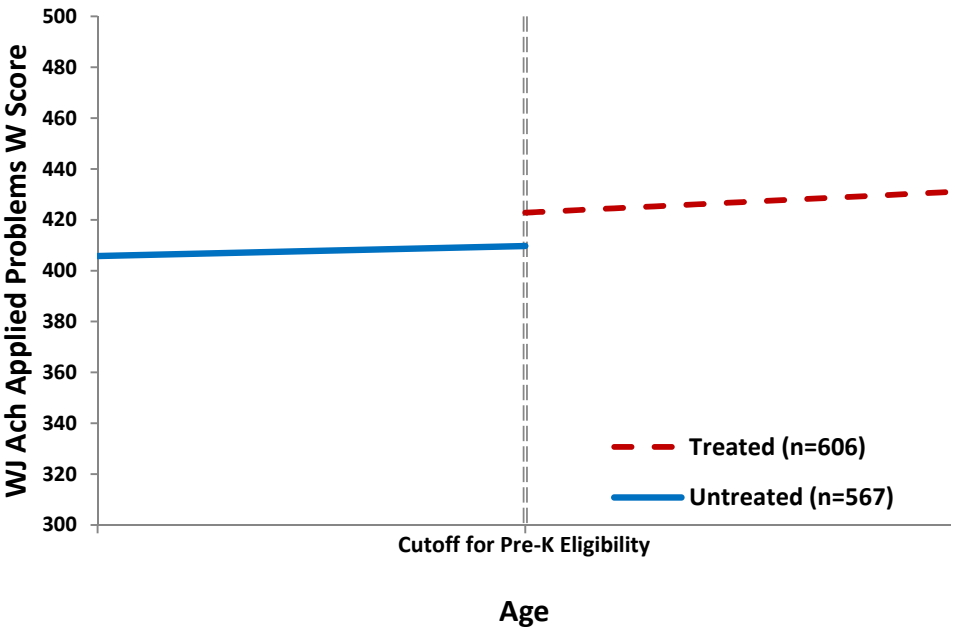


Figure 6. Counting (Counting Task)

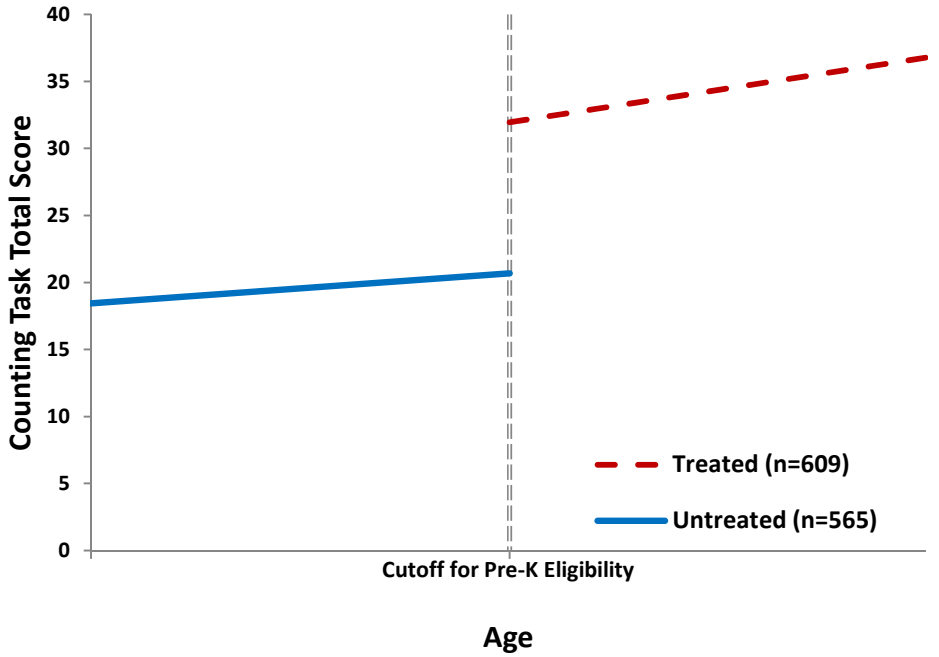


Figure 7. Basic Self-Knowledge (Social Awareness Task)

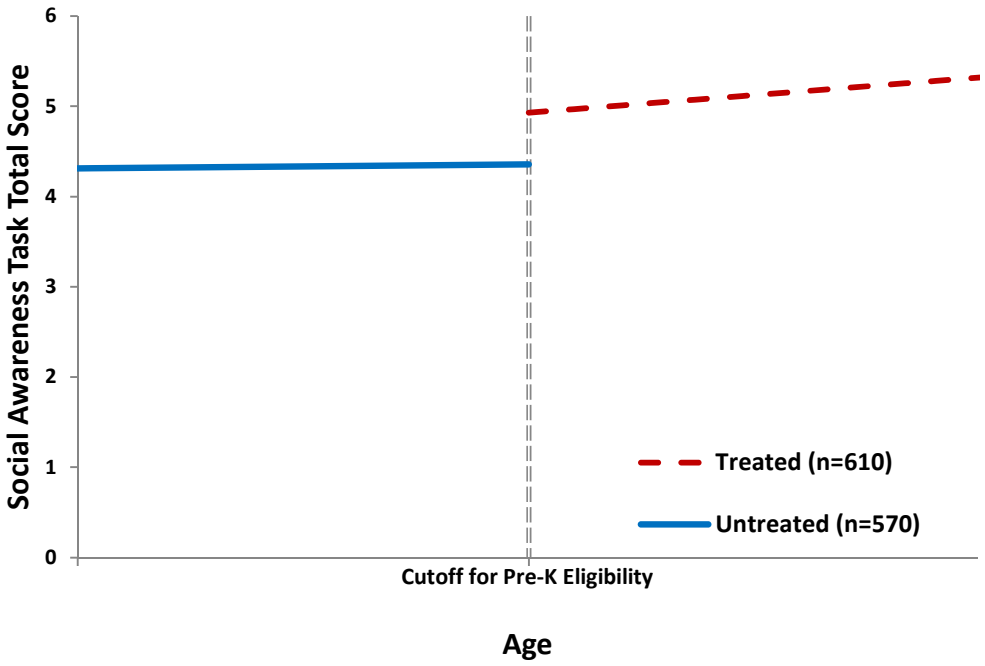
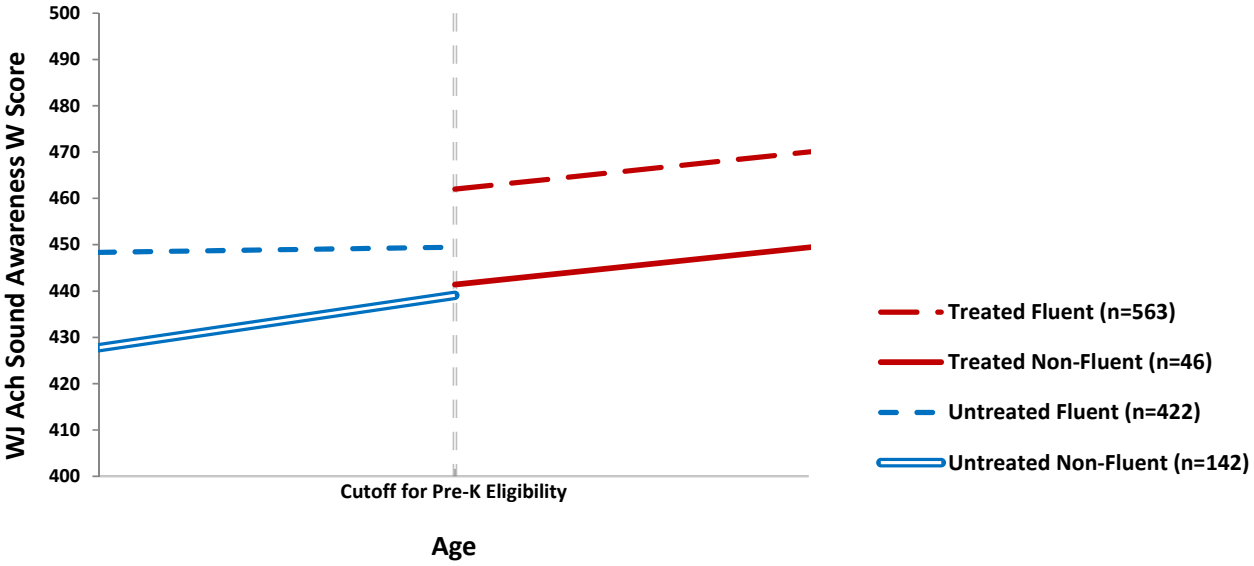


Table 7. Effect Sizes for Treated vs. Untreated Differences

Measure	d^a
Language and Literacy	
Letter Knowledge (Naming Letters)	0.89***
Letter-Word Identification (WJ Ach Letter-Word Identification)	1.05***
Vocabulary (WJ Ach Picture Vocabulary)	0.01
Phonological Awareness (WJ Ach Sound Awareness)	0.59***
Phonemic Awareness (WJ Ach Word Attack)	1.20***
Math	
Math Problem-Solving (WJ Ach Applied Problems)	0.51***
Counting (Counting Task)	0.86***
General Knowledge	
Basic Self-Knowledge (Social Awareness Task)	0.43***
Behavior Skills	
Social Skills (SSiS)	0.23
Problem Behaviors (SSiS)	0.10

[a] Results based on Cohen's *d* *p< .05, **p< .01, ***p< .001.

Figure 8. Phonological Awareness (WJ Ach Sound Awareness) Treatment by Language Proficiency



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