

**The Effects of the Arkansas
Better Chance Program
on Young Children's
School Readiness**

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The Effects of the Arkansas Better Chance Program on Young Children's School Readiness

Executive Summary

This report estimates the effects of the Arkansas Better Chance Program (ABC) on entering kindergartners' academic skills using a rigorous research design. Receptive vocabulary, early literacy and early math skills were assessed in a sample of 911 children from across Arkansas. We found that the Arkansas Better Chance Program has statistically significant and meaningful impacts on children's early language, literacy and mathematical development.

Specifically:

1. The ABC program produces an increase in children's vocabulary scores of more than 5 raw score points, 31 percent more growth over the year due to the program. This improvement translates into an additional four months of progress in vocabulary growth due to the preschool program. This outcome is particularly important because the measure is strongly predictive of general cognitive abilities and later reading success.
2. Children who attended the ABC program scored higher on a test of early math skills. The ABC program increased children's math scores by more than 1 raw score point, 37 percent more growth over the year due to the program. Skills tested include basic number concepts, simple addition and subtraction, telling time and counting money.
3. The ABC program had large effects on children's understanding of print concepts. The program increased children's print awareness by nearly 23 percentage points, more than doubling growth over the year due to the program. Children who attended the ABC program before entering kindergarten know more letters, more letter-sound associations and are more familiar with words and book concepts.

Using a sophisticated research design (a regression discontinuity approach) we estimated the gains from one year of state-funded prekindergarten at age 4 compared to the preschool education experiences children would have had otherwise. This report is the first in a series of reports on a 5-year longitudinal study that will document the effects of the Arkansas Better Chance Program over time.

Introduction

State-funded preschool programs have become increasingly common across the country, having been established to some extent in up to 39 states. While the services that these programs provide to families are influenced by complex parental needs, which may include longer hours, transportation, health services and the like, a main goal of all state-funded preschool programs is the preparation of young children for kindergarten. Effective preschool programs lay a foundation for children's subsequent school success by imparting the varied knowledge, abilities and dispositions children need to succeed in school such as rich vocabulary and complex sentence structure, an understanding of story structure, self-regulation, cooperative play and abstract thinking. This constellation of abilities provides children with the real confidence that success creates.

Previous research has established that high-quality and well-funded preschool programs make valuable contributions to improving children's learning and development (Barnett, 2002). Studies of model prekindergarten programs including the Abecedarian Early Childhood Intervention program, the High/Scope Perry Preschool program, and the Chicago Child-Parent Centers have shown that these types of programs produce economic benefits that are much greater than their costs (Barnett, 1996; Masse & Barnett, 2002; Reynolds, Temple, Robertson, & Mann, 2002). The benefits of preschool education include higher scores on achievement tests and lower rates of special education placements and grade repetition, as well as longer-term effects such as improved high school graduation rates and reduced levels of crime and delinquency.

Although state-funded preschool programs are not as well funded as many of the model programs that have been intensively studied, the state programs are larger and serve more diverse populations. As the number of state-funded preschool programs grows and more children participate, it is increasingly important to determine how effective these programs are in improving children's potential for school success.

The Arkansas Better Chance (ABC) Preschool Program Context

The Arkansas Better Chance (ABC) state-funded program provides early care and education services for children from at-risk or low-income families. Expanded funding beginning in 2004 led to the creation of the Arkansas Better Chance for School Success (ABCSS) Program, which follows the same policies as the ABC initiative, but targets districts in which at least 75 percent of children have literacy and math scores below proficient levels. To provide some context for the findings of the study, some of the main characteristics of Arkansas' program as listed in NIEER's *The State of Preschool: 2005 State Preschool Yearbook* (Barnett, Hustedt, Robin, & Schulman, 2006) are described here. Arkansas is a national leader in the standards it has set for its programs in seeking to provide quality preschool environments, and it is important to know more about the impacts of those programs on children's learning. The ABC preschool program served 9,316 children from ages 3 to 5 in FY 2005 using \$43.9 million in state funding. Participating providers include public schools as well as private centers. Additionally, 5,242 children received state-funded early educational services in the form of home visits

through a component of the program known as HIPPY. These services were supported with \$7.2 million in additional funding in FY 2005.

Methods

The Research Model

Our ABC program evaluation employed regression-discontinuity design (RDD), a statistical model with several strengths. The design deals with one of the most vexing problems in educational research, that of selection bias. Typically, state preschool program evaluations estimate program effects by comparing the test scores of children who attended a program with the scores of similar children who did not attend. As programs move toward offering all children services, it can be very difficult to find a comparable group of children who did not go to preschool. Even when programs target a special subgroup of children (e.g., low-income children, or those with learning delays), 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 attend state prekindergarten programs differ from those who do not because programs select children and families select programs.

The RDD solution is to compare two groups of children who selected (and were selected by) the ABC program, using the stringent age cutoff for enrollment eligibility to define groups. This concept is easier to understand when taking 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 completed the preschool program. If both are tested at that time, the difference in their scores provides an unbiased estimate of the state preschool program's effect, under reasonable assumptions. 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 ABC preschool program, and all children beginning preschool in the same year can be included in analyses using the RDD. The RDD approach has been used to examine the effects of Oklahoma's universal prekindergarten program (Gormley, Gayer, Phillips, & Dawson, 2005) and in several other states by NIEER (Barnett, Lamy, & Jung, 2005).

In this study, the research question addressed by the RDD is whether the ABC preschool program at age 4 has an impact on children's academic skills at kindergarten entry. Our study also involves an added longitudinal component using the more typical approach of comparing children in the same age cohort who did and did not attend ABC. By following this sample of children across 5 years, we can estimate the impact of the program on children's learning through age 8. One of the keys to success in this longitudinal effort is the ability to check and revise its initial estimates using the RDD

results. Thus, this is the first of a series of reports detailing the estimated effects of the Arkansas Better Chance preschool program. Findings from the RDD analysis of Fall 2005 data are presented in the rest of this report.

Sampling Strategy

To choose a sample of children we first randomly selected ABC preschool classrooms from a list of all ABC classrooms across the state. If only one classroom in a county was selected, then another one was randomly chosen from an already-selected county, and was used as an alternate for the sake of making data collection more efficient. We then sampled twice the number of kindergarten classrooms as preschool classrooms within the districts from which the preschool classrooms were selected. The kindergarten sample was selected to include one group of children who attended preschool at age 4 and one group who did not. From each of these classrooms we then randomly selected approximately four children.

Trained research staff from the University of Arkansas for Medical Sciences 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 \$5.00 per selected child. The children's teachers were asked to complete a social skills rating for each sampled child, and received a \$20.00 reimbursement for each completed rating.

The Sample

As mentioned above, our RDD methodology requires two groups of children. The group of kindergartners who attended the ABC preschool program the previous year is called the *Preschool* group, or the experimental group. Children who received some form of early care other than the ABC preschool program at age 4 were not included in this group. The second group of children currently attending the ABC 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 at the very beginning of their preschool year and have not had the preschool "treatment" yet.

In Arkansas, an initial random sample was drawn, including 125 preschool classrooms from across the entire state. An additional 250 kindergarten classrooms were then randomly selected in districts where preschool children had been drawn, for a total of 375 classrooms of preschoolers and kindergartners. As a result of district, school or classroom refusals, data were gathered from 346 center-based classrooms, with an average of 3.80 children per class. Children (N = 92) were also sampled from home-based HIPPIY programs, so that this component of Arkansas' state prekindergarten initiative would be represented. The total Arkansas sample size for Fall 2005 was 1,408 children.

In general, teachers in the ABC program were highly educated. Based on data from our sample, we estimate that 94% of the teachers in the sample had at least a bachelor's degree.

Our research plan specified a sample of 500 preschoolers enrolled in ABC and 500 kindergarteners formerly enrolled in ABC (250 total classrooms). An additional 125 kindergarten classrooms were sampled to include a group of children who did not attend ABC. This group will be used as a comparison in the longitudinal component of the study. A small number of 3-year olds were also randomly selected for study.

The current report will focus on only the Preschool and No Preschool groups, which comprise the RDD sample. The total RDD sample is 911, with 407 in the No Preschool group and 504 in the Preschool group. Our primary analyses were “sharp” regression-discontinuity models that employed a total 883 children in our sample, dropping 28 children (3 percent of the total) whose birth date information appears to be inconsistent with the birth-date cut-off requirement for their programs. An average of 2.69 children were sampled per class. The sample is 52% male. The percentage in each major ethnic category is as follows: American Indian, 0.3%; Asian, 1%; Latino, 6%; African American, 36%; and White, 57%.

Instrumentation

Receptive Vocabulary

Children’s receptive vocabulary was measured using the Peabody Picture Vocabulary Test, 3rd Edition (PPVT-III; 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.

All children in our sample were administered the PPVT, regardless of home language, to get some sense of their receptive vocabulary ability in English. All children who spoke some Spanish were also subsequently administered the TVIP. The testing session was then continued, with the additional measures administered in either English or Spanish, depending upon what the child's teacher designated as his or her best testing language. When running preliminary analyses, if there was a case where a child scored

better on the TVIP than on the PPVT, but the assessor had continued testing in English (or vice versa), we excluded that case from the analyses.

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. For Spanish-speakers the *Bateria Woodcock-Munoz Pruebas de Aprovechamiento – Revisado* (Woodcock & Munoz, 1990) *Prueba 25 Problemas Aplicados* was used. Subtests of the Woodcock-Johnson are reported to have good reliability. Raw scores are reported.

Print Awareness

Print awareness was measured using the Print Awareness subtest of the Preschool Comprehensive Test of Phonological and Print Processing (Pre-CTOPPP; Lonigan, Wagner, Torgeson & Rashotte, 2002) 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-CTOPPP was developed recently, relatively little technical information is available about its performance and psychometric properties.

Print Awareness 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

We began our analysis by testing for significant differences at the beginning of the school year between 4-year-olds enrolled in classroom-based ABC programs and those receiving home-based services through HIPPI. Significant differences were found on only one measure: children enrolled in HIPPI had higher math scores than center-based ABC children. RDD analyses were run with HIPPI participants excluded from the No Preschool (4-year-old) group, but the results were similar to the RDD analyses with HIPPI participants included. The analyses reported below include HIPPI participants, and do not make further distinctions between children who received the ABC program in home- or center-based settings.

Our RDD analyses were conducted in STATA (StataCorp, 2005), and we used classroom as the primary sampling unit, since multiple children were sampled from classrooms. The reported analyses all use 1 year as the margin around the kindergarten

cut-off date. As a result, children with birthdays up to 12 months before and 12 months after the kindergarten cut-off date were represented.

The estimated effects of the ABC program are displayed in individual figures for each outcome measure. Each figure displays a regression line of the children's predicted test scores by age, measured by the number of days their birth date is from the program enrollment cut-off date. The discontinuity (gap or jump) in the regression line at the cut-off date is the estimated effect of the ABC program.

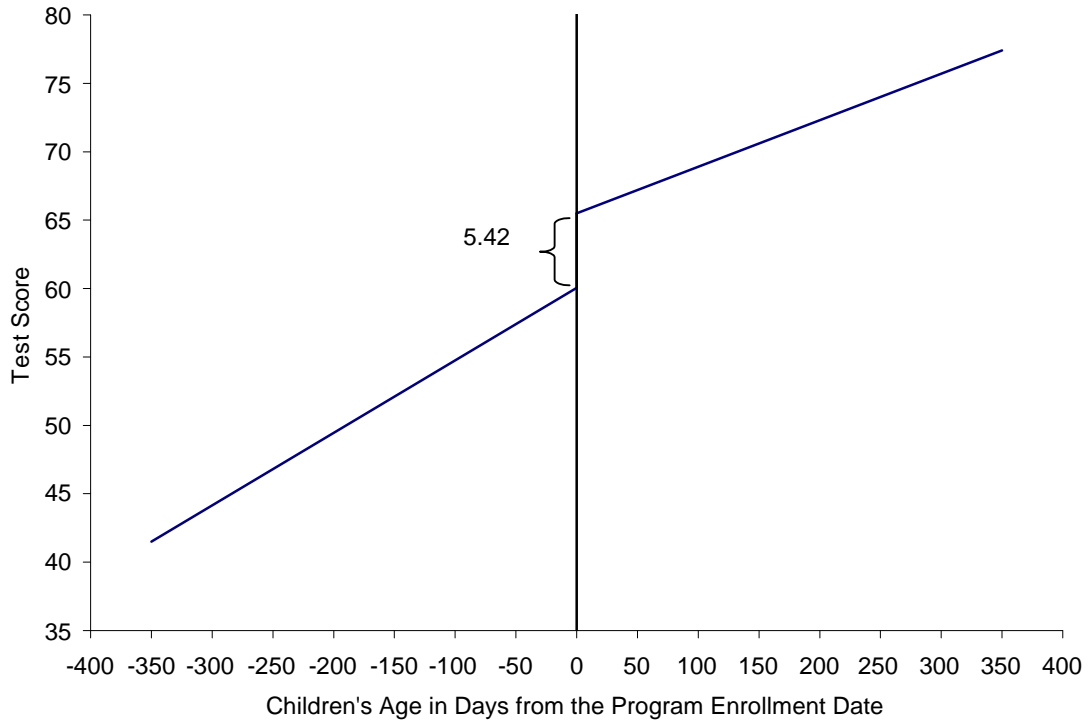
Receptive Vocabulary

The estimated effect of state-funded preschool on children's receptive vocabulary as measured by the PPVT is statistically significant. Attending the ABC program at age 4 is estimated to increase PPVT scores by about 5.42 raw score points. For children of preschool and kindergarten age, raw score points on this measure translate into about the same number of standard score points, so the improvement is about 36% of the test's standard deviation for the national population (i.e., the normed standard deviation, which is 15 points). The effect of the program can also be understood as 31% more growth over the year 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 ABC program is approximately an additional four 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 section of the line to the left of the program enrollment date represents receptive vocabulary scores of children beginning the state pre-K program, while the section of line to the right of the enrollment date represents scores for children entering kindergarten. The discontinuity in the regression line at the cut-off date represents the estimated effect of the preschool program, or 5.42 raw score points.

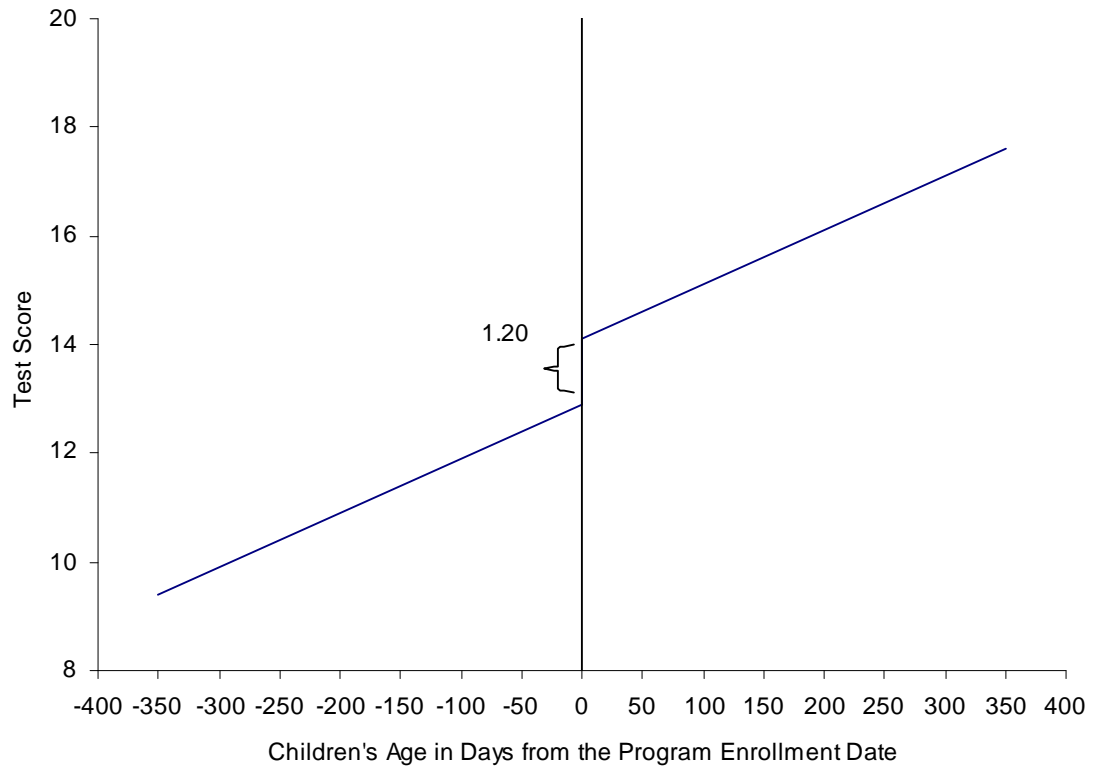
Figure 1. The Effect of the ABC Program on Children's Receptive Vocabulary Scores



Math Skills

The estimated 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 the ABC program. The increase in scores for ABC children due to the program is about 1.20 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 ABC is equivalent to about 3.6 standard score points or 24 percent of the population (normed) standard deviation. The effect of the program can also be understood as 37 percent more growth over the year 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 section of line to the left of the program enrollment date represents math scores of children beginning the state pre-K program, while the section of line to the right of the enrollment date represents scores for children entering kindergarten. The discontinuity in the regression line at the cut-off date represents the estimated effect of the preschool program, or 1.20 raw score points.

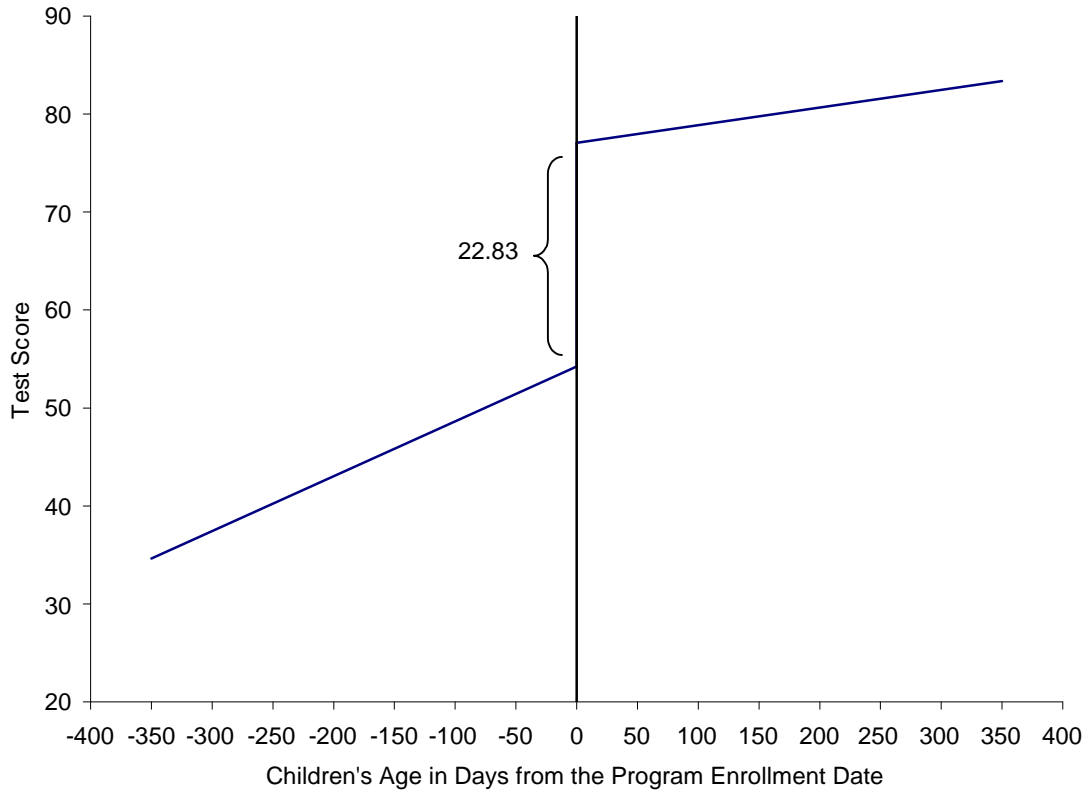
Figure 2. The Effect of the ABC program on Children's Early Math Scores

Print Awareness

The effect of state-funded preschool on children's Print Awareness scores is statistically significant for the ABC program. The effect of the ABC program on children's gains in Print Awareness scores is 23% more items answered correctly. This increase represents approximately 76% of a standard deviation on the Print Awareness subtest. The effect of the program can also be understood as more than doubling (116 percent more) growth over the year 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 section of line to the left of the program enrollment date represents print awareness scores of children beginning the state pre-K program, while the section of line to the right of the enrollment date represents scores for children entering kindergarten. The discontinuity in the regression line at the cut-off date represents the estimated effect of the preschool program, or 22.83 percent more items answered correctly.

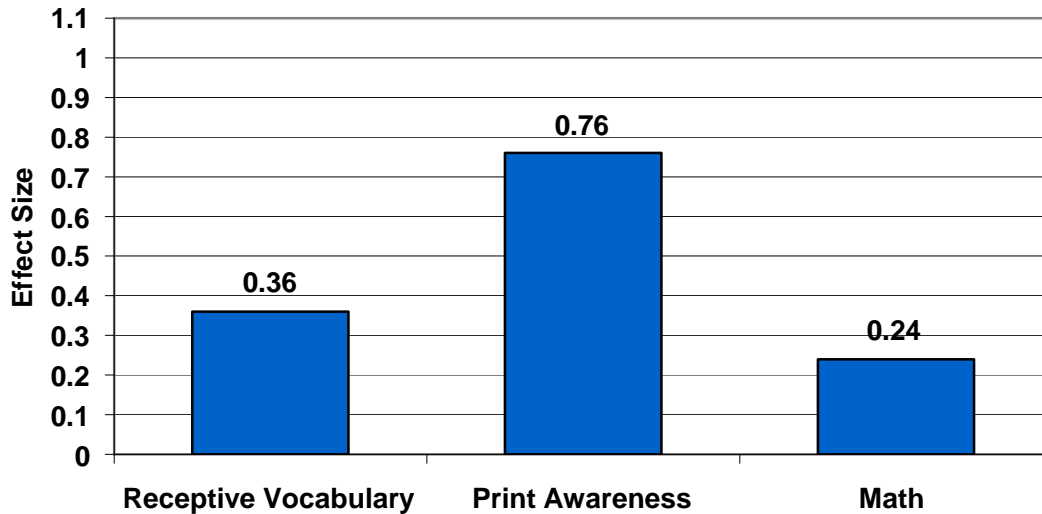
Figure 3. The Effect of the ABC program on Children's Print Awareness Scores



Summary and Discussion

In Figure 4 below we summarize our results in the form of estimated effect sizes for the impact of ABC on children's receptive vocabulary, print awareness, and math scores. These effect sizes are a common way of standardizing the estimated effects of the program for comparison across studies.

Figure 4. The Effect of the ABC Program on Children's Scores across Measures



These results provide strong evidence that the ABC program has positive effects on children's learning in the areas of language, literacy and math skills. This indicates that ABC produces the kinds of initial effects likely to lead to increased school success and continued advantages in reading and math skills. Meaningful effects were found on children's receptive vocabulary, math and print awareness skills, with the largest effects apparent on children's early print awareness skills. 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 can produce the long-term school success and economic benefits found in other preschool education studies that have followed children into adulthood (Schweinhart, Montie, Ziang, Barnett, Belfield, & Nores, 2005; Campbell, Ramey, Pungello, Sparling, & Miller-Johnson, 2002; Reynolds et al., 2002).

This is the first in a series of reports on the effects of the ABC program, focusing on child data collected in Fall 2005 during the initial year of a projected 5-year longitudinal study. The data presented in this report show that participation in the ABC prekindergarten program has statistically significant effects on children's learning that are evident when they begin kindergarten. In a future report we will also present data Spring 2006 child assessment data, as well as data on prekindergarten classroom quality gathered at the same time.

The child assessment results presented in this report are consistent with our findings from studies of other states' prekindergarten initiatives. However, the longitudinal component of the Arkansas study will also allow us to re-examine the estimated effects over time. Our examination of longitudinal effects will draw upon data from two cohorts of children. The younger cohort consists of two groups of children who were prekindergartners during Year 1 of the study (2005-2006): the control group from this report and a new group of children who did not attend ABC and who joined the study in Fall 2006. The older cohort of children consists of two groups of children who were kindergarteners during Year 1 of the study: the experimental group from this report and an additional group of kindergartners who did not attend the ABC program. Beginning with the 2006-2007 school year, reports on the ABC evaluation will include examination of longitudinal trends for ABC and non-ABC children from both cohorts. These data will allow us to present revised estimates of the effects of participating in the Arkansas Better Chance program until the two cohorts of children are in third and fourth grades, respectively.

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