

**The Effects of West Virginia's Early Education
Program on Young Children's School Readiness**

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Executive Summary

In this study, we measure the effects of West Virginia's Early Education Program 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 720 children from across West Virginia. We find that West Virginia's Early Education Program has statistically significant and meaningful impacts on children's early literacy and mathematical development.

Specifically:

1. The Early Education Program produces an increase in children's vocabulary scores of about 4 raw score points, 30 percent higher growth over the year due to the program (and a 7 percent increase in children's average vocabulary scores). This improvement translates into an additional three 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. Children who attend the Early Education Program score higher on a test of early math skills. The children in the program increased their math scores by more than 2 raw score points, 63 percent more growth over the year due to the program (and a 17 percent increase in children's average math scores). Skills tested include basic number concepts, simple addition and subtraction, telling time and counting money.
3. The Early Education Program has large effects on children's understanding of print concepts. The program increased children's print awareness scores nearly 23 percentage points, 121 percent more growth over the year due to the program (and a 56 percent increase in children's average print awareness scores). Children who attend the program know more letters, more letter-sound associations, and are more familiar with words and books concepts.
4. We found no significant effects on a measure of children's skills in phonological awareness. As this measure is relatively new, it is difficult to determine the extent to which the result is due to a true lack of program effects.

West Virginia's preschool program 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, New Jersey, Oklahoma and South Carolina.

Introduction

State-funded preschool programs have become increasingly common across the country, having been established to some extent in up to 40 states. While myriad services these programs may provide to families are influenced by complex parental needs which may include longer hours, transportation, health services and the like, the main goal of all 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 Early Childhood Education Program Context

To provide some context for the findings of the study, some of the main characteristics of West Virginia's program are described here. West Virginia's state-funded preschool program served 7,911 children in FY 04 using \$34.5 million in state funding. In many counties all children were eligible as long as they met the age requirements and lived in participating districts. In a smaller number of counties, eligibility was based on at-risk status. It is operated under the auspices of the West Virginia Department of Education. The state school code allows preschool programs to be created by local school boards.

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. West Virginia ranked 6th in the nation in enrollment of 4-year-olds. Importantly, West Virginia requires that teachers in the public preschools have a bachelor's degree with specialized training in early childhood development.

Methods

Study Design

The evaluation of the effects of West Virginia's state-funded preschool program 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 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.

Our approach is to 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 concept 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. 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.

The research question of interest is whether attendance in the state-funded preschool program at age 4 has an impact on children's 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).

Sampling Strategy

To choose a sample of children we first randomly selected state-funded preschool classrooms from a list of the total number of state-funded preschool classrooms across the state. We then sampled the same number of kindergarten classrooms as preschool classrooms within the districts from which the preschool classrooms were selected. From each of these classrooms we then randomly selected approximately four children.

Trained research staff from Marshall University visited each sampled program site, selected children into the sample using a procedure to ensure randomness, and 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, and was reimbursed \$5 per selected child.

Sample

As mentioned above, the 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 of children currently attending the state-funded preschool program 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 only at the very beginning of their preschool year and have not had the preschool “treatment” yet.

In West Virginia, an initial random sample of 139 preschool classrooms across the entire state was drawn. Then the district randomly selected a matching number of kindergarten classrooms. As a result of district, school or classroom refusals, children in 115 classrooms (41percent of the total initial sample) were not assessed. As a result of district and classroom additions, children in 24 classrooms were added to the sample. Data was gathered from 187 classrooms, with an average of four children per class. The total sample size is 720 children, 341 in the No Preschool group and 379 in the Preschool group. The sample is 50 percent male, and includes children of different ethnicities in numbers that closely represent the overall state percentages, as follows: White, 95 percent; African-American, 4 percent; and less than 1 percent each American Indian, Hispanic and Asian.

Findings for the West Virginia sample are not directly comparable to findings from the larger study sample of 5071 children including the four additional states because of differences across programs (for instance, children in other states may begin state-funded preschool at age 3) and other circumstances that affect the experiences of children who do not attend state-funded preschool programs. The larger study 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 by the Peabody Picture Vocabulary Test, 3rd Edition (PPVT-3) (Dunn & Dunn, 1997). 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, 3rd Edition (Woodcock, McGrew & Mather, 2001) Subtest 10 Applied Problems. 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-income 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 two-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 West Virginia's program 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

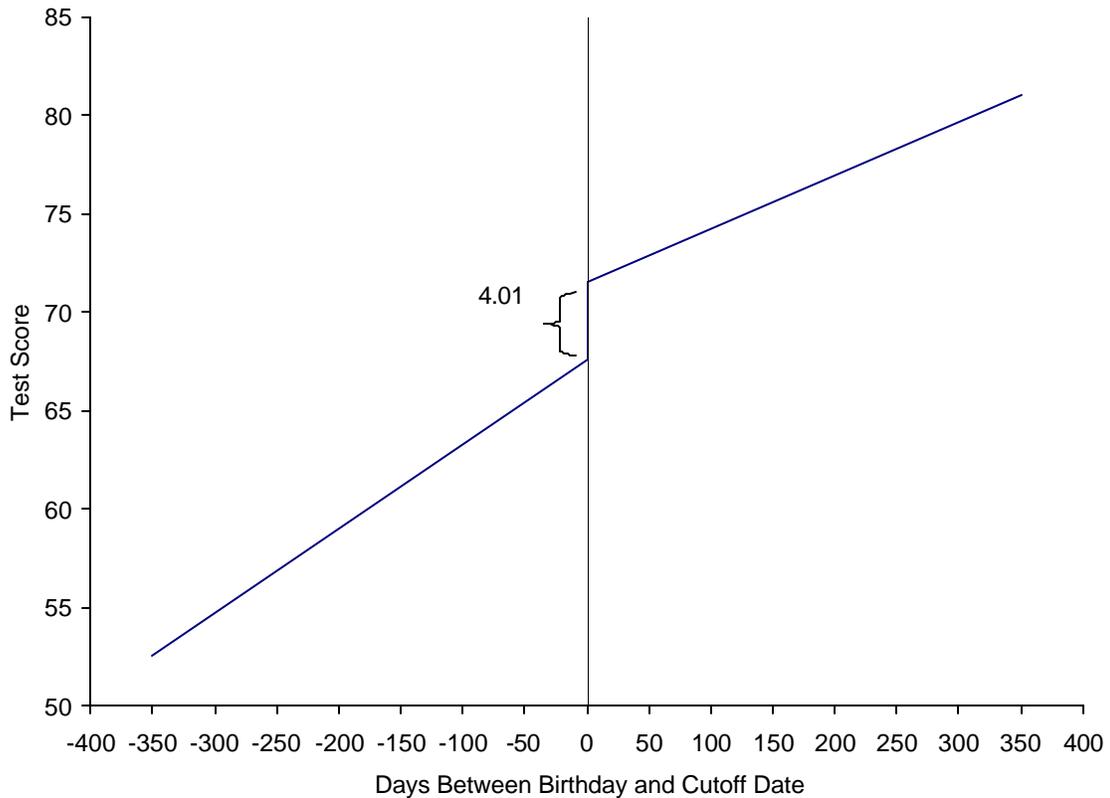
The effect of state-funded preschool on children's receptive vocabulary as measured by the PPVT is statistically significant for West Virginia's program. Results indicate that attendance in West Virginia's preschool program is estimated to increase

children’s PPVT scores by about 4 raw score 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 27 percent of a normed standard deviation. The effect of the program can also be understood as a 30 percent increase in the growth of vocabulary scores over the preschool year and a 7 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 in children’s scores due to the program is worth an additional three months of vocabulary development.

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 equals 4 raw score points.

Figure 1. The Effect of West Virginia’s Early Education Program on Children’s Receptive Vocabulary Scores

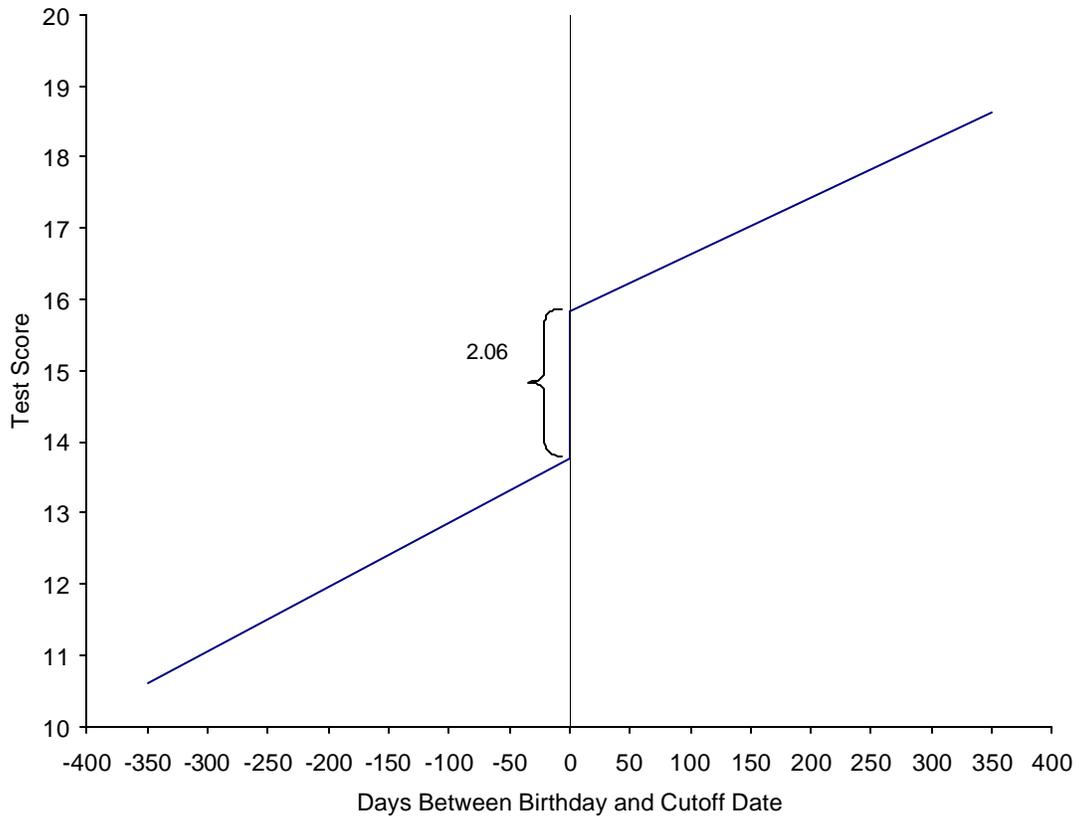


Mathematical Skills

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 West Virginia. The increase in scores for children in West Virginia due to the Early Education Program is worth 2.06 raw score points. One raw score point roughly translates into 3 standard score points for children of preschool and kindergarten age, so the effect of West Virginia’s program is equivalent to about 6 raw score points or 41 percent of a normed standard deviation. The effect of the program can also be understood as 63 percent more growth during the year or a 17 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 2.06 raw score points.

Figure 2. The Effect of West Virginia’s Early Education Program on Children’s Early Math Scores

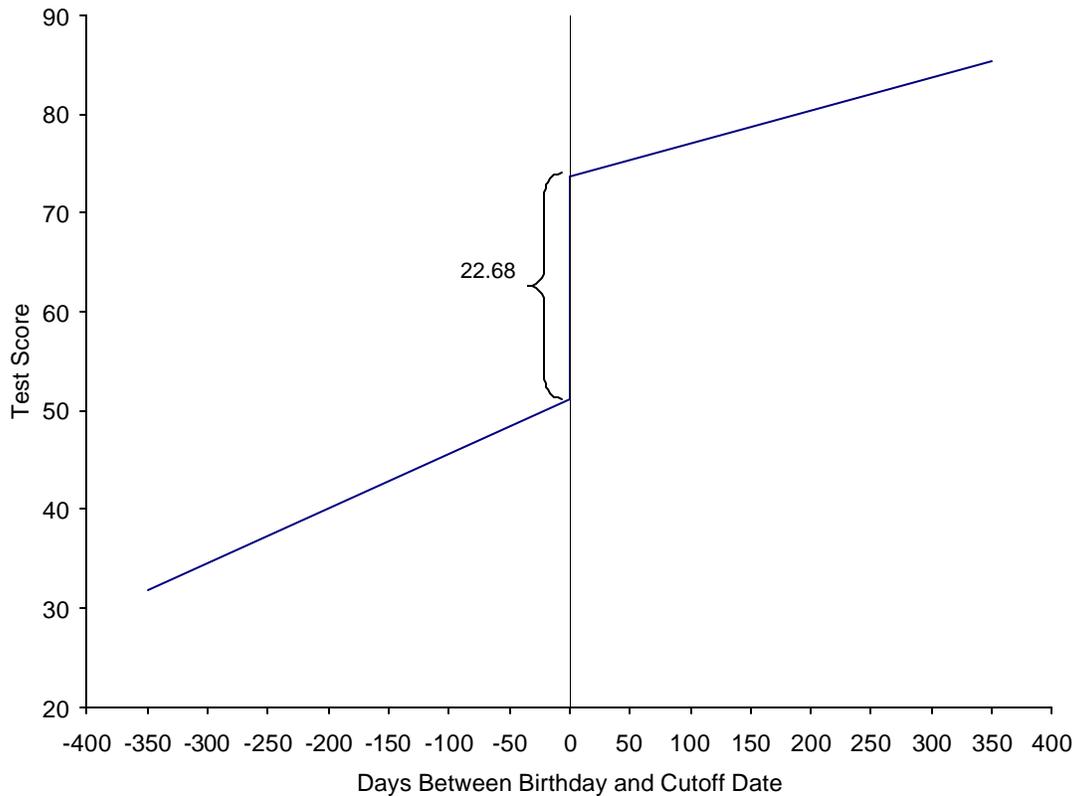


Print Awareness

The effect of state-funded preschool on children’s Print Awareness scores is statistically significant for West Virginia’s Early Education Program. The effect of West Virginia’s program on children’s Print Awareness scores is an increase in the average number of items correct of 22.68 percent, equivalent to an improvement of approximately 93 percent of a standard deviation on the Print Awareness subtest. The effect of the program can also be understood as 121 percent more growth in print awareness over the year or a 56 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 22.68 raw score points.

Figure 3. The Effect of West Virginia’s Early Education Program on Children’s Print Awareness Scores



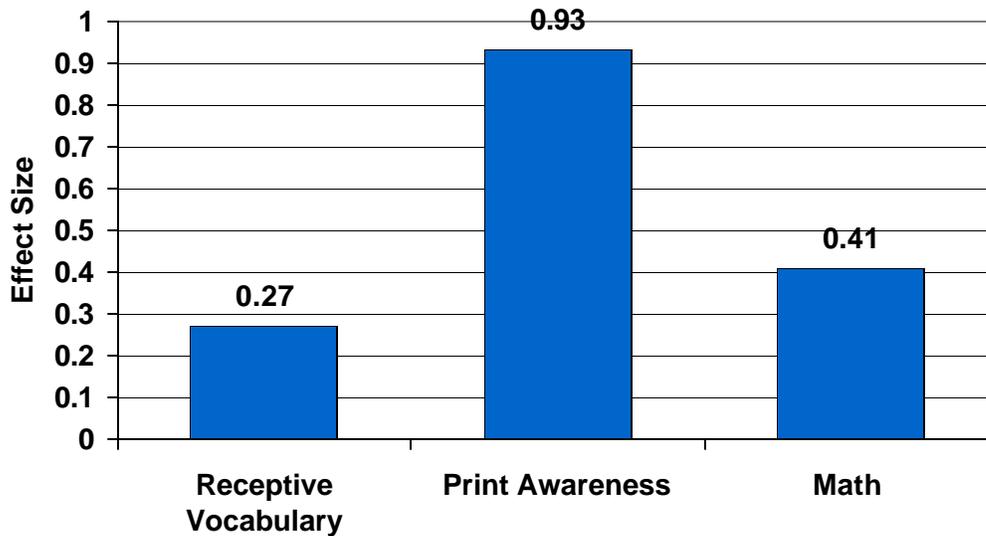
Phonological Skills

Results indicate that the effect of West Virginia’s Early Education Program and state-funded preschool overall on children’s phonological development scores is minimal and not statistically significant. While the difference in Blending subtest scores between the groups may seem large (71 percent of items correct for the No Preschool group versus 83 percent for the Preschool group), the difference due to the program is not statistically different from zero. The remainder of the difference is most likely accounted for by the fact that the Preschool group children are older than the No Preschool group children, and they have developed the skills to score higher outside of the preschool program.

Summary

By way of summary, Figure 4 below portrays the effect sizes of the impact of West Virginia’s Early Education Program 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 West Virginia’s Early Education Program 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 primary analyses presented here because missing data on this measure reduced sample size by nearly 20 percent overall and by more than 50

percent in West Virginia. However, separate analyses conducted to test whether preschool programs produced larger effects for children who qualified for free or reduced price lunch provide some evidence for a stronger effect of the program on print awareness skills for children in poverty. This interaction effect approaches significance across all the states and in two other states effects were somewhat larger on print awareness for children from lower income families. No differences in effects were found on other child outcomes. Of the 47 percent of sample children for whom we have data in West Virginia, 70 percent receive free or reduced price lunch.

Discussion

These study findings provide strong evidence of the positive impact of West Virginia's Early Education program on children's language, literacy and math skills development. This evidence indicates that the West Virginia's 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, math and print awareness skills, with West Virginia'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 West Virginia's program, may produce particularly large effects on children's early print awareness skills.

We did not find that state-funded preschool programs significantly improved children's blending skills, our sole measure of phonological awareness. Perhaps these preschool classrooms did not provide as much support for these skills as they did for vocabulary development and print awareness (Lamy & Frede, 2005). In that case, 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.

Results indicate that estimated program effects varied among the study 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, however, the broader context of available preschool experiences is not the same across states, nor is population served. The samples varied across states, from highly disadvantaged to a cross-section of the general population, as programs vary from highly targeted to universal. For example, in New Jersey's Abbott program the majority of the sample 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, but 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 student-teacher ratios and provided more than one-year of education at age 4 (Barnett, 1998).

The states studied almost universally require prekindergarten teachers to be licensed teachers with BA degrees and certification in early childhood education. Head Start requires that 50 percent of teachers have two-year Associates' degrees and the others must have a Child Development Associate (CDA) credential or its equivalent. A CDA represents 120 clock hours of training. Public preschool programs with weak standards for teacher qualifications (and low teacher pay) might increase their effectiveness by raising their teacher qualifications standards and compensating teachers accordingly.

In sum, this study finds that West Virginia's Early Education program 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.

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