

# **The Effects of New Jersey's Abbott Preschool Program on Young Children's School Readiness**

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### **Executive Summary**

This study measures the effects of attending New Jersey’s Abbott Preschool program at age 4 on entering kindergartners’ academic skills using an innovative research model. Language (receptive vocabulary), early literacy and early math skills were assessed in a sample of 2072 children from across 21 Abbott districts. For most children, this is an estimate of the effects of attending preschool for two years rather than one year, since most children start the Abbott Program at age 3. Results indicate that the Abbott Preschool program has statistically significant and meaningful impacts on children’s language, literacy and mathematical development. Specifically:

1. Attending the Abbott Preschool Program at age 4 increased receptive vocabulary scores by almost 4 raw score points, 26 percent higher growth over the year due to the program (and a 10 percent increase in average scores). This improvement translates into an additional four months of progress in vocabulary growth due to the program. This outcome is particularly important because the measure is strongly predictive of general cognitive abilities.
2. Attending the Abbott Preschool Program at age 4 increased children’s math scores by almost one raw score point, 24 percent more growth over the year (and a 10 percent increase in average scores). Math skills tested include basic number concepts, simple addition and subtraction, telling time and counting money.
3. Attending the Abbott Preschool Program at age 4 increased children’s print awareness scores by over 12 percentage points, 61 percent higher growth for the year (and a 28 percent increase in average print awareness scores). Children who attend the program know more letters, more letter-sound associations, and are more familiar with words and book concepts.
4. We found no significant effects on children's phonological awareness. A relatively new measure was used, and it is difficult to determine whether this result is due to a true lack of program effects.

New Jersey’s evaluation is part of a larger multi-state study of the effects of state-funded preschool, which includes 5071 preschool and kindergarten children sampled across four additional states – Michigan, Oklahoma, South Carolina and West Virginia. It is important to note that children in the other study states could not have attended a state-funded program at age 3, while most children in New Jersey’s Abbott districts started at age 3. Results for New Jersey should not be compared one-to-one with those from other states. The New Jersey study estimates the added effects of preschool at age 4, after most children have had a year of preschool at age 3. It does not estimate the effects of two years of preschool, which could be much larger. This is the first of a series of reports from this study examining the effects of the Abbott preschool program.

## **Introduction**

State-funded preschool programs have become increasingly common across the country, having been established to some extent in up to 40 states (Barnett et al. 2004). The primary goal of these state-funded preschool programs is the preparation of young children for the increasingly rigorous challenges of kindergarten. Effective preschool programs lay a foundation for children's subsequent school success by imparting the basics – colors, shapes, numbers, letters, how to look at a book, how to get along with classmates, how to live by the rules in school - sending children to kindergarten with solid successes in preschool and the real confidence that success creates. As the number of state funded preschool programs grow, it is important to determine how effective these programs are in improving children's potential for school success.

### **The Abbott Preschool Program Context**

New Jersey's Abbott preschool programs served 38,011 children in FY 04 using \$367 million in state education funding. The Abbott preschools were named after a long-running court case, in which the state was ordered by the court to provide high quality preschool education to children in the state's 31 highest poverty districts. The NJ Department of Education funds preschools to provide year-round, full-day services (6 hours per day) in public schools, Head Start programs and private child care centers. Additional state childcare funds provide extended day services.

The NIEER *2004 State of Preschool: State Preschool Yearbook* analyzed state funded preschool initiatives in FY '02-03 based on access, resources and quality. Each state was ranked on access to and resources for preschool education. New Jersey stands as a national leader in providing access and resources for preschool, ranking 1st in the nation for access for 3-year-olds; 11<sup>th</sup> for access to preschool for 4-year-olds; and 1st in the nation for fiscal resources provided. It is a relatively new preschool program compared to those in many other states.

In addition, New Jersey's educational policies for preschool programs rated relatively highly, earning nine points out of 10 on a quality standard checklist. Importantly, New Jersey's Abbott preschools have comprehensive curriculum standards and require that teachers have a bachelor's degree and specialized training in early childhood education.

## **Methods**

### **Research Model**

The Abbott preschool program evaluation is based on regression-discontinuity (RD) design, a statistical model with several strengths. The design addresses one of the most vexing problems in educational research, that of selection bias. Typically, program

effects are estimated by comparing the test scores of children who attended a program with the scores of similar children who did not go. Where programs are universal, the problem of finding a “comparable” group of children who did not go to preschool is obvious. Yet, even where programs target only some children, a problem remains: those who go to preschool are *not* the same as those who do not. Preschool programs that target specific types of children create these differences, but differences also come about because some parents choose to enroll their children and others do not. In sum, children who go to preschool differ from those who do not because programs select children and families select programs.

Using the RD design we compare two groups of children who select (and are selected by) the state program, using a fairly stringent age cutoff for enrollment eligibility to define groups. This approach is easier to understand when considered in the extreme case: consider two children who differ only in that one was born the day before the age cutoff and the other the day after. When both are about to turn 5 years old, the slightly younger child will enter the preschool program and the slightly older child will enter kindergarten having already attended the preschool program. If both are tested at that time, the difference in their scores can provide an unbiased estimate of the state preschool program’s effect since both are essentially the same age. Obviously, if only children with birthdays one day on either side of the age cutoff were included in a study, the sample size would be unreasonably small. However, the approach can be applied to wider age ranges around the cutoff. In fact, all children entering kindergarten from the state preschool program, and all children beginning preschool in the same year can be included using regression discontinuity statistical techniques that adjust for the effects of age. This RD approach reduces the likelihood that selection bias has an appreciable impact on our results.

For the overall study the research question of interest is whether attendance in the state-funded preschool program at age 4 has an impact on academic skills at kindergarten entry. This question is addressed with identical methods and measures across five states: Michigan, New Jersey, Oklahoma, South Carolina and West Virginia. The programs in Michigan, New Jersey and South Carolina are targeted to at-risk children while the programs in Oklahoma and West Virginia are universal. Each state program is unique, but all required licensed teachers with four-year college degrees and certification in early childhood (with minor exceptions in Michigan).

An additional question was added in New Jersey to investigate the impact of one or two years of preschool on skills at kindergarten entry, since most children in the sample there attended two years in the Abbott Program. This report addresses the impact of the Abbott preschool experience on children’s skills at kindergarten entry for children who attended at age 4, whether they had two years beginning at 3 or just one year at 4 years old. Subsequent reports will address in detail the impacts of one and two years of preschool in the Abbott Program on skills at kindergarten entry.

## **Sampling Strategy**

A stratified random sample of 21 Abbott districts was selected across factors including district enrollment size, geographic location within the state, urban versus rural settings, and percentage of bilingual students. We first randomly selected Abbott-funded preschool classrooms from a list of the total number of Abbott-funded preschool classrooms across those districts. We then randomly selected kindergarten classrooms within the districts to provide an equal number of kindergartners. Kindergartners were over-sampled to comply with district-level reporting requirements. From each of these classrooms approximately four children were randomly selected.

Trained research staff from the National Institute for Early Education Research at Rutgers University visited each sampled program site, selected children into the sample using a procedure to ensure randomness. They then conducted the child assessment as early as possible in the school year. A liaison at each site gathered information on the children's preschool status, usually from existing school records but occasionally from parent report. Reimbursement was \$5 per selected child.

## **Sample**

As mentioned above, this evaluation requires two groups of children. One group, currently attending kindergarten and who attended the state-funded preschool program the previous year, is called the "Preschool" group or the experiment group. The second group, currently attending the state-funded preschool program, 4-year-olds only, is called the "No Preschool" group, or the control group. This group is called the "No preschool" group despite the fact that they are currently enrolled in the state-funded preschool program, because they are at the very beginning of their preschool year and have not had the preschool "treatment" yet.

In New Jersey, an initial random sample of 709 classrooms, 284 preschool classrooms and 425 kindergarten classrooms was randomly selected across 21 Abbott districts. As a result of school/ classroom refusals or fieldwork issues, children in 191 classrooms (27 percent of the total initial sample) were not assessed. Data were gathered from 518 classrooms, 223 preschool and 295 kindergarten classrooms, with an average of four children per class. The total sample size is 2072 children selected across 21 of the Abbott districts, 900 in the No Preschool group and 1172 in the Preschool group. The sample is 49 percent male, and includes children of different ethnicities as follows: Hispanic – 44 percent; African-American – 34 percent; White – 17 percent, Asian – 2 percent, American Indian - 0.5 percent, and other ethnicities – 3 percent.

Findings for the New Jersey Abbott sample are not directly comparable to findings from the larger study sample of 5071 children including four additional states (Michigan, Oklahoma, South Carolina and West Virginia) because children in New Jersey's Abbott districts usually begin state-funded preschool at age 3 and a variety of circumstances affect the experiences of children who do not attend state-funded preschool programs in all of the states. Additionally, New Jersey's sample includes

much higher percentages of African-American and Hispanic children. The larger sample is 48 percent male with ethnicities as follows: White – 47 percent, African American – 25 percent, Hispanic – 21 percent, Native American - 2.5 percent, Asian – 2 percent and all other ethnicities – 2 percent.

## **Measures of School Readiness**

### **Receptive Vocabulary**

Children’s receptive vocabulary was measured using the Peabody Picture Vocabulary Test, 3<sup>rd</sup> Edition (PPVT-3) (Dunn & Dunn, 1997) and for Spanish-speakers the Test de Vocabulario en Imagenes Peabody (TVIP) (Dunn, Padilla, Lugo & Dunn, 1986). The PPVT is commonly used as quick test of IQ and can be used as a rough assessment of general cognitive abilities. The PPVT is a direct measure of vocabulary size and the rank order of item difficulties is highly correlated with the frequency with which words are used in spoken and written language. The test is adaptive (to avoid floor and ceiling problems), establishing a floor below which the child is assumed to know all the answers and a ceiling above which the child is assumed to know none of the answers. Reliability is good as judged by either split-half reliabilities or test-retest reliabilities. The TVIP is appropriate for measuring growth in Spanish vocabulary for bilingual students and for monolingual Spanish speakers. Raw scores are reported.

### **Mathematical Skills**

Children’s early mathematical skills were measured with the Woodcock-Johnson Tests of Achievement, 3<sup>rd</sup> Edition (Woodcock, McGrew & Mather, 2001) Subtest 10 Applied Problems. For Spanish-speakers the Bateria Woodcock-Munoz Pruebas de Aprovechamiento – Revisado (Woodcock & Munoz, 1990) Prueba 25 Problemas Aplicados will be used. Subtests of the Woodcock-Johnson are reported to have good reliability. Raw scores are reported.

### **Phonological Skills and Print Awareness**

Phonological skills development was measured using the Blending subtest of the Preschool Comprehensive Test of Phonological & Print Processing (Pre-CTOPPP; Lonigan, Wagner, Torgeson & Rashotte, n.p.) The Pre-CTOPPP was designed as a downward extension of the Comprehensive Test of Phonological Processing (CTOPP; Wagner, Torgeson & Rashotte, 1999), which measures phonological sensitivity in elementary school-aged children. Although not yet published, the Pre-CTOPPP has been used with middle-class and low-income samples and includes a Spanish version. As the Pre-CTOPP has only been very recently developed, very little technical information is available about its performance and psychometric properties.

The Blending subtest includes items that measure whether children can blend initial phonemes onto one-syllable words, initial syllables onto 2-syllable words, and

ending phonemes onto one-syllable words. The percentage of items the child answered correctly out of the 21 total subtest items is reported.

Print Awareness was measured using the Print Awareness subtest of the Pre-CTOPPP. Items measure whether children recognize individual letters and letter-sound correspondences, and whether they differentiate words in print from pictures and other symbols. The percentage of items answered correctly out of the 36 total subtest items is reported.

## **Results**

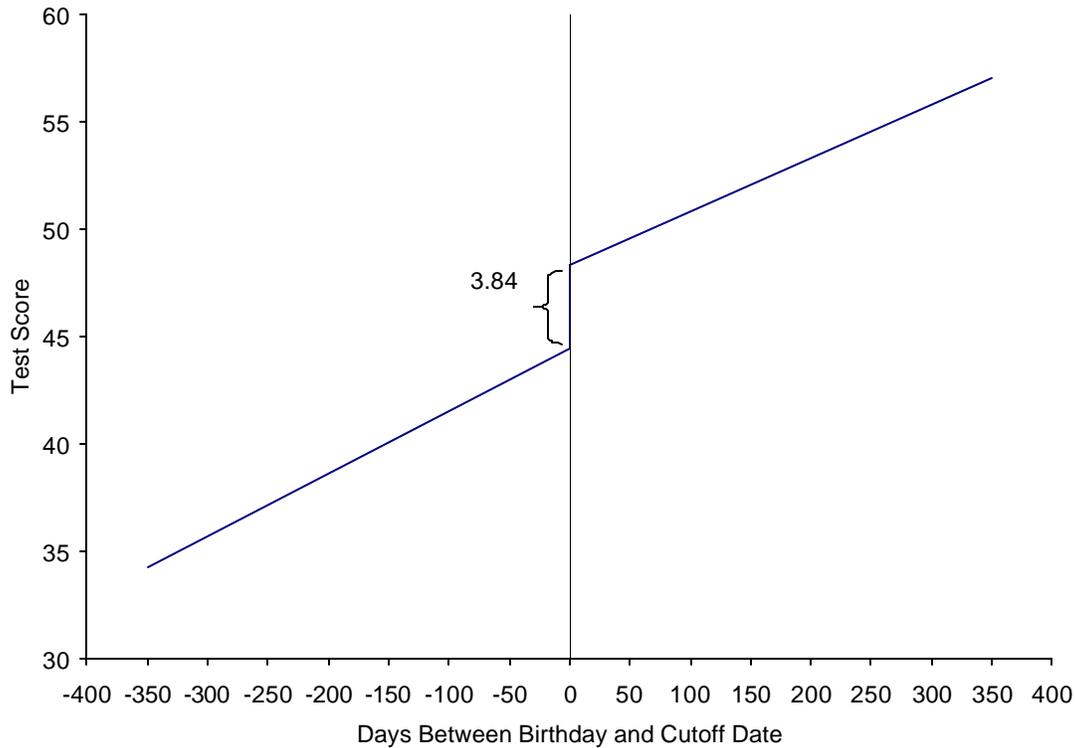
The main results for the effects of New Jersey's Abbott program at age 4 are displayed in individual figures for each outcome measure. Each figure displays a regression line of the children's predicted test scores by the distance away in days their birth date is from the program enrollment cut-off date. The discontinuity in the regression line at the cut-off date is the estimated effect of the preschool program.

### **Receptive Vocabulary**

The estimated effect of state-funded preschool on children's receptive vocabulary as measured by the PPVT (or TVIP for Spanish-speaking children) is statistically significant. Attending New Jersey's Abbott program at age 4 is estimated to increase PPVT scores by 3.84 points. For children of preschool and kindergarten age on this measure raw score points translate into about the same number of standard score points, so the improvement is about 26 percent of a normed standard deviation. The effect of the program can also be understood as a 26 percent increase in the growth of vocabulary scores over the preschool year and a 10 percent increase in children's average vocabulary scores.

Age equivalence scores provide a measure of children's vocabulary knowledge using a normed estimate of the average age of children who score the same. Results indicate that the average improvement due to the program in New Jersey at age 4 is approximately an additional four months of vocabulary development over the year.

Figure 1 below portrays a regression line of the children's predicted PPVT scores by the distance in days their birth date is from the program enrollment cut-off date. The discontinuity in the regression line at the cut-off date represents the estimated effect of the preschool program which is 3.84 raw score points.

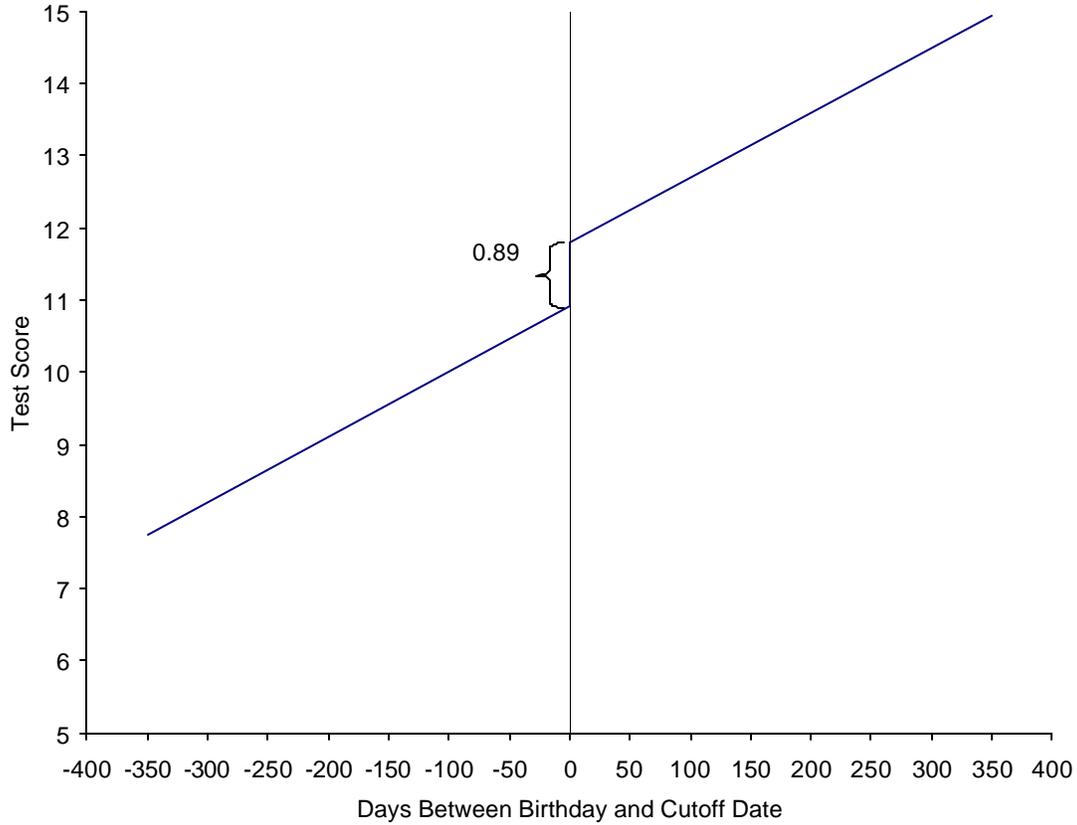
**Figure 1. Abbott Preschool's Effects on Receptive Vocabulary Scores**

### **Math Skills**

The effect of state-funded preschool on children's early math skills as measured by the Woodcock-Johnson-III Applied Problems subtest scores is statistically significant for New Jersey's Abbott program. The improvement in children's scores due to New Jersey's Abbott program at age 4 is just under one raw score point (0.89). One raw score point roughly translates into 3 standard score points for samples of preschool and kindergarten age, so the effect of New Jersey's program is equivalent to about 2.7 standard score points or 18 percent of a normed standard deviation. The effect of the program can also be understood as a 24 percent increase in the growth in children's math scores over the year or a 10 percent increase in children's average math scores.

Figure 2 below portrays a regression line of the children's predicted Applied Problems scores by the distance in days their birth date is from the program enrollment cut-off date. The discontinuity in the regression line at the cut-off date represents the estimated effect of the preschool program, or .89 raw score points.

**Figure 2. Abbott Preschool’s Effects on Early Math Scores**

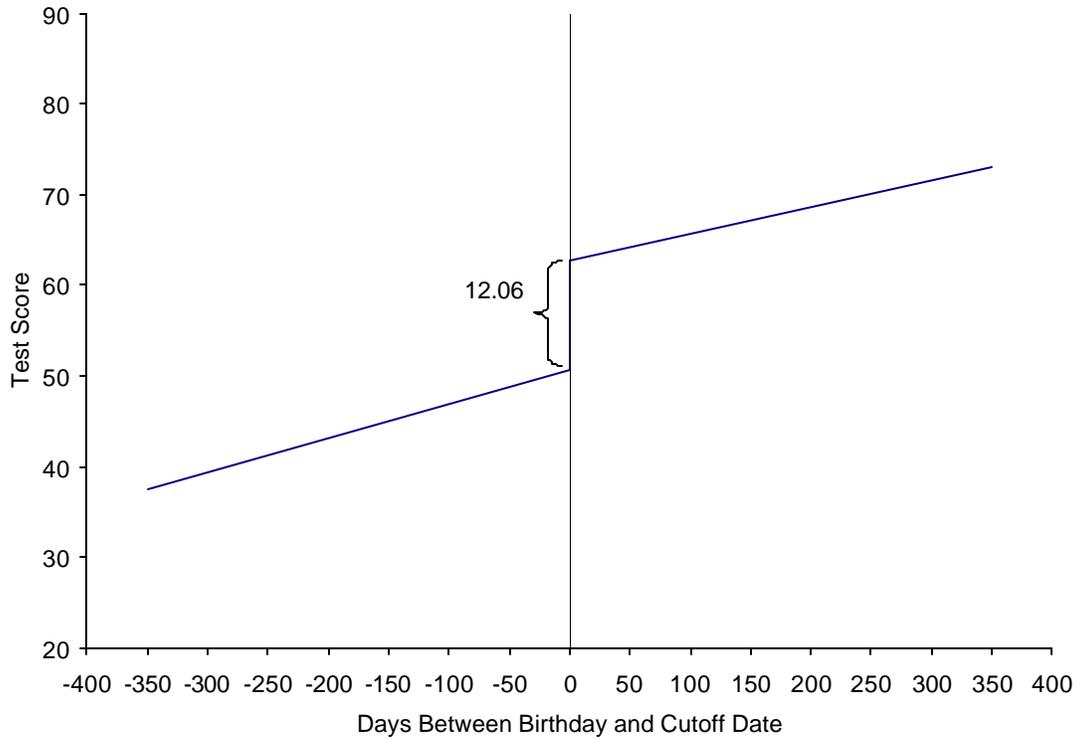


**Print Awareness**

The effect of New Jersey’s Abbott program at age 4 on children’s Print Awareness scores is statistically significant. New Jersey’s program increases children’s scores by just over 12 percent more items correct, or almost half of a standard deviation on the Print Awareness subtest. The effect of the program can also be understood as a 61 percent increase in growth of children’s print awareness scores over the year or a 28 percent increase in children’s average print awareness scores.

Figure 3 below portrays a regression line of the children’s predicted Print Awareness scores by the distance in days their birth date is from the program enrollment cut-off date. The discontinuity in the regression line at the cut-off date represents the estimated effect of the preschool program, or an increase of 12.06 percentage points in items answered correctly.

**Figure 3. Abbott Preschool’s Effects on Print Awareness Scores**

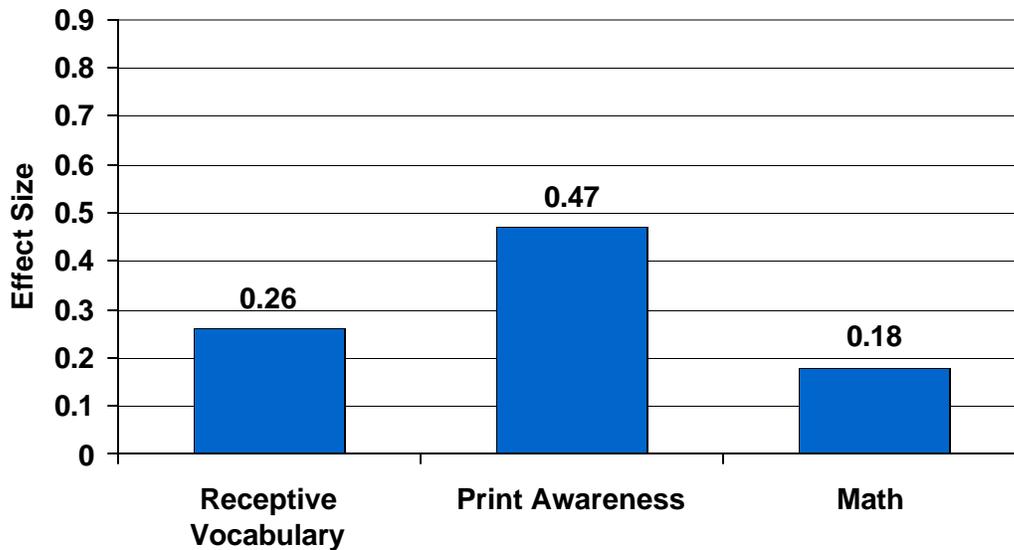


**Phonological Skills**

No statistically significant effect of prekindergarten was found on phonological awareness as measured by the Blending subtest, either overall or for New Jersey. In New Jersey, while the difference in Blending subtest scores between the groups may seem large (61.06 percent of items correct for the No Preschool group versus 70.78 percent for the Preschool group), the estimated effect of the program was small and not statistically significantly different from zero. The positive difference between the group average scores is mostly likely accounted for by the fact that the Preschool group children are older than the No Preschool group children, but would have developed these skills at this rate even without the program.

**Summary**

By way of summary, Figure 4, below portrays effect sizes of the impact of the Abbott preschool program at age 4 on children’s receptive vocabulary, print awareness and math scores. These effect sizes are another way of standardizing the estimated effects so that they may be compared to estimated effects in other studies.

**Figure 4. The Effect of Abbott Preschool on Children’s Scores across Measures**

### **Preschool Effects and Family Income**

Family income, measured by free or reduced-price lunch status as reported by the school was not included in the analyses presented here. Although there is some evidence of slightly larger effects for children from lower-income households when looking across all of the 5 states we studied, the results are broadly similar for all children. New Jersey’s program focuses on children in communities where most children are from lower-income families. Of the 90 percent of sample children for whom we have data, 75 percent receive free or reduced-price lunch. It would be expected that most of those who did not qualify for a lunch subsidy did not have much higher family incomes. Thus, it is not surprising that the effects of the preschool program were found to be highly similar across different income groups in the sample.

### **Discussion**

These study findings provide strong evidence of the positive impact of the Abbott preschool on children’s language, literacy and math skills development. This evidence indicates that the Abbott preschool program produces the kinds of effects that lead to increased school success and later improvements in children’s reading and math skills. For example, children’s early print awareness and receptive vocabulary skills have been found to predict later reading abilities in the early elementary grades (Snow, Burns, & Griffin, 1998). The effects found in this study are the first link in a chain that produces the long-term school success and economic benefits documented by preschool studies that have followed children into adulthood (Schweinhart, Montie, Ziang, Barnett,

Belfield, & Nores, 2005; Campbell, Ramey, Pungello, Sparling, & Miller-Johnson, 2002; Reynolds, Temple, Robertson, & Mann, 2002).

Important positive effects were found for children's receptive vocabulary, print awareness and math skills, with New Jersey's program effects on receptive vocabulary scores very similar to the findings of the overall study. Overall, findings suggest that state-funded preschool programs, including New Jersey's Abbott program, have particularly large effects on children's early print awareness skills. There is some evidence across all five states that economically disadvantaged children gain more from preschool on print awareness than do higher income children.

These impacts are found for the Abbott program even though many of New Jersey's sample children have already had a year of preschool. One might expect the impact of a second year of preschool at age 4 to look somewhat less successful, statistically, than just one year because the first year has already produced some gains. The question of the relative impact of one or two years of preschool will be addressed in subsequent research. It would be expected that the effects of two year of preschool would be considerably larger. In the meantime, score increases that represent an additional four months of vocabulary development at age 4 for Abbott children entering kindergarten may have important implications for school success.

We did not find that state-funded preschool programs significantly improved children's blending skills, our sole measure of phonological awareness. Previous research has shown that the Abbott preschool classrooms do not provide as much support for these skills as they do for vocabulary development and print awareness (Lamy & Frede, 2005). Activities and interactions to support children's phonological sensitivity – hearing smaller sounds within the spoken word that may be parsed out and switched for others to create rhymes and alternate endings – may need to be increased. However, additional construct measurement issues may influence this finding. The No Preschool sample children produced higher average scores on this measure than the average scores reported by the instrument authors. Higher scores at preschool entry would mitigate the impact of preschool on those scores at kindergarten entry; however, the fact that even highly disadvantaged children had higher average scores while scoring relatively lower on other measures may indicate that this instrument is not measuring those skills well for children of this age. Our results suggest that more research is needed on the measure itself.

A limitation of our study is that the vast majority of children were tested only in English. New Jersey, particularly in the Abbott districts, has a large number of children who are English language learners (ELL), and the vast majority are from homes where Spanish is the primary language. As noted earlier, 44 percent of our sample is Hispanic, which is twice the national average for children under 5. Future studies could more fully assess language and literacy development by testing all ELL children in both English and their home language with equivalent tests. Our study provides reasonably good estimates of children's progress in English, but we may underestimate the impact of the preschool programs on language and literacy because we do not capture the gains in Spanish and because even the math test relies on language to provide accurate scores.

Looking across states in the larger study, results indicate that estimated program effects varied among the states on print awareness and math skills, but not on vocabulary. We do not discuss these variations in detail here because their interpretation is not straightforward. It is possible that some of the variation is due to differences among the programs, but this is difficult to determine as the populations served and broader context of available preschool experiences is not the same across states. Some state programs target disadvantaged children and others serve the general population. In New Jersey's Abbott program the population served is highly disadvantaged and contains a much larger percentage of likely ELL children (who are more difficult to test accurately) compared to other state programs. In addition, most of New Jersey's comparison group children attended the same program at age 3. In the other states, many fewer children (in some cases none) attended the state-funded program at age 3, though they could have attended Head Start or a private preschool program or child care center and it is likely that many did (Yarosz & Barnett, 2001).

This study's results are consistent with findings from other rigorous studies of state preschool education programs (Gormley et al., 2004; Barnett et al., 2004; Frede & Barnett, 1992; Irvine, Horan, Flint, Kukuk, & Hick, 1982). Where direct comparisons can be made, the size of the impacts is quite similar to those found in the recent study of Oklahoma's program in Tulsa. These estimated effects for state-funded prekindergarten programs are smaller than those found for highly intensive model programs that had much better teacher-student ratios and provided more than one year of education at age 4 (Barnett, 1998), and are larger than those found in the recent national impact study of the federal Head Start program (Puma, Bell, Cook, Heid, Lopez, Zill, et al., 2005).

In sum, this study finds that New Jersey's Abbott preschool program at age 4 produces significant, meaningful improvements in children's early language, literacy and math skills development at entry into kindergarten, similar to the results of other relatively high quality programs across the country, even those that serve a more advantaged population. As the New Jersey program is relatively new and has been rapidly increasing in quality in recent years (Lamy & Frede, 2005), we look forward to future studies of the program's impact that will add to what we have learned here.

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